O.P.U.S.

Optimising Public Understanding of Science and Technology

Final Report

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CHAPTER 0

OPUS – Background of the Project

Ulrike Felt

The pervasiveness of science and technology's influence in every aspect of modern life implies a real necessity for citizens to understand and appreciate the contributions, but also the limits, of what research and technological development can/should provide for human society and the natural environment. While these issues have for a long time been confined to the nation states and were — according to the cultural, social, political and economic context — handled in very different ways, they have definitely become a common European concern. Solutions to societal questions closely linked to scientific and technological development — e.g. biotechnology and food, health, communication, environmental issues, technology and labour market, economic development — can not be addressed anymore only on the national level, but have to be considered as a European challenge with the aim of finding suitable common policies.[1] This means that on the one hand public awareness of the European dimension of scientific and technological development has to be addressed taking into account the diversity of the European regional and national contexts. On the other hand, questions of public awareness of science and technology cannot be "answered" anymore after scientific and technological developments have taken place, but they have to become integral part of a European and national science policy. Combining these two approaches would allow an **increased public involvement in the process of agenda setting**[2], but also of **decision-making** — and thus **lead to a new kind of trust-relationship** between science and the public and to innovative form of knowledge-politics in the European context.[3]

[1] See Amsterdam treaty; CEC (1997): *European Union Consolidated Treaties* (incorporating the Treaty of Amsterdam, signed 2/10/97 and entered into force on 1.5.1999) (Luxemburg); Action Plan Science and Society

[2] For the policy questions see: J. SEARGEANT and J. STEELE (1998): *Consulting the Public: Guidelines and Good Practice*, (Policy Studies Institute, London); L. ROSENBERG et.al., (1998): *Scientific Opportunities and Public Needs: Improving Priority Setting and Public Input at the National Institutes of Health*, (National Academy Press, Washington, DC); S. JASANOFF (1996): "Is Science Socially Constructed, and Can It Still Inform Public Policy?" *Science and Engineering Ethics*, 3 (2), 263-276

[3] In the recent years a number of studies have hinted to the importance of trust in the relation between science and the public. For a broad and very interesting collection of articles, see A. IRWIN & B. WYNNE (eds.) (1996): *Misunderstanding science? The public reconstruction of science and technology.* (Cambridge UK: Cambridge University Press). B. WYNNE, B. (1995): Public Understanding of Science. S. Jasanoff Gerald E. Markle, James C. Petersen, Trevor Pinch (Eds.), *Handbook of Science and Techology Studies* (Thousand Oaks/London/New Delhi: SAGE): 361-388.See also the publication of the papers presented at a conference organized by the Social Science Research Center Berlin in cooperation with DG XII on public understanding of science: M. DIERKES & C. VON GROTE (Eds.): *Between understanding and trust: science, technology and the public* (Berkshire: Harwood Academic Publishers, 1999)

The barriers to communication and interaction between researchers and the diverse publics are of high complexity, depending on a combination of social, cultural, educational and practical factors. While increasing institutionalization and specialization has led science and technology to develop even faster and more efficiently, and global network building has fostered the transnational and transdisciplinary component of science, these developments have also contributed to construct and continuously reinforce the boundaries of the science system to the outside world. Scientific research and technological development has become a central profession with clear conditions of access, control over "reproduction" being exclusively in the hands of scientists. And, although this profession shapes our life in decisive ways, the wider public has little idea about the kind of work that is performed and about the precise nature of scientific and technological advances, their possibilities and constraints.

This fact seems to become a crucial problem when science moves to the public space in the framework of controversies. While scientists have learned to actively manage uncertainties and contingencies that are inseparably linked to the complexity of the scientific enterprise, the public image of science as producing "objective knowledge" and thus eliminating uncertainties is still strongly (re)present(ed). This more naive and politically powerful image of science is thus confronted with the fact that there often exist different legitimate interpretations of data and different models of explanation.[4]

These tensions between being "confronted with" but "not really grasping their technical possibilities and limitations" is gaining importance also in the field of technological development in modern societies. While technologies have moved into the most remote corners of work and every-day life and all of us have become acquainted to using them, they have at the same time become more and more opaque.[5] We know how to handle them, but only few people grasp their basic functioning principles. All this taken together leads — even in the case of apparently unquestioned domains of science and technology — to a system-inherent situation of ambiguity, which means that public perception of science can rather unexpectedly shift from support and admiration to refusal and fear.[6]

Despite this, recent studies by Gibbons and others have diagnosed another major change taking place in the field of scientific and technological development with a new phenomenon appearing, which they label "knowledge production mode 2". In contrary to the classical disciplinary organized knowledge production the new way is characterized by a large heterogeneity in the organizational structures involved, by the temporary character of the research groups, by the transdisciplinarity of the

[4] S.M. FRIEDMAN, S. DUNWOODY & C.L. ROGERS (eds.) (1999): *Communicating Uncertainty – Media Coverage of New and Controversial Science* (Mahwah: LEA)

[5] LEVY-LEBLOND, J.-M. (1996): *La pierre de touche – La science à l'épreuve* (Paris: Gallimard)

[6] M. BAUER (ed.) (1995): *Resistance to New Technology. Nuclear Power, Information Technology and Biotechnology.* (Cambridge: Cambridge University Press)

approaches as well as by the increased importance of the potential applications in the course of knowledge production. With regard to the relation between science and the public this has partly contradictory consequences and can be observed as: 1) a decrease in the visibility of the ”places” where knowledge is produced; 2) a higher degree of social distribution of scientific knowledge; and 3) an increased public influence on agenda setting and quality control.[7]

Finally, taking into account the progressive mediatization of contemporary societies together with the intrusion of science and technology into many areas, different sources for opinion formation have to be considered. It is possible to observe the development of enlarged expert cultures (e.g. creation of para-scientific organizations, the rise in importance of associations of consumers etc.) as well as the establishment of new social milieus at the border or outside classical communication in politics and economy. Thus, we witness an increased complexity in knowledge and opinion structures with regard to science and technology within national contexts, but in particular also on the European level.

The often historically rooted differences between nations and regions in their public‘s relation to science and technology have led to different patterns in public awareness promotion of science and technology (S&T), in concepts of what constitutes public understanding of S&T as well as in the degree to which the importance of public awareness is realised and forms part of the science policy discourse.[8] For example in the United Kingdom the shift in the discussion from popularisation of science and related problems to public understanding of science as a challenge both for scientists and science policy makers has taken place already in the first half of the 80ies. A number of initiatives and research programmes have been undertaken covering both more theoretically oriented perspectives but also empirical work.[9] On the contrary, in Austria the idea of taking measures to raise public awareness of science and technology is only a very recent preoccupation, and still shows a rather low profile with actions taken that are neither concerted nor placed in a more general framework. Or to mention a third example, in France the debate is much more structured around issues of ”mise-en-culture de la science”, thus aiming at a cultural integration of scientific and technological issues. In many ways, there is a clear lack of a broad knowledge base, partly of theoretical reflection and surely on systematic cross-national empirical work on the image of science that is promoted in certain key-actions. **Putting actions on the national as well as the European level in the context of a large variety of methods**

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[7] M. GIBBONS et. al. (1994): *The new production of knowledge* (Thousand Oaks: Sage); NOWOTNY ET AL. (2001): *Re-thinking Science. Knowledge and the Public in an Age of Uncertainty*.(Cambridge: Polity Press)

[8] For a discussion of the developments in the field of science-society interactions see: FELT U. (2003): Science, Science Studies and its Publics: Speculating on future relations, in: H. NOWOTNY; B. JOERGES: *Social Studies of Science & Technology: Looking Back, Ahead*, Yearbook of the Sociology of Sciences, 2003.

[9] See for example: *ESRC New Opportunities Programme in the Public Understanding of Science*. One of the OPUS-network members (J. Stein) is taking part in this programme with a project called: The Changing Mores of Science: Public Understanding and Public Accountability.

and know-how would surely bring an overall benefit, but would for example also allow **to address key-questions** such as the gender issue in public awareness of science and technology in a more systematic way.[10]

At the European level, the communication barriers are even higher. There seems to be a general lack of public awareness of European-level research activities and their impact on the economy, the quality of life, employment and environment.[11] There is considerable public scepticism/ambivalence towards the role of science in public policy making in Europe, with major controversies on biotechnology and food, for example, having a clearly negative impact on public confidence in both science and European governance. On the other hand, in areas such as medical issues and healthcare confidence is placed in "European solutions".

Raising public awareness of science and technology is for sure **more than just a question of education and promotion**. It does not function along a linear model of simple information transfer with clear hierarchies, with scientists being at the top and handing down validated information to the public. A mere increase in the quantity of information or better distribution is thus definitely not the solution. On the contrary, any improvement **requires sensitivity on the part of the experts towards legitimate public concerns, an appreciation of the complexities associated with risk and the right balance between accessibility of information and necessary sophistication of presentation.** Further, scientists and science policy makers need a higher degree of awareness of other kinds of knowledge present in the public space. Indeed, lay knowledge, as a kind of **alternative knowledge-system** seems rather powerful in certain areas. This could be explained by the fact that lay knowledge is generally more sensitive towards the preoccupations of the public, often has a visionary component and is "pragmatic rather than rigorous and testable."[12] But, above all, lay knowledge can be acquired by everybody in a direct way and does not need the mediation of an expert.[13]

For these reasons it is important to understand these multi-layered communications about science far more as a process of negotiation of meaning between scientists,

[10] The issue of science and technology has been widely debated both from the perspective of gender in science and gender of science. See S. HARDING (1991): *Whose Science, Whose Knowledge: thinking from women's lives. (*Milton Keynes: Open University Press); H. ROSE (1994): *Love, power and knowledge* (Cambridge: Polity Press). However so far very little research has been done on gender and public understanding of science. S. DOONAN, and F. HENWOOD (1990): *Women, Science and Technology: what's it all about?: an evaluation of a new adult education course*. (London: Workers' Educational Association).

[11] This has in particular been discussed in the framework of the EUROBAROMETER opinion polls: Commission of the European Communities (1993): *Europeans, Science and Technology. Public Understanding and Attitudes*. EUR 15461. Such a tool only allows for a rather restricted vision of the attitude people have towards science, offering little hints for solutions. There are number of other European as well as national projects which try to approach to issue of public perception/ comprehension/up-take in particular in sensitive research areas such as biotechnology.

[12] See DOLBY, R. G. A. (1982): On the autonomy of pure science. The construction and maintenance of barriers between scientific establishments and popular culture, *Scientific Establishments and Hierarchies, Sociology of the Sciences* VI: 267-292.

[13] See Irvine & Wynne (1996), op.cit.; NOWOTNY, H. (1993): "Socially distributed knowledge: five spaces for science to meet the public.", *Public Understanding of Science* 2(4): 307-319.

science mediators and different publics. Any scientific knowledge needs to be recognized by the public as relevant, and it is reinterpreted and reorganized in their respective contexts of knowledge and experience.[14] Lay people negotiate their relationship with science taking into account "existing relationships, division of labour, dependency and trust."[15] An excessive emphasis on promotion can diminish the credibility of the proponent and prove detrimental to public attitudes towards research, science and technology in the long run. The same holds for excessively "masculine" or elitist values attributed to science and technology in the public domain, which could alienate both men and women. Hence, it is not obvious and straightforward to develop good ways to manage communication in a constructive fashion.

The optimisation of Public Understanding of Science raises a large number of questions, among which some of the more important are:

- What are the current practices in the different national contexts, in Europe and beyond, to promote public awareness of science and technology?
- To what degree are they accepted/taken up by the public and what kinds of publics do they address?
- What are the actors involved in these promoting public awareness initiatives?
- What idea/image of science is shaped by these initiatives?
- Are these practices transferable to other national and European contexts? What requires adaptation and what can be regarded as a common core that can be adopted as it is?
- How is it possible to increase mutual knowledge of the know-how as well as of the experiences of different scientific and technological areas, and of actors ranging from academia, to science policy makers and to the practitioners of science communication?

In order to be able to answer these and related questions a **broader and comparative approach between different European countries is required**. We therefore propose on the one hand to examine the underpinning theories of public awareness and public understanding in the different national contexts, but also in the framework of the academic debate in the field of Science and Technology Studies (STS). On the other hand we want to seek out examples of particularly successful, practical instruments in order to improve the process of communication between science and the public and thus reach both more engagement from the side of the public but also increased possibilities of participation. As the field of public communication of science and

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[14] U. FELT (1999): The social and cultural tayloring of scientific knowledge in the public space, in M.E. GONCALVES (ed): Cultura cientifica e participaçao pública (Lisboa: Bertrand)
[15] B. WYNNE (1993): The public uptake of science: A case for institutional reflexivity. *Public Understanding of Science* 2(4): 328.

technology is already a rather differentiated field with both practitioners of various kinds as well as academics working on these issues, we are confronted with a high degree of heterogeneity and diversity but partly also with ignorance of expertise and practical experience that may be present in closely-related specialities. Hence, we propose to use the results of the European-wide analysis and synthesis to develop practical resources for students, professionals and policy makers that will allow sharing a knowledge-base. This might contribute to optimising the processes of building public awareness of science and technology.

Aims of the project

The aims of the project could be summarised as follows:

To achieve these aims we held after a start-up meeting

- Review national experiences with practical approaches and activities in Europe regarding public understanding of science and technology as well as the policies linked to them in six different countries; a good representation of the different European regions is assured: Austria, Belgium, France, Portugal, Sweden, United Kingdom;

- Critically examine and analyse the different conceptual and theoretical understandings of the interfaces between science, technology and society present in these initiatives and develop a better understanding of the cultural differences encountered as well as of the importance of the historical precedents in this field.

- Compare the dynamics of the various national systems studied with regard to promoting public awareness of S&T and sketch out their different and possibly convergent paths of evolution. This will allow us to step back and to learn through a more distanced look from local initiatives on a more global level.

- Develop an OPUS resource manual — both in print and electronic form — that brings together theoretical reflection, a carefully assembled and distilled set of Public Awareness initiatives as well as the experiences in making them work them from the six European countries. Particular attention will be paid to the local specificities as reflected in the tools.

- Reflect these experiences with view of improving public engagement with S&T at European level, taking into account the results of exchanging the different analysis, of transfer of experiences and methods across national boarders and good practice at national level and a jointly-developed characterisation of the European environment.

Consider the gender perspectives that are embedded in these issues, as gender-sensitivity in the interactions between science and society might turn out to have a wide ranging impact on future developments of science and society

- define the structure and the conceptual issues (12th to 13th May 2000),
- a second internal workshop ("2nd OPUS Network Meeting") in Lisbon (12th May 2001)
- a third internal workshop ("3rd OPUS Network Meeting") in London (29th November and 1st December 2001)
- an international workshop under the title "Science, Society and Citizenship in the 21st Century" on the 30th of November 2001 in London.
- and finally, an international conference "Envisioning Scientific Citizenship: Science, Governance and Public Participation in Europe" from 28th to 30th November 2002 in Vienna.

Apart from these instances the team-members presented the work in progress at international conferences such as the EASST-conference "Responsibility under Uncertainty", July 31 - August 3, 2002 in York and at numerous other conferences as well as at one meeting of the ENSCOT Network. Further the work was presented at one meeting of the HLG group, who was in charge of bench-marking aspects of science and society.

Readers and ways of reading the report

The report was written and structured in such a way that it is not explicitly addressed to on particular restricted readership. Our audience embraces colleagues working in the domain of social studies of science and technology or policy studies dealing with questions of public understanding and up-take of science and technology, policy makers as well as practitioners at science-public-interfaces. We also would like engage in exchange and discussion with people working in any of the spaces or activities that we have analysed and are dealing with questions of communicating science and technology – i.e. policy makers – both on the national as well as the EU level, people working in media, museums, etc. The material brought together in this report and the reflections behind it is also meant to form an interesting background for science journalist training courses.

Reflecting this broad variety of potential readers we imagined, the report has been written in a way that opens many different ways to access it. It does not necessarily need to be read in a linear way starting with the introduction. One can access through country reports, through special spaces of communication, enter through a more theoretical and conceptual reflection or look into the issues of transferability of experiences as well as to the European perspective. Links between the chapters and to information sources on the web allow the reader to wander through the text, stop and get more details, just to continue at another point in the report.

Given the idea of this report as an open document through which each user chooses its way according to individual interests, we decided that the different chapters should also be readable as more or less independent units. This has the disadvantage that some elements might reappear several times throughout the report and might sound repetitive if all the elements are read. Even if one only reads one country in all its perspectives, there will be overlaps caused by this policy.

Limitations of our approach

As already explained on the first page, this report is the outcome of a networking activity under "Raising Public Awareness of Science and Technology" over the last three years. The financial support which was granted by the European Commission allowed us to organise a start-up meeting and three workshops/conferences. The first two workshops were meant to build a common agenda and to reflect on the approaches we would take in detail to carry out our project.
As there was no money available to do genuine research in the domain, we could only build on our previous research experiences and on work that had been carried out by others. This fact explains why the chapters are neither homogeneous in structure nor do we have comparative material for all the countries. We also had to make choices in the sense that it would have been, for example, interesting to focus on the role of science communication by industrial research labs, but as there is no analysis available; this domain had to be excluded. Similarly, we did not go into the role of

science and technology education in the school sector, which was touched upon only very briefly.

The more important it is to underline that our descriptions and analysis remains much on the production side and does not look into the mechanisms of interaction and learning which take place in the different communicational settings.
What our work showed very clearly is the lack of a systematic, qualitative reflection within the national contexts about the directions in which this field as a whole is moving and what this means with regards to its roots within a larger European context.
We understand this project as a first step to be taken – others could follow.

Content and structure of the report

Apart from this introduction, the report contains eight chapters.
The **first chapter** aims at setting the conceptual frame for the chapters to follow. It begins by giving a short account of how the question of Public Understanding of Science and Technology developed over the last few decades, what were the motives and preoccupations that drove the field and the expectations and logics behind. This will allow us to better understand the policies that were put in place in the different countries, the models of science-society interactions have been there and are at work as well as some of the concrete actions that were taken.
After this first step we will structure our reflections around a series of three questions, which came up during our discussions and accompanied us throughout the report:

- Why should the public understand science and technology?
- What happens in the process of communicating about science and technology?
- What should be understood about science and technology?

In the third part we will then discuss the different notion used such as public, users, consumers and citizens. We will try to grasp the differences between them, the expectations expressed towards them, will reflect on how public perceptions of science get constructed, to end with some thoughts about gender aspects linked to science-technology society interactions.

The **second chapter** deals more explicitly with the policies behind activities in the field of science-society interactions. This chapter contains six reports from the countries (Austria, Belgium, France, Portugal, Sweden, United Kingdom) represented in this study as well as a header, synthesising and analysing the similarities and differences in the national approaches. This chapter should convincingly show the multiple ways that were chosen to address the issue of public understanding of science on a policy level, the different time-lines in the national developments which hint at different histories and political traditions but also dig out some interesting similarities between countries.

In the **third chapter** we enter the empirical core of this report that is entitled "Spaces where sciences encounter their publics". We start by developing a basic conceptual frame which will allow us to structure the multiple settings, actors and activities that take place in the field of science communication and raising public awareness activities in the different countries. This conceptual frame is based on the idea that the interaction between science, technology and publics takes place in different kinds of settings, for which we will use the notion of "spaces". These spaces differ fundamentally in the driving force that makes them interact with different segments of the public. We introduce this metaphor of spaces in order to hint at the multidimensionality of these interaction processes, at the fact that interactions between science and society always take place in settings which open possibilities but also have constraints, and at the fact that the concrete arrangements need to be foreseen. Finally the spatial metaphor also alludes to the fact that there are entry-barriers which make the interaction with science more or less easily accessible. At the same time it is central not to imagine any kind of homogeneity within these spaces. We have distinguished five such spaces, namely those which

- have as a central and main aim to communicate science and technology
- produce knowledge and technological artefacts, while at the same time communicating about them
- are a hybrid between science and the public sphere
- are structured by the professional background that is tied to the knowledge to be communicated
- are linked to the policy sphere, where decisions have to be taken about science and technology and communicated to the citizens

Given the limited resources and the fact that this was a network and not a research project we hade to select a number of examples for such spaces. We selected the following:

- Media and their PUS activities, Science museums and Exhibitions, Science Weeks and Festivals as examples for spaces that are explicitly oriented towards science communication;
- universities as they are an excellent case for the space where scientific knowledge is produced and communicated;
- Public Consultation and Foresight exercises, which partly belong to what we call the hybrid space and partly to the policy space;

- "Non-governmental initiatives" which embrace a broad range of PUS activities ranging from the work of NGOs, over professional groups, to consumer organisations and which belong partly to the hybrid and partly to the professional space;
- and finally "governmental initiatives" which explicitly fall into the policy space.

Each of these chapters gives an analysis of the situation in the six national contexts and is headed by a comparison and analysis of the findings.
The **fourth chapter** titled "National Profiles in Public Understanding of Science and Technology" then attempts to bring together these different elements and observations made in the previous chapters. It is meant to build a condensed, more general picture of the six countries and their positioning with regard to the PUS-question.

Chapter five is aimed at producing a comparative approach – following a grid that evolved in our debates. It will look at the different countries from ten different perspectives.

The question of transferability of experiences and concepts across European countries will be in the focus of **chapter six**. Here the central question is whether, how and up to what degree successful initiatives and experiences can be taken out of their local contexts and be transferred to other national contexts. What happens in such a transfer, what are the advantages of being able to use experiences, what are the problems one might meet in doing so. This is a central question as in the process of building Europe, the mobility of concepts and ideas plays an important role. Thus here we want to reflect on the possibilities, gains and limitations of sharing experiences, models and good practice in the European context.

Taking the issue of transferability of experiences, models and practices further in **chapter seven** we ask what this would mean for the European Dimension of this issue and in particular for building a European research area.

The **concluding remarks** will round off the picture and stress the most important elements. Furthermore we would like to share some of our experiences in working in this network, which reflect also the differences between European approaches.

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CHAPTER 1

When societies encounter “their” sciences: Conceptualising the relationships between sciences and publics

Ulrike Felt

Introductory remarks

This first chapter, which has the aim to set the conceptual frame for our analysis, will start with a short reflection on the choice of the project title “Optimising public understanding of science and technology in Europe”. Why use the British notion Public Understanding of Science (PUS) and not for example the French notion of “scientific and technological culture”? Why not follow the rhetoric move on the European level to new notions such as “Raising Public Awareness of Science and Technology”, or to “dialogue between science and society”? And why speak about “optimizing”, which implicitly alludes to the existence of one “best practice” in organising this interaction between sciences and publics?

In order to be able to answer the first question a few observations should be made. To start with, the notion of PUS, introduced in the mid-80ies in the British context, stands for a shift in the attention of policy makers and analysts from the production side of public representations of science to the public up-take of science. This was an extremely important change, which brought a lot of movement into the debates around the relations between science and society. Yet one should not overlook that it did not fundamentally question the role and position of “the public”: The latter was still supposed to understand science and not the sciences had to aim at a better comprehension of the social worlds the act and encounter publics in. In that sense the PUS movement could be interpreted, at least in those parts that followed the argumentative logics of the *Royal Society Report* on PUS published in 1985, as a far-reaching enlightenment programme, with the aim of making people admire, appreciate and support science.

The subsequent shift from *Public Understanding of Science* to *Public Awareness of Science and Technology* on the European policy level hints at the idea that people should – if they are not really able to understand – at least realise the wide ranging positive consequences of science and technology, get a feeling for the potential behind these developments, accept the explanatory authority of science and in a certain way subscribe to the idea of social and economic progress through scientific and technological advances. Although a more active role was now attributed to the public, the power relationships embedded in this new notion had not been altered fundamentally as compared to the initial PUS idea: it is still the public that should raise its awareness of science and technology whereas the scientists are not expected to increase their awareness of public expectations and agendas.

The introduction of the notions dialogue and participation, which have become more prominent recently, in a certain sense signalize change. However the realisation of such dialogue-oriented settings – as will be seen in the empirical parts of this report – still remains rather episodic.

Having made these observations, it was decided to keep the term *Public Understanding of Science* in the title of our project, as the focus of our interest was on the relational settings in which communication of science and technology takes place as well as on reflecting the ideas, expectations and power structures that are behind them. Taking PUS as a point of departure, we will try to account for the consecutive shifts, to describe and analyse the relation between the accompanying rhetoric and the realisations of concrete science-society interactions. Further, using the PUS notion accounts for the fact that in a number of national contexts, which have largely been inspired by the “British model”, this notion is still in use at least as a point of reference.

The second question one could pose concerns the use of the term “optimising”? Does this notion not implicitly contain the idea that there is one best way to communicate science and to get into interaction with the public? In a sense using “optimizing” in the project title is meant to challenge the idea of **best practice** in this domain, which is rather powerful both in the science system as well as in the policy circles. Assuming – as we do in this project – that while science has managed to implement a global system of exchange of information and knowledge, science communicated to different publics happens in local settings which shape this interaction, one would have to question what the reference frame and the criteria applied would be for judging an initiative or a communicational setting as a best practice and who would be those that are entitled to decide on this issue. We will investigate the different national traditions in the PUS-area, will explore similarities and differences and observe how ideas and experiences in science communication moved across Europe, were successfully adapted or failed to make sense in a different cultural setting. In our context the term “optimizing” means leaving the classical understanding of best practice as a recipe that can be followed, and make the effort of creating possibilities of mutual learning from the experiences with science-society interactions in different European countries, while at the same time keeping cultural traditions and differences alive.

Having clarified the way the project title should be understood, I now shortly want to touch on the different notions used in the report to describe science-society interactions. We will use terms like popularising or communicating science and technology, we will speak about PUS-activities and -initiatives, in France and Portugal we will meet the term “scientific culture” – although with different meanings – and in Belgium “Raising awareness for science and technology”. We understand the interaction between science, technology and publics as a process in which many layers of communication and experience-making overlap and criss-cross to form a variety of attitudes and images of science in the public space in the end. It is an open-ended process whose outcome is impossible to control. In that sense we understand the different initiatives to be investigated as being situated in a broad spectrum of concepts of how and where people encounter science and what they can learn about science.

In what follows I will proceed in three steps. I will start with a historical account on the development of science and society over the past decades. What were the main steps taken, how did the understanding of and the expectations behind science/society interactions evolve and what changed in the relation between science and the public? – are but some of the central questions. I will try to show that it is not a linear history in which one conceptualisation of the relationship replaced the other, but much more new concepts and discourses overlap existing ones and create an bewildering diversity of perspectives, rhetoric and concrete realisations in this domain.

The second part will then be organised around three central questions: Why should people understand science and technology? How does this interaction between science and technology take place? and, What should be understood about science and technology? Providing some elements to answer these questions should lead us to a better grasp of what happens in the encounters between science and society. In this part I will also address the basic paradoxes characteristic of science communication.

The third and final part will then be devoted to the question of the "publics" with regard to science and technology. How are they imagined, constructed and addressed in the diverse settings of PUS initiatives? And what consequences does this have for the position of technoscience in society?

1. The development of the PUS agenda from an international perspective: a short historical account[16]

How the question of the interactions between science and publics developed over the recent decades as a research territory, looking at its past performances, its basic assumptions, they ways in which paradigms changed or remained partly stable, is the focus of the following account. Important elements to investigate will be the specific relations between science, politics and publics at a given point in space/time, the ways in which the boundaries of science were defined and drawn, the concepts that are introduced to describe the relationship between science and its publics or the general democratic agenda, which is supposed to be at stake. Further the growing tensions

[16] This sub-chapter is drawing on a recent paper U. Felt (2003): Science, Science Studies and its publics: Speculating on future relations, in H. Nowotny/B. Joerges, (eds.): *Social Studies of Science & Technology: Looking Back, Ahead*, Yearbook of the Sociology of Sciences.

between the techno-science system, which is increasingly integrated into a larger socio-economic context and develops according to this rhythm, and the more local settings in which science and technology are implemented and communicated to publics will be discussed.

In what follows I will distinguish four phases in the PUS debate, with the aim of highlighting the key-features in each of them. The aim is not so much to produce a complete account than to understand the shifts that have taken place, what motivated them and what were the consequences for the place of science and technology in society. While these steps are presented in a somehow chronological order, this does not mean that the phases are clearly separated or that one phase ends when the next starts. Much more one would always have to understand new approaches as additional to the already existing ones, opening new territories of reflection, while not definitely closing the previously existing ones. The deficit model of science communication is a good example in that respect: while it was declared “dead” for so many times over the past 25 years of science-technology-society analysis, it in a certain way seems to have survived the major shifts through gradual adaptation.

Phase 1

The deficit approach to science–public relations

While science communication to selected lay-audiences had taken place already for some centuries[17], more systematic reflections on the role, meaning and impact of it both on society as well as on the science system have only started in the second half of the 20th century. The idea of a linear communication between science and larger publics characterises best this first phase of dealing with science-public relations, which lasted until the late 70ies. Building on the sender-receiver model that was taken over from communication sciences it described scientists in their role as the producers of genuine scientific knowledge, which would then be “translated” into a more easily understandable language in order to be transmitted to a wider public. Restricted to the role of quite passive consumers and perceived as a rather undifferentiated ensemble of individuals not much power of action was attributed to “the public”.

The hierarchies inherent in the model are clear: Scientific knowledge was understood as being clearly distinguishable from folk-knowledge and it was seen as superior because of its specific form of rationality. Scientific knowledge became the symbol for complexity, while the public's knowledge could be ignored because of its alleged simplicity and emotionality. Interactions were thus unidirectional, from the producers to the consumers/receivers of knowledge. As a consequence only scientists could claim the status of being experts.

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[17] See Shapin, S. (1990): Science and the Public. R. C. Olby et al. (Ed.), *Companion to the History of Modern Science.* London: Routledge.

Raising the density (and partly also the quality) of the communication and stimulating the public's readiness to open themselves up towards science was seen as the solution to answer any criticism science and technology would encounter in the public sphere. The public was basically conceptualised as ignorant about science, this ignorance however being coupled with an alleged keenness to become knowledgeable about it. If lay-people would reject science then it was explained as due to a lack of information, which caused distance to, fear of and alienation from science. The importance and value of science in society could thus supposedly be conveyed through large information/education campaigns. Yet, in the end such an approach did not open up science to wider publics through communication activities, but quite on the contrary simply reinforced and enacted the authority of science.

Thus much of the early reflections and analysis devoted to this issue remained oriented pedagogically, dealing with questions of how to better translate for and speak to a wider public about science. Little attention was given to the role of the concrete settings in which communications took place, to the symbolic character of parts of communication (e.g. the use of images and metaphors) and what happened at the moment people encounter and have to make sense of this information handed over to them. Above all, it was not reflected that this type of uni-directional communication had two rather contradictory effects: while it conveyed the impression to give people access to science, at the same time distance to science was (re)constructed. Getting involved with science was most of the time linked to being told about the complexity and its inaccessibility for non-scientists. Thus one could say that the powerful and distanced position of science with regard to society was constructed precisely through creating an "imagined closeness".[18]

The kind of knowledge people should have about science also became increasingly a normative issue. Through looking at questionnaires developed for surveys on public knowledge of and attitudes towards science carried out during this early phase one can get an idea about the dominant vision on science and society issues. From the late 50ies onwards such surveys became an integral part of the US-American context, a fact that analysts ascribe to the Sputnik shock as well as to the extraordinary growth of financial needs for science and technology.[19]

This approach pretended to offer the possibility to observe and follow the position of science and technology in American society over time in an “objective” manner. Yet critics would underline that these questionnaires in fact do nothing else than reflect the

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[18] See Felt, Ulrike. (1997): Wissenschaft auf der Bühne der Öffentlichkeit: Zur "alltäglichen" Popularisierung von Naturwissenschaften in Wien, 1900-1938 (Habilitationsschrift, 300 p), Felt, Ulrike (2000): "Why should the public »understand« science? Some aspects of *Public Understanding of Science* from a historical perspective", In M. Dierkes and C. von Grothe (Eds.): *Between understanding and trust: the public, science and technology.* Berkshire: Harwood Academic Publishers: 7-38.

[19] See Wynne, Brian (1995): “Public Understanding of Science”, In Jasanoff, Sheila, Gerald E. Markle, James C. Petersen, Trevor Pinch (Eds.), *Handbook of Science and Technology Studies* Thousand Oaks/London/New Delhi: SAGE: 361-391; Lewenstein, Bruce (1995): "Science and the media". In Jasanoff, Sheila et al., op.cit.: 343-360.

representation of science and technology held by those commissioning and/or developing the research. It would eventually become a way to measure the success with which scientific rationality had managed to become the only type of rationality, as well as to see the prevailing ideas about the institutional character of science and the set of standardised "knowledge-packages" which had been enforced upon the public as "the correct answers". The very staging of such surveys in the form of a quiz, with only one “right way” to answer reflects the particular vision of science that is embedded here.

Phase 2

The performative character of communication on science and technology

The late 1970s could be characterised both by a growing critique and scepticism towards science and technology in general as well as towards the ways in which the science-technology-society relationships were conceptualised. Social movements like the environmental movements, peace movement or women's movements were the contexts in which doubts about science and its impact on society could be raised in a legitimate way. Alternative knowledge forms started to claim their place in societal decision making, thus questioning the classical model of decision-making based on technoscientific expertise. In this context the classical linear communication models also started to be questioned.

During this period, which witnessed an increasing number of technoscientific controversies and the growth of risk issues in the public sphere, also the research on public perception of risk and the study of public controversies on science and technology started[20]. Increasingly the rather positive vision of science and technology was tempered by growing awareness also of negative impacts. Questions of responsibility and power started to be posed. They related to the social distribution of risk, to the role of citizens in decision-making about science and technology as well as to the access to expertise. The instrumental character of performing science and technology on the public stage became clearly visible in these studies and was addressed from different angles.

It was a central message that popularising science should not be seen as a mere simplification of knowledge, but as a highly complex attempt of constructing both a public as well as their vision of science. One would thus need to closely investigate the

[20] This corpus of literature would for example embrace work such as Dorothy Nelkin's on controversies (e.g. Nelkin, Dorothy Ed. (1979): *Controversy: Politics of technical decisions.* Beverly Hills, CA: Sage), but also the early work by Brian Wynne (e.g. Wynne, Brian (1980): "Technology, risk, and participation: The social treatment of uncertainty." In J. Conrad Ed., *Society, Technology and Risk*. London: Academic Press: 83-107). Wynne, Brian (1982): *Rationality and Ritual: The Windscale Inquiry and Nuclear Decisions in Britain*. Chalfont St. Giles, UK., British Society for the History of Science) on risk and participation, to give but two examples of researchers in this domain.

performative nature of the public discourses on science and technology.[21] In this sense one could paraphrase Jacobi and Schiele: the very fact that discourse on science and technology exists and the framework it offers practitioners became more important than the question whether the information that is processed was right or wrong.[22] Thus it was the power of the narratives on science, technology and society that were questioned, counter-narratives were developed and conflicts between them broke out frequently.

The strong critique of science and technology did not only cause an increase in communication activities. In parallel also concepts such as technology assessment were developed as a way to handle technological developments as well as the policies that would accompany them in a more systematic and controlled way. Like that it was hoped to be able to better get grip on the societal boundary conditions for technological development. Other answers to this increased tension between societal perception and technoscientific development were for example more interaction-oriented and open settings such as the science shops in the Netherlands which tried to act as intermediary institution between the science system and the public sphere. Again in other national contexts the idea of a growing necessity of educating the public with regard to science and technology was dominant. Only if one could convince a larger segment of the public to accept the technoscientific rhetoric of progress as well as the new artefacts and procedures, would scientific and technological development be able to continue its trajectory in an unhindered way.

In that sense it became clearer how multiple the possibilities and motivations were for scientists when moving to the terrain of science communication. Popularisation of science was seen as a way to exert influence on institutional settings and society at large by imposing certain visions/images of the world around us, and the public stage had developed into an extended terrain to fight scientific controversies.

Thus on the level of analysis one could see a clear shift away from the idea that scientific knowledge was communicated in a simplified way, towards studying the power relations that were embedded in such undertakings as well as in the narratives produced. Through popularisation of science so-called "icons of truth"[23] would be produced, which would then be able to transport the non-explicit and non-deliberative dimensions of science. Michel Cloître and Terry Shinn brought this aspect nicely to the point: "In the case of popularization of science, the language, the reasoning and the images do not manage to elucidate the phenomenon, but quite to the contrary there is a tendency to create a conceptual incomprehension. (…) Popularization constitutes

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[21] A good example would be the articles which appeared in the following yearbook: Shinn, Terry and Richard Whitley (1985): *Expository Science: Forms and Functions of Popularization*, Sociology of the Sciences Yearbook, Dordrecht: Reidl.

[22] Jacobi, Daniel and Bernard Schiele (eds.) (1988): *Vulgariser la science - Le procès de l'ignorance*. Seyssel:Champs Vallon: 14.

[23] Whitley, Richard (1985): Knowledge Producers and Knowledge acquirers, in Shinn, Terry and Richard Whitley (1985), op.cit.note 6:3-28.

thus not an efficient instrument for the transmission of a better knowledge about the physical world. Its force and its pertinence lay in the links which it establishes between a scientific subject and the social sphere".[24]

What happened to the role of the public in this period of change? With a few exceptions, it remained in the classical role of the knowledge acquirer and the scientists stayed the producers, although the former started to be perceived as much more diverse, structured and guided by different interests and as having a potential impact on techno-scientific development.

Phase 3

From performing technoscience to attributing meaning to it in the public sphere

In 1985 the well-known Royal Society report with the title "Public Understanding of Science" was published.[25] The public and how to make them "understand" science would be declared as the centre of interest. In a British context, largely damaged by Thatcher's science policy measures, the support of the larger public seemed to have become an essential pre-requisite for a decent survival of the research system, and one thus aimed at gaining the public as allies.

This report is interesting for a number of reasons. It still clearly subscribes to the deficit model idea and very explicitly expresses the hopes and expectations that were put in this effort. People were supposed to have a knowledge deficit, there was a gap to be filled that separated them from science and all that was needed was to find out where the deficiencies lay and then develop programmes of wider "education". Thus we find the declaration that "some basic understanding of how they (technologies) function should make the world a more interesting and less threatening place." Or as people would be allowed to participate in democratic decision-making it was seen as crucial that they "recognize and understand the scientific aspects of public issues."[26] As "the uninformed public is very vulnerable to misleading ideas" science communication would make lay-people themselves able to make the difference between competing claims and would be able to recognise and choose the scientific claim as the right one.

To sum up: Science should communicate its ideas, "facts" and methods better in order to become recognisable and more acceptable to a wider public and to make vanish any of these "unreasonable" fears present in the public arena. The parallels in this kind of discourse to the 19th century enlightenment discourse, aiming at educating the bourgeoisie and later also the working class, are striking, in particular if we consider

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[24] Cloître, Michel and Terry Shinn (1986): "Enclavement et diffusion du savoir." *Information sur les Sciences Sociales,* 25(1): 161-187.

[25] Royal Society (1985): *The Public Understanding of Science*, Report of the Ad Hoc Group, London: Royal Society.

[26] Royal Society (1985), op.cit.note 10.

that we find ourselves in the late 20th century, in a period which would be described by analysts as reflexive modernisation.[27]

The lines of research which managed to develop from this starting point where at least two-fold. The first would actually build on the survey research experiences and define the notion "understanding" as operationalisable through defining and measuring a set of "factual" knowledge about science – which scientists would decide upon beforehand. These tests of what was called "scientific literacy" had started to become more regular in the 1980s first in the US context and later on also in Europe.[28] In that sense this strand can be seen as a clear reinforcement of the separation of science from its publics and thus as a safeguard of the authority status of the former. The basic assumption was that a minimum scientific literacy would be required in order to allow citizens to fully appreciate technoscientific progress in contemporary societies.

Guided by the idea that science functions in a universal manner and is communicated in highly standardised ways in networks that span our world, it was assumed that one should also search for "best practice" models for science communication and to implement them widely. Starting from this perspective much effort and money was invested in regularly observing public opinion on science and technology issues. Wide ranging surveys questioning the attitudes people have towards, but also the knowledge they would hold on scientific issues were perceived as an ideal policy tool to monitor this domain.[29]

Underlying these surveys was/is a set of rather normative ideas about science. Scientific knowledge is equated to a number of facts - and this after years of research that convincingly argued how strongly contextualised scientific knowledge is, how interpretation processes and tacit knowledge are needed to produce it and how deeply it is dependent on consensus building processes within a social community. Questions in these surveys generally allow for <u>one correct answer</u>, even if the former would be open to diverse interpretations.

Criticism of this research was formulated from within the STS community, mainly on the methodological level: The fact that respondents were taken out of their social environment when questioned, knowledge and understanding were completely decontextualized and thus answers would loose their meaning, the questions were simply reproducing certain assumptions (e.g. on the scientific method) and many other weaknesses were underlined. Thus this research would also reproduce a number of existing prejudices e.g. concerning the gender divide with regard to science, the north/south differences and many more. To use the terms of Brian Wynne: "Evidence

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[27] See for example Beck, Ulrich (1992): *Risk society: Towards a new modernity*. London: Sage.

[28] See Miller, John D (1983): *The American people and science policy: The role of public attitudes in the policy process.* New York: Pergamon; Durant, John R., G.A. Evans and G.P. Thomas (1989): “The Public Understanding of Science”, *Nature* 340 (6 July): 11-14; National Science Board (1989): *Science and engineering indicators: 1991*. Washington DC: Government Printing Office.

[29] See for example the following DG Research Report from the Expert group: Benchmarking the promotion of RTD culture and Public Understanding of Science, July 2002.

of internal coherence among survey data is not itself evidence of wider validity – only of consistency. Too often the latter is mistaken for the former."[30]
Rather than entering once more into the methodological debate, I would like to point to the power of the discourse that developed around the results of these surveys on the science policy level and in the media. As they seem to produce “hard data” and “prove” the public deficits with regard to science and technology, they can more easily be used in argumentative contexts.

The second line of research triggered by the PUS-debate embraced more qualitatively oriented studies. They focused on the ways in which people would up-take science in concrete settings. The processes of knowledge dissemination were thus increasingly deconstructed. Especially the rigid demarcation between genuine and popular knowledge turned out to be rather problematic as non-experts appeared to have their own models and representations about the world surrounding them which could not simply be ignored or declared as too simplistic and bare of rationality. As a consequence also the dichotomy between scientific texts on the one hand and popularised accounts on the other had to be replaced by the picture of a continuum of different kinds of texts. Popularization started to be understood increasingly as a negotiation of meaning and it was underlined that both the very act of popularization as well as popular knowledge would be fed back into the process of knowledge production and thus have an impact upon the cognitive dimension of science itself.[31]
What lay-people do with scientific information, how they interpret it with regard to the existing knowledge-structures and what place they give to scientists and scientific institutions in their decision making, these are but a few of the questions that became central. The shift that took place was therefore twofold. First, it was not so much the production side of popular science accounts which was studied, but the way people would attribute meaning to the scientific knowledge and information they managed to obtain, or were offered. Secondly, not abstract knowledge structures were of interest, but particular settings in which people would encounter science and be forced to take decisions, which would at least partly involve technoscientific knowledge. Thus our attention was drawn to the fact that the public up-take of science depended upon previous experiences, on the social setting in which people would meet science and what expectations they would have with regard to science. These negotiations concern the degree of importance that would be attributed to scientific knowledge and expertise as compared to other forms of knowledge and expertise as well as how scientific knowledge was socially mediated and embodied when it was experienced by people.[32]

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[30] Wynne (1995), op.cit.note 4: 370. Felt (2000), op.cit. note 3.
[31] See for example, S. Hilgartner (1990): „The dominant view of popularization: conceptual problems, political issues“, *Social Studies of Science*, 10: 519-539;
[32] Wynne, Brian (1992): "Misunderstood misunderstandings: Social Identities and the public uptake of science", *Public Understanding of Science* 1: 281-304; Irwin Alan and Brian Wynne (eds.) (1996):

Much of the research focused on the way people framed techno-scientific problems in society and thus attributed meanings. The conclusion reached was that people would live/experience science through social relations and that the core of the problem was thus less the lack of knowledge about science, but **trust** in the science system and in scientists.

If we look at the impact these two research strands have on the policy level, it is easy to perceive the powerful position of the quantitative indicator oriented research. The more qualitatively oriented research strand was criticised and partly ignored, as the evidence produced was deeply embedded in a particular setting and thus seemed less generalisable or would not offer easy ways to compare and monitor the developments in these areas. Further the case studies addressed socially rather coherent knowledge networks, such as patients touched by a particular illness, sheep-farmers or Saami population who would have particular ways of confronting "outside" knowledge compared to those who could not draw upon this quite organised collective kind of experience or knowledge.[33] Thus at a first glimpse is was seen as less attractive on the policy level or as steering instrument and much more attention was given to the "hard facts" produced by survey research. A further key reason for this “resistance” to qualitative research was that it quite explicitly understood that the "PUS problem" was one of scientists’ understanding of the public as much as of public understanding of science.[34] Thus it to a certain extent represented a challenge to scientific culture and institutions too.

An interesting hybrid phenomenon emerged in the public terrain as a consequence of this “clash” of different approaches. While the more reflexive positions found their place mainly in general statements or in the preface to papers and reports, the "hard core" of argumentation and practice would much more follow the rhetoric development around the quantitative survey results. Yet we should draw attention to the fact that survey research ironically produced results, which in fact challenged its own basic assumptions. For example the assumed correlation between ignorance and non-acceptance of science (e.g. in the case of GMO risks) did not correspond with the results obtained. Or, after years of information campaigning and increased communication efforts the responses to the questionnaire did not really shift fundamentally.[35] Thus the "hard-core" of the PUS policy could not really built on the results of such survey research, but much more on the very method of this social

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Misunderstanding science? The public reconstruction of science and technology. Cambridge: Cambridge University Press; Michael, Mike (1992): "Lay Discourse of Science: Science-in General, Science-in-Particular, and the Self", *Science Technology and Human Values*, 17 (3): 313-333.

[33] Wynne, Brian (1992): op.cit. note 17; Paine, Robert (1992): "Chernobyl reaches Norway: the accident, science, and the threat to cultural knowledge", *Public Understanding of Science* 1: 261-280; Irwin, Alan and Brian Wynne (eds.) (1996), op.cit note 17.

[34] Lévy-Leblond, Jean-Marc (1992): "About misunderstandings about misunderstandings", *Public Understanding of Science* 1: 17-21

[35] European Commission (2001), Research Directorate-General, *Europeans, science and technology*, Eurobarometer 55.2.

science, which projected and performed a standardised public with standardised science-centred worlds of meaning. It thus reaffirmed and reinforced policy assumptions that existed prior to research.

Phase 4

Repositioning science in society: dialog and participation

Stretching our narrative to the most recent period, one can see that *Public understanding of science* has become an issue of growing concern both for national governments as well as on a supranational level (e.g. in the European Union) and for research institutions and enterprises in the technoscientific area alike.[36] It has been reformulated in many different ways using the notions of *Raising Public Awareness on Science and Technology* or *Dialogue between science and society*, which is a clear indicator for the difficulties one is facing and the search for new ways of addressing them. Indeed the growing ambivalence expressed by wider segments of the public towards technoscientific development represent a threat for a number of actors. Governments are threatened to loose science as an advisory/legitimatory device as people's trust in expert opinion seems shaken.[37] Scientists feel this change both in the growing number of occasions in which the ethical and societal dimensions of their research is questioned, but also in a decreasing number of science students in recent years. Enterprises in the technoscientific domain are concerned because of the seemingly "unpredictable and irrational behaviour" of consumers, who start to be reluctant to accept technoscientific progress at any price.

The UK crisis with regard to BSE has clearly shed light on the doubtful role scientific advisors have come to play in the public eye and the weakness of the relation between science and politics has become highly visible.[38] The analysis made in the report *Science and Society* pointed at diminishing trust in science from the side of the public although people showed interest in science and this was perceived as having major consequences for public policies in a number of ways. It underlined the need for science to better understand the changes in society and also shift its positions accordingly.

Rejection of technoscientific innovations by the public could no longer be easily argued as being simply due to a lack of information. New ways of interaction and communication between science and the public were called for and public participation in decision making for sensitive technoscientific issues had to be considered as central.

[36] See for example Fuller, Steve (1997). *Science.* University of Minnesota Press, Ashworth, J. ed.(1997): *Science, Policy and Risk* London: The Royal Society., Collins, Harry M. and Trevor Pinch (1993). *The Golem - what everybody should know about science.* Cambridge: Cambridge University Press.

[37] Hilgartner, Stephen (2000): *Science on Stage - Expert Advice as Public Drama*. Stanford CA: Stanford University Press.

[38] Science and Society (2000): *Science and Society: Report by the Select Committee appointed to consider Science and Technology*.
http://www.publications.parliament.uk/pa/ld199900/ldsctech/38/3801.htm;
see also the Lord Phillips "BSE Inquiry Report", http://www.bseinquiry.gov.uk/

Trust, co-operation, dialogue and participation have become the buzzwords that dominate the discourse. Examples would be the British Science and Society report by the Select Committee appointed to consider Science and Technology, the British Department of Trade and Industry White Paper, the OECD report on Promoting public understanding of science and technology, the "Memorandum: Dialog Wissenschaft und Gesellschaft" by the *Stifterverband für die Deutsche Wissenschaft* and finally the Report of the EU working group "Democratising expertise and establishing scientific reference systems".[39] All of them would in one way or the other address this discrepancy between increasingly relying on technoscientific expertise for public decision-making and the contested character of this expertise.

It seems as though there is agreement that it would not be possible to merely continue to follow the "we need more science communication" logic. What we can see from this development is the shift in the role accorded to publics, which is increasingly posing a challenge also to the development of technoscience and its integration into society. The debates seem to be torn apart between some elements of enlightenment science and the increasing necessity to integrate the public into the decision making procedures in some way. New, more interactive and open-ended procedures such as consensus conference or round-table discussions are experimented with in order to get closer to the idea of an integrated and broader expertise that would then be the basis for decision-making. The same can be said about the development of participatory technology assessment. Science and technology would thus be subject to stronger interactive forces that allow for a large diversity of exchanges, and a context is created in which expectations, preferences, incompatibilities and needs can be articulated. Science and technology – if they want to keep their place in society – would then have to allow for debate and contestation and engage into these kinds of confrontations in public arenas.[40]

To close this first part, it is fascinating to observe how elements of the deficit model still manage to get their place and thus keep alive the hierarchies and power-relations that assure an exceptional status to science and technology in many of the communicational settings that inscribe themselves in this new rhetoric. In that sense one could follow the convincing analysis of Lévy-Leblond: „The problem we face is not so much that of a knowledge gap which separates lay people from scientists, but that

[39] OECD. *Promoting public understanding of science and technology*. Paris: OECD, 1997; Science and Society (2000), op.cit. note 23; White Paper dti. *Excellence and Opportunity – a science and innovation policy for the 21st century*. Department of Trade and Industry, 2001 http://www.dti.gov.uk/ost/aboutost/dtiwhite/; Stifterverband. Memorandum zum "Dialog Wissenschaft und Gesellschaft", 1999 http://www.stifterverband.org

[40] Nowotny Helga, Michael Gibbons and Peter Scott (2001): *Re-Thinking Science. Knowledge and the Public in an Age of Uncertainty.* Cambridge: Polity Press: 209.

of the power gap which puts scientific and technical developments outside of democratic control.“[41]

2. Communicating about science and technology: Why, how and what?

Having developed an account of the changing perceptions and realisations of science-technology-society relations in the first part of this chapter, our discussion will now shift to reflecting on the motivations behind, on the structural specificities of as well as on the perspectives addressed in communicating about technoscientific issues. This reflection will be organised around three questions, each approaching this complex relationship from a different angle and shedding light on the possibilities and limitations of such an interaction.

Why should the public understand/be aware of scientific and technological developments?[42]

Looking at the in part highly emotionalised debates on PUS issues in different national settings as well as on the European level, one is tempted to question the core motives that drive different actors to engage in science and technology communication activities of various kinds. In fact one could even argue, that we cannot understand what happens in these interactions, nor speak about effectiveness or success of any PUS-initiative without trying to clarify the “political paradigms” behind, the underlying tacit assumptions as well as the roles and functions such communication initiatives would have.

Taking a closer look, two distinct categories of motives can be identified. The first set of motives is rather situated on the meta-level and has to be understood as closely linked to the authority claims of science and technology in contemporary societies, to the request of the science system for autonomy as well as to the wish to enforce the epistemic model of science as a dominant way of societal knowledge-production. Within this first set we find however two somewhat different approaches. One motivation behind the abundant communication activities is linked to the wish of the technoscience system to *clearly demarcate its territory*. Indeed, if one assumes that the meaning of “technoscience“ is not fixed in time and is subject to negotiations and if there is no obvious clear-cut societal set of demarcation criteria to distinguish science from non-science, then the public representations constructed in the course of science-public interactions come to play an important role.

Within the scientific community considerable effort is devoted to formalisation and standardisation procedures precisely to be able to delimit scientific knowledge production from non-science. This „boundary-work“, as it was labelled by Thomas Gieryn, „occurs as people contend for, legitimate, or challenge the cognitive authority of

[41] Lévy-Leblond (1992), op.cit. note 19.
[42] Parts of the here presented concepts have been developed in Felt (1997, 2000), op.cit. note 3.

science." If there is a social interest in „claiming, expanding, protecting, monopolising, usurping, denying, or restricting the cognitive authority of science" then pragmatic demarcations of science from non-science seem important. Science is, seen from this perspective, „nothing but a space, one that acquires its authority precisely from and through episodic negotiations of its flexible and contextually contingent borders and territories. Science is a kind of spatial ‚marker' for cognitive authority, empty until its insides get filled and its borders drawn amidst context-bound negotiations over who and what is ‚scientific'". One territory on which this negotiation of the borders of science takes place is definitely the one of public communication of science (see chapter 3).[43]
The preoccupation to draw a borderline between science and other forms of cultural knowledge production is omnipresent in the discourse around popularization of science.[44] Indeed folk-knowledge as a kind of alternative knowledge-system seems very powerful in the public domain and thus threatening to science: It is generally more sensitive towards the preoccupations of the public, often has a visionary component and is "pragmatic rather than rigorous and testable."[45] But above all folk-knowledge can be acquired by everybody in a direct way and does not need the mediation of an expert. Thus „effective" popularization of science is seen as an important counter-measure in areas where folk-knowledge is powerfully represented. But this engagement into science communication also means to enter into negotiations about what was to be considered science and what not on a hybrid territory (being both scientific and public) where the public becomes a relevant actor to be convinced.
Finally, boundary work is also linked to the important question of who has the legitimation to speak for science. Should these link-persons be scientists or should we greet the professionalization of science journalism as a way of gaining a clearer and maybe more critical view on science and technology from the "outside"? To whom should it be left to define „patterns of cognition, interpretation, and presentation, of selection, emphasis, and exclusion" and thus to choose one version of reality to be present in the public sphere?[46]
Besides this boundary-drawing motivation, a second perspective could be discussed, the aspiration to implement what is often labelled as "*scientific and technological culture*". Here two slightly different discourses can be observed. The first argues for a place of science and technology in what is regarded as general culture, thus to put science and technology as a system on the same level as other cultural domains. The

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[43] Gieryn, Thomas F. (1995) "Boundaries of Science". In Jasanoff, Sheila, Gerald E. Markle, James C. Petersen, Trevor Pinch (Ed.), *Handbook of Science and Techology Studies* Thousand Oaks/London/New Delhi: SAGE: 393-443. See also Gieryn, Thomas (1999): *Cultural Boundaries of Science: Credibility on the Line.* Chicago: University of Chicago Press.
[44] See Felt (1997, 2000), op.cit. note 3.
[45] See Dolby, R.G.A. (1982): "On the autonomy of pure science. the construction and maintenance of barriers between scientific establishments and popular culture", in N. Elias, et. al. (eds.), *Scientific Establishments and Hierarchies*, *Sociology of the Sciences*, Volume VI: 267-292, quotation p. 271
[46] LaFollette, Marcel (1990): *Making science our own: Public images of science 1910-1955.* Chicage: The University of Chicago Press: 47

second strand of argumentations could be labelled “science as culture” and addresses the idea of building a society which is somehow modelled along the basic functioning principles of science, i.e. science as a way of thinking, as a method of approaching problems and as an „ideal“ functional system. Science here is conceptualised as largely value-free, objective and following a perfect internal logic. As a source of truth and an enterprise that is allegedly morally above most other social enterprises, it is staged as an ideal fundament for political and ethical judgements. Science should become the basis of what can be labelled „*Weltanschauung*“(world view). This discourse remains often rather implicit, however in part becomes visible for example through the reaction of both large segments of the scientific community as well as of policy makers to cases of scientific fraud. In fact instead of questioning the basic functioning principles of the science system that have been largely altered through its closer association with the economic system and its presence in the public sphere, the cases are generally treated on the level of failure of the individual scientists. This makes it possible to keep up the strong beliefs about the basic functioning mechanisms of science.

The second category of motivations to engage in science communication is much more concrete and aims at shaping the societal environment in such a way that it becomes more supportive to specific technoscientific developments. A first example is the public discourse meant to create a favourable climate for scientific and technological innovations, a fact that explains why *Public Understanding of Science* policies are often extremely closely intertwined with innovation policies. Behind this approach lies the classical deficit model, which assumes that people refuse technoscientific innovations because they do not grasp the wide-ranging positive impacts those would have on their lives. Informing them about technological and scientific innovations is thus seen as a remedy, which should quasi automatically change public attitudes. In these discourses very little reflexivity is present on the different value systems on the basis of which innovations are evaluated by the publics, on the fact that while innovations might seem attractive to one user group they might represent a threat for another as well as on the fact that innovations get their meanings attributed in concrete social contexts where also personal and collective knowledge and experiences enter the judgement. And even if initiatives taking place in these contexts were initially declared as aiming at engagement and negotiation with a wider public, in the course of realisation often they rather shifted into doing publicity for science than initiating any critical and informative discourse on it.

A second important element that is a motor for and shapes the public discourse on science and technology is the need to attract more students to the core fields of science and technology. The fear of loosing power to attract young people, of not being able to transmit scientists’ fascination for a particular field of investigation and for science in general and thus to run into difficulties in reproducing the field of research largely motivates scientists to get personally engaged in communicating research to wider publics. Science Weeks, but also other activities such as open house events are very good examples for direct engagement of scientists.

The third and last aspect to be mentioned here is linked to a growing public demand for accountability and legitimation, which should be answered through an increased public communication. Linked to the enormous expansion of the technoscience system, to the increasing specialization and the growing cost-intensiveness, but also to the obvious partly negative consequences of scientific and technological developments, accountability for the funds spent and ever better strategies to legitimise both additional money but also the kind of research to be carried out (see for example the debates around stem-cell research) have become integral part of strategies of scientists and scientific institutions alike. Popularization of science thus also has to be discussed under the aspects of power, political usefulness and accountability.

How can we understand the process of communicating about science and technology?

When analysing the processes of science communication a number of interesting paradoxes can be discerned which represent an important challenge to any future development in this area. At least three of them should be mentioned here.

Paradox 1:
Reconstructing distance through offering closeness

Although we witnessed a multiplication of media opening up new spaces where science meets the public in the course of the 20th century, thus allowing for new and qualitatively different ways of creation and diffusion of representations about science (e.g. internet), this did paradoxically not lead to a rapprochement between science and the public nor to the birth of something one could label “mise en culture de la science”.[47] Quite on the contrary, the increasing sophistication and density of the information exchange did on the one hand privilege those people who already had a considerable intellectual starting capital — a phenomenon which was labelled as the “increasing knowledge gap”, while on the other hand it also signalled the increasing complexity and inaccessibility of science and technology. One could thus say that the idea of “bridging the knowledge gap”[48] between the science system and the public by means of popularisation of science – an idea which often serves as motor and legitimation for the efforts to diffuse scientific knowledge – always leads to a double phenomenon: while in a certain sense it brings people closer to science, it at the same

[47] For more detailed reflections on this point see among others for example Lévy-Leyblond, J.-M. (1996): *La pierre de touche - La science à l'épreuve ...* Paris: Gallimar.

[48] For an analysis of the history of meanings and development of this notion see: Bensaude-Vincent, Bernadette (2001): A genealogy of the increasing gap between science and the public, *Public Understanding of Science*, 10: 99 –113.

time also reconstructs the distance – a phenomenon already pointed out in the first part of the chapter (phase 1).

Paradox 2: Not science produces "hard facts"
but popular accounts of science do so.

When looking at the way scientific results are communicated within the scientific community in form of publications many analysts have hinted at the fact that the production process behind the results generally does not become visible. Nothing is said about the time consuming work, the choices and negotiations throughout the process of knowledge production, the drawbacks, the costs and manpower involved, the energy invested as well as the deceptions encountered. It seems for the scientists important to agree on one single narrative – the publication – telling how "the idea" became "the result" – fact or artefact. The scientific paper is built in a way to contain the core elements – the "scientific result" – as well as the boundary conditions under which validity can be claimed. When such a scientific fact leaves the realm of science and enters the societal sphere through popularisation it undergoes in this process of rewriting again a fundamental change. It is first once more decontextualised from its conditions of production – we learn nothing about the science-in-the-making –, and is then recontextualised in its societal environment. As a consequence once scientific results are popularised they generally "loose" the information about the scientific context of production and the boundary conditions for validity which would allow to question them and are turned quasi automatically into "hard facts" which can only either be trusted or not.

Paradox 3: Uncertainties linked to technoscientific developments that have
emerged through an increase in reflexive knowledge
cannot be eliminated through further increasing knowledge.

Living at a time where debates on risks and how to handle them are strongly present in the public domain, the call for expertise in order to react to these uncertainties is omnipresent. However if we take the thesis of reflexive modernisation[49], the application of modernist principles to themselves, seriously, then one quickly realises that we are confronted with increasing uncertainties, closely linked to technoscientific development. However these uncertainties do not simply exist, but are "fabricated" in the sense that they come into being, are realised through the production of reflexive knowledge. To quote Ulrich Beck: "Science (…) provides the means – the categories and cognitive equipment – required to recognize and present the problems *as*

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[49] See Beck U. (1992): *op.cit. note 12.*; Giddens, Anthony (1991): *Modernity and Self-Identity: Self and Society in the Late Modern Age*. Cambridge: Polity.

problems at all, or just not to do so."[50] Thus the systematic and reflexive study of science and technology and of the expertise produced in this context, has not strengthened the cognitive authority of technoscience in the public space, but rather shown its limitations. In particular disputes between experts and counter-experts over the scientific assessment of risk are convincing examples. One can thus say that the uncertainties linked to scientific and technological development definitely cannot be resolved by simply producing more knowledge and increasing its public communication.

Leaving the reflections on the three paradoxes of science communication, I now want to investigate the conditions under which communication can take place. To do so I will introduce two key-notions, "boundary object" and "popular scientific language".

The concept of „*boundary objects*" was developed by Susan Leigh Star and James R. Griesemer in their work on the creation of the Berkeley Museum of Vertebrate Zoology. Following their definition, boundary objects, which are central in creating common grounds for exchange and negotiation of science have to be understood as "objects" being „both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites." Said more plainly, this means that one and the same „object" can obtain different meanings and functions for the different groups appropriating it, while at the same time having sufficiently common features to allow for exchange and some understanding between the actors. In this sense all kinds of „popular science products" such as articles, exhibitions, documentary films etc. can be regarded as such boundary objects. "They have different meanings in different social worlds, but their structure is common enough to more than one world to make them recognisable, a means of translation." It is thus possible that the scientists, the mediators, those financing the popularisation effort, policy makers and the different publics keep their own reading, their own interpretation while at the same time rallying around specific boundary objects.[51]

Much of the „success" of popularisation of science thus lies in the fact that apparently there is no need to share one interpretation of a popular science artefact. Quite on the contrary, according to the different social or cultural contexts in which boundary objects are shaped, read, visited, used, ... they will acquire completely different meanings. This flexibility of interpretation and the importance of openness in the act of communication are thus integrated in the concept of the boundary object. At the same time, as stated above, in order to assure a possibility of co-use of the communicated elements despite

[50] :See Beck (1992):op.cit. note 12: 163

[51] See Star, Susan L. and J. R. Griesemer (1989): "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939", *Social Studies of Science*, 19: 387-420.

these different interpretations, there must be a sufficiently common basis to make the popular science artefact recognisable to all actors involved.

What could be this common basis most participants in this interaction process share? Could it be what often is vaguely labelled common scientific culture? Can we discern something like a general agreement on certain aspects of science, which seem central to most of the actors involved? Or are there collective concerns that can be identified? These in fact become the key-questions to be investigated rather than only looking at the content level and the forms of representation of science and technology in the public space.

The third access to a better understanding of what is happening in the interactions along the border between the technoscientific system and the public sphere is to focus on *the language used in these exchanges between science and the different publics*. To do so I introduce the concept of "popular scientific language". In fact the central basic assumption about popular science narratives, be they in newspapers or magazines, oral presentations or descriptions in museums, is that they use a less complex language, i.e. closer to the every-day (more popular) language. Further these accounts are less obliged to follow formal rules of presentation and they contain little information about the context in which scientific knowledge was produced. However, one could argue that a multilayered implicit categorisation stands behind the adjective "popular" (or popularised). In analogy to Pierre Bourdieu's reflections on popular language and its relation to educated language[52], but also taking into account what had been said earlier about the negotiation of meaning in the case of boundary work, we could assume that different actors involved define the notion "popular" in accordance with their respective interests, prejudices or expectations. Needless to say that this definition happens without any of the actors being obliged to justify their definition or even to feel the necessity to make it explicit.

This offers an explanation for the fact that we very rarely come across in depth discussions of what *public understanding* or of what *popular* could mean with respect to science. Thus ideas and visions that are at the basis of the concept of popular science do not necessarily rely on concrete observations or experiences, but much more on expectations and projections.

Further Bourdieu underlines that communication of members of the popular class in public places is, contrary to the impression of superficiality one might have at first sight, in reality highly ritualised and submitted to rather strict rules. Here it would be interesting to draw a parallel between what Bourdieu observes for the relation between popular language and educated language and the relation between the language used in popularisation of science and scientific language. He attracts our attention to the

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[52] See Bourdieu, P. (1993): Sagten Sie "populär"? In G. Gebauer und C. Wulf (Ed.), *Praxis und Ästhetik. Neue Perspektiven im Denken Pierre Bourdieus*. Frankfurt: Suhrkamp.

eloquence that can be observed with members of the popular class in public places, "which is interpreted by the unfamiliar perception as a kind of unrestrained momentum" and which "is in its kind not more nor less free than the improvisations of academic eloquence." This eloquence, this capacity to communicate is based on ideas and expressions, which had stood the test and which were well suited to transmit the feeling that they are participating in an exceptional event to the others who have no command over those ideas or expressions.[53] In this sense science popularisation has – to draw the parallel – developed its own rhetoric, and a particular kind of vocabulary, metaphors and images, "which have stood the test" and which implicitly or explicitly transmit certain values about science. As popular language is linked to a particular constellation of actors, has a certain tradition and is rooted in a precise cultural context, it seems central to understand popular science language with regard to the cultural context and the social background of those involved.

What should be understood about science and technology?

Investigating both the discourses around public understanding of science we are struck by the inherent vagueness of the term „understanding". Scientists involved in the communication initiatives, politicians as well as public forums have dealt more or less explicitly with this notion, which represents a rather important rhetoric mean to position their efforts to communicate science and technology in a specific context. We will also see that the notion of understanding only is filled with meaning in the context of application and that we are often confronted with the coexistence of partly contradictory meanings.

Indeed the spectrum of meanings condensed in the term "understanding science" is rather broad. One could ask with Harry Collins "whether understanding is to be of the content of scientific knowledge or the nature of science as a cultural enterprise"?[54] Or does it mean that the public should become familiar with the way „how, with what confidence, and on what basis, scientists come to know what they do"?[55] Or is it simply an expression of the hope to be able to ensure science's appreciation (and support) by the public? Or does understanding mean transmitting knowledge in a way that it becomes applicable in the context of work or every-day life?

Getting into some more details, let us first consider the often-stressed dichotomy of representing *"science-in-the-making" versus "science-ready-made".* Analysing the different moments when and settings where science communication is taking place there appears a clear tendency towards representing science-ready-made.

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[53] See Bourdieu (1993) op.cit. note 37: 87-88

[54] Collins, Harry (1987): "Certainty and the Public Understanding of Science: Science on Television", *Social Studies of Science*, 17: 689-713.

[55] Shapin, S. (1992): "Why the public ought to understand science-in-the-making", *Public Understanding of Science*, 1: 27-30.

Breakthroughs, revolutionary new findings, outstanding results are the kind of news that often capture public attention. Other such privileged moments are of more commemorative kind, presenting the exceptional contributions of “big men” of science. In such constellations science can be presented as unquestioned, as outstanding, as challenging the frontiers of knowledge and as opening new territories to be conquered. As described just above there is little, if any, possibility to question these findings or to learn more about the context of discovery and justification. Science is already presented in form of neatly sealed “black boxes” in which the processes of knowledge-production and the boundary conditions have somehow disappeared. Generally these knowledge-entities have “forgotten” their history, the difficult ways that had to be taken in order to arrive at them as well as the time horizons that were involved. The advantage of such a form of representation is that science is portrayed as an enterprise producing facts, which then – through more or less lengthy processes – can be transformed into products contributing to societal progress.

Presenting science-in-the-making, however, would mean that one shows the messiness of the processes which lead to producing knowledge, the role played by the social structures in which knowledge is generated, the negotiations that take place between scientists as well as the complex boundary-conditions under which it becomes possible to claim the validity of a scientific result. While this would definitely not produce an easier public image of science and technology as an enterprise, it would surely form the basis of a more reliable and down-to earth vision of what science and technology can contribute to the shaping of society and where other forms of knowledge and judgements should find their place and be given voice.

The second point to make is linked to the fact that when studying public up-take ofscience we also have to consider that even the very *notion of science* may be quite different according to national traditions. This has so far been largely ignored as the Anglo-Saxon context played a rather dominant role and strongly formed the structure and development of the debate. Yet, if we want to understand the ways people perceive science we surely have to take these variations into account. Thus it is important to remark that the very notion of *Wissenschaft* – to take the German example – has a profoundly different meaning than *science*. It does not only embrace the social sciences and humanities, but it addresses also different features that were seen as central during the formation process of the science system, a fact which was also reflected in the German programme dealing with science-society relations.[56] The title "Public Understanding of Science and Humanities" (PUSH) expresses clearly the much more extended notion of "Wissenschaft", which is not reduced to natural sciences and technological applications.

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[56] Stifterverband (1999), op.cit. note 24

Thirdly, „understanding“ science would partly also mean developing a certain kind of *admiration for science and technology as a cultural enterprise*, and having trust into a small elite that produces dominant explanations of the world. Here the focus is neither the process of science nor its products. Reading popular science books, listening to talks of scientists and being able to physically encounter the “objects of science” for example in museums and exhibits, the public was meant to participate in the fascination and in the complexity of scientific thought, even though they were not expected to grasp the details. These reflections also fit with the increasing scientainment character of part of the science communication activities. But in this context it is interesting to underline that science is used in some of the national contexts to contribute to the definition of “national culture” and was/is used for identity building.

Yet part of the efforts – and this is the fourth perspective – were also devoted to make science understood as *a particular way of thinking*, as a specific form of rationality, which is supposed to be unquestionably superior to any other kind of rationality. Presenting science and scientific knowledge in different public contexts was expected not so much to contribute to the establishing of a scientific way of thinking and reasoning in society at large, but people should recognize and trust in this way of arguing and thus attribute less trust and power to forms of knowledge which follow in their production other rationalities.

Finally, science and technology should be appreciated as being a *source of innovation that contributes* in an important way *to the economic development* of a country. This belief of the coupling of national scientific investment and economic progress was strongly present well into the 1980s. Only slowly one had to realise and publicly admit that in a globalised world it was difficult, if not impossible, to claim that money invested in a national science system would quasi automatically lead to a more prosperous economic development of this country. The relationships between the two systems – technoscience and economy – would thus be much more complex and dependent on multiple factors: on the structure and the innovative force of the economic system, on the quality of the person-power available and on a certain diversity and flexibility of the knowledge production system. In that sense it also became increasingly difficult to give credibility to the simplistic version of this claim in the public sphere and to sell science as the central motor for economy.

To sum up: In fact when taking a closer look at the interaction of science and the public we discern a complex process of negotiation of meaning and value of scientific knowledge. The social context and the relational networks people live in impinge upon the ways they perceive scientific knowledge handed down from institutions as if already validated and closed. Science alike has to be seen as imbued with social interest, and thus has an impact upon existing relations, identities and value systems. However, when we realise how little past experiences in the field of science popularization are reflected in the actual discourse, I can but agree with Brian Wynne stressing that „science appears to be unable to recognize these social dimensions of its own public forms or the fact that public readiness to ‚understand' science is fundamentally affected by whether the public feels able to identify with science's unstated prior framing."[57] We assist thus the encounter of two cultures: the scientific culture, which tends to reduce issues to those of control and prediction, and social worlds, which are much more open.

3. Public, Users, consumers or citizens: Constructing and imagining "the others"

The third and last part of this chapter is devoted to reflect on descriptions, characterisations and notions used to identify those who should be informed about, should engage with or should up-take science. I start from the assumption that the different forms of publics science and technology encounter are not simply there waiting to encounter in one way or another science and technology, but are constructed and imagined in the different communicational settings. Science and technology are thus through its communication activities actively engaged in shaping what is labelled generally as "the public".

Thus we will need to reconsider the omnipresent notion of "the public" in its locality and variations, in its cultural and geographic complexities. The different terms used to name the "others", that are addressed by science and technology, will reveal much of the potential set of agency which is implicitly attributed to them.

Shifting notions for "the public" and forms of agency attributed[58]

The general public – The danger of aiming at everybody and reaching nobody

Once the number of public controversies on science and technology has started to grow from the 1970s onwards, public trust in the technoscientific establishment started to decrease and also social science research started to strongly criticize the deficit model of science communication, it became evident that the public could not be conceptualised anymore as a homogenous group of knowledge acquirers, but needed better specification and understanding in its development. Habermas has provided us with a detailed account of the transformation process of the public from a small critically discussing public in the 18th century through a complex set of steps to a public sphere dominated by mass media and mass culture and obtaining power in mass

[57] Wynne (1995), op.cit. note 4: 377

[58] Parts of this chapter have been developed in the presentations "Framing the relation(s) between technology and the public: Imagining and constructing "the public"", given at the summerschool on "Technology and the Public" in Deutschlandsberg (A), 9/7/2002, and "Public-Citizens-consumers: Shifting roles and changing political paradigms" given at the EASST Conference "Responsibility under Uncertainty" in York (UK), 31/7/2002.

democracies. These gradual and successive changes were closely linked to the formation of classes, growing urbanisation, cultural mobilization and new communication structures.[59] We now seem to witness a further shift towards a much more individualised society, a fact that poses completely new challenges to PUS-initiatives.

Using the term public in relation to science in the 20th century indeed opens a large range of possible meanings: more abstract constructions like „public opinion“ which has mainly strategic and legitimatory functions coexist with rather differentiated and specialized publics while at the same time the public appears often represented by institutions, as users of knowledge, spectators, referees and in many other roles. I would therefore agree with Neidhardt stating that, „in modern democracies the public plays an important role — but nobody seems to know exactly what the public is.“[60]

There are however two basic assumptions all constructions of „the public“ have in common: the public is ignorant with regard to scientific knowledge, and simultaneously has the wish to know. Indeed it is a specific condition distinguishing the popularization of science from many other enterprises of knowledge transfer, that the supposed audience is always perceived as a mixture of ignorance and something which was often labelled “natural curiosity“, a *libido sciendi*.

To reach a better understanding of the notion public we could also investigate the process of drawing the boarder-line between scientists and non-scientists. Even if we are tempted to adopt a very simplistic definition of scientist by the fact of belonging to the institutional setting of science and of lay-public by the fact of being excluded, we quickly run into conceptual difficulties. With increasing specialization and differentiation within scientific disciplines the ideal of the generalist becomes a fiction and as a consequence also the boarder line between science and the „lay-public“ increasingly gets blurred. Jean-Marc Lévy-Leyblond brought the problematic aptly to the point: “When discussing the public understanding of science, a serious, but current fallacy is to equate the 'public' with 'lay people', that is 'non-scientists'. However, it must be recognized that we all, scientists and non-scientists alike, share a common 'public misunderstanding of science'. Indeed, given the present state of scientific specialization, ignorance about a particular domain of science is almost as great among scientists working in another domain as it is among lay people."[61]

The users

This second notion, which often appears in the debates around science, technology and society, is that of the user. It is already rather more focused than the notion of the public and is often linked to discussions around technology development. The user and

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[59] See Habermas, J. (1962/1990): *Strukturwandel der Öffentlichkeit* Frankfurt a.M.: Suhrkamp; Neidhardt, F. (1993): „The public as a communication system“, *Public Understanding of Science* 2: 339-350.

[60] See Neidhardt, op.cit. note 44: 339

[61] Lévy-Leblond (1992), op.cit. note 19

his/her role, power, possibilities and degrees of involvement have been discussed widely.[62] This notion conveys the impression that there is a clear segment of the public that is potentially touched in a specific way by technoscientific developments and should thus up to a certain degree get the possibility to participate in shaping process of these developments. These users might get involved through institutions or associations (e.g. certain patient organisations) who are supposed to represent their interests, on a more individual basis, or often only in form of imagined users in the heads of those who conceptualise, develop and design technoscientific artefacts and processes. While it is important to reflect on how users' involvement can be organised in an efficient way, the central question is who decides who is to be regarded as relevant user and thus can get voice in negotiating about possible technoscientific developments and gain weight in decision making processes. The problem of participation in and engagement with science and technology clearly also has to framed in terms of power relations.

The consumer

While the user is a notion, which is generally based on the idea that there are collectives of people that are touched by scientific and technological change in a very concrete way and who would thus also express needs, fears and expectations in similar ways, the notion of the consumer is more individualized while at the same time being also collective. The collective idea of the consumer is a theoretical construction, an imagined entity of people represented by consumer associations and similar institutions. In the individualized concept of the consumer he/she is confronted with taking decisions and making choices whether or not to consume certain goods. With regard to PUS-issues one would have to understand the notion "consumer" as linked to more global changes, such as the rise of consumer culture and the increasing aesthetisization of everyday life.[63] People would thus choose technoscientific informations and artefacts among a broad spectrum of other offers and thus there would be a clear competition between the science system and other explanatory contexts. In that sense we can for example partly explain phenomena such as the growing market-share of *scientainment-events* compared to other ways of communicating science and technology or the boost in para-medical literature which positions itself as alternative to scientific explanations. Popularised science is thus *sold* to wider segments of the public. As a consequence even the most local settings of lay-culture would be influenced by these changes and science and technology would become a consumer good as many others.

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[62] In the domain of constructivist studies of technologies there is a broad variety of studies that have been analysing the role of users in the development of technologies.

[63] Michael Mike (1998): Between citizen and consumer: multiplying the meanings of the "public understanding of science, *Public Understanding of Science* 7, 313-327.

Both the notion user and consumer hint at a more pragmatic view on the science-society relationship, the success of which is evaluated along criteria of public acceptance.

The Citizen

The citizen is the most recent notion that appeared in the discussions around interactions between science, technology and society. Without wanting to enter here a more in-depth discussion about this notion, which has very different meanings and histories in the different national/cultural contexts, there are some fundamental features implicitly embedded in this notion, which are of relevance to our discussion. The first aspect is that these citizens are living in knowledge-societies and thus also citizenship becomes up to a certain degree "scientific".[64] Using this notion of "scientific citizenship" implicitly addresses both the rights but also obligations of these persons: the right to be informed, to position oneself, to engage in debate and decision making, but also the obligation to confront, to take responsibility, to be supportive to collective interests and to participate. A citizen in this sense is supposed not only to act as an individuum, but also in the sense of the collective, it would mean defining rights but also conferring obligations, to create new forms of informed engagement. The objective is to give voice not only to stakeholders but also to other "ordinary" members of society in shaping future relationships between science, technology and society.

While the introduction of this notion is generally not questioned, I would just like to hint at two critical details. First the concept cannot only be interpreted in the sense of a freely deciding citizen, but it is often used to remind the individual of its duty as member of the collective. In particular in highly emotionalised debates, such as the one around gene-food, it was frequently underlined that citizens should not act short-sighted, but see the collective interest of economic benefit and technological progress and thus stop protesting against this development. Second, citizenis a more exclusive concept than "the public", and could in its classical meaning hint at the fact that not everybody living in a given context would have the same possibilities to raise voice and be heared.

Roles attributed to "the public"

Having discussed the different notions used in order to describe "the others", we will now take a closer look at the roles they get attributed or which they are allowed to play. While we will identify four such roles, we have to be aware, that in most cases a mixture of roles is present and makes it difficult to gain a clear impression.

In many cases the public is pushed or slips into the role of *‚naive' spectators* who are meant to be fascinated, amused and impressed by science rather than being taught

[64] Irwin, Alan (2001): Constructing the scientific citizen: science and democracy in the biosciences, in: *Public Understanding of Science* 10: 1-18. Irwin, Alan (1995): *Citizen science: a study of people, expertise and sustainable development*. Routledge.

anything about or even engage with it. People become consumers of divers popular science goods. This role appears in a dominant way, when science is staged as unique, magic, powerful and promising and the important part is not the scientific or technological information but a message, an image that is transferred. There is a large variety of science popularization literature but also museums and exhibitions, which are mainly aiming at conveying this celebrating science mood. We found and find it in spectacular scientific performances at science weeks or festivals, in popular science books be they fiction or non-fiction, or in museum exhibits, to mention just a few examples. The public is clearly perceived as a consumer and science popularization as a good of mass consumption meant to entertain.

The second role attributed to the public was that of *supporters for science*. Science was „sold" to them as a general cultural good or its practical applicability underlined. Once convinced of the importance of scientific knowledge, the public was supposed to be an ally in arguing for more funding or even exert direct pressure to invest into particular scientific domains.[65] Many analyses link the phenomenon of "selling science" to the cost intensification of research in post World War Second science, but also numerous earlier examples can be found. Economic arguments play also a central role here.

Third, the public had the function of *witnesses* — a role that existed in divers forms and out of different motives since the early beginning of modern science. The public (often selected according to suitable criteria) was used to testify experimental results and thus to assure credibility as well as priority of the author over others. It was the administration of the scientific proof in which the public took a decisive role. With increasing institutionalization and differentiation of the science system also the reward system became more formalised and standardised. However, we still find the public as witnesses at moments when the conventional procedures of the science system threaten to break down. Then scientists tend to use for example the press or other mass-media to announce their scientific findings, well before their research is published or submitted to the critical eye of colleagues. Recent examples for such behaviour have been the cold fusion story or high-temperature superconductivity.[66] But this role of witnessing could also be extended to situations where science and technology are put in the situation of needing to account for and legitimate the funds spent. In this situation the public is called to testimony the past successes of science and what it brought to them.

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[65] In the medical sector the formation of self-help mouvements can be observed who then also influence research in this domain. See for example, R. von Gizycki (1987): "Cooperation Between Medical Researchers and a Self-Help Movement: The Case of the German Retinitis Pigmentosa Society", in: Blume S.S. (Ed.), *The Social Direction of the Public Sciences, Sociology of the Sciences*. Dordrecht: Reidel: 75-88.

[66] See B. Lewenstein (1996): „From Fax to Facts: Communication in the Cold Fusion Saga", *Social Studies of Science*, 25: 403-436; U. Felt (1993): „Fabricating scientific success stories", *Public Understanding of Science* 2: 375-390.

Finally, the public was also attributed the role of *participants.* While one could think of amateur scientists when using the notion of participants, we much more mean here the public as actors in hybrid forums where science and technology issues are up for decision-making. Be they users, consumers or citizens they would get involved and have an impact on both concrete decision-making as well as on the way future steps to take are planned.[67]

Collective and individual epistemologies: Developing public perceptions of science

Having looked at the ways in which “the public” takes form in concrete settings and gets attributed particular roles, we now want to reflect on the way these groups position themselves towards technoscientific issues. We start from the idea that what happens with scientific and technological information in public arenas is not simply a process of public up-take of knowledge and information packages handed over to them from the technoscientific system, but people appropriate this information, embed it in their own contexts of knowledge and experience and develop their own individual or more collective epistemologies. These are their basis to explain the world that surrounds them and allows them to make sense of the informations they get, to position themselves and to take decisions.

In order to be able to describe the complex process of developing individual and collective epistemologies, I would like to use the concepts of *thought collective* and *thought style* developed by Ludwik Fleck.[68] A thought collective would then be a group that has direct or indirect interaction with regard to a certain epistemic territory, they collectively are the carriers of the history of this territory, of the knowledge as well as of the practices and cultures that are embedded in there. What all members of a thought collective share is a thought style, a way of approaching issues. But every single person does not only belong to one such though collective but to numerous and rather different ones. Thus one could be at the same time member of the thought collective of environmental activists, be a person having children, be a car user, have to face a specific job, be a long-standing passionate reader of a certain newspaper, belong to a political party and many more. In each of these different roles one does belong to different thought collectives, they overlap and influence each other. In some cases one particular thought collective gets a dominant role, while all others are moved to the background. If this holds for a strongly tied together social group, then I would speak of *collective public epistemologies.*[69] On the other hand most citizens who are not

[67] See for example: Epstein, Steven (1995): The Construction of Lay Expertise: AIDS Activism and the Forging of Credibility in the Reform of Clinical Trials, in: *Science, Technology and Human Values* 20/4:408 – 437.

[68] Fleck, Ludwik (1935/80): *Entstehung und Entwicklung einer wissenschaftlichen Tatsache*. Frankfurt a. M.: Suhrkamp

[69] The sheep-farmer community described in Brian Wynne’s case study (1992, op.cit.) could be interpreted as a case where such collective epistemologies start to play a role.

strongly tied to one social setting will develop out of this multitudes of partly contradictory thought-styles they are confronted with, an *individual epistemology* which shapes his or her position towards technoscientific issue.

Following this logic one quickly has to realise, that it will hardly be possible to easily “guide” public attitudes towards science and technology, as many different visions and perceptions encountered in different social settings collectively form what then becomes visible as public perceptions of science.

Special target audiences: Science communication and gender perspectives

To close this chapter that tried to span a number of issues that are relevant in order to understand the descriptions and analysis offered in the following empirical parts, we want to have a look at one specific target audience that is strongly present and has been so throughout the history of science popularisation, namely women.

But I do not want to focus at when, how and in what contexts women were addressed as audiences from the side of science and technology, as this will be done in the empirical chapters, but I aim at reflecting here on the issue of gender and science communication in more general terms from different perspectives.

To start with it is interesting to remark that through addressing exclusively “women” in specific communication initiatives, one is indirectly creating the idea of a “virtual community” of women, which would seek specific kinds of information, has certain needs and plays particular roles for which this knowledge would be essential. Seen from a historical perspective, women – although first largely excluded and later still marginalised in many scientific domains – became a central audience for popular science accounts as they were perceived as *the weak link* in building a scientifically and technologically grounded society. They were those who would have important educational tasks and their support was essential in many domains of technoscientific change.[70] Through this special attention devoted to them and the quasi-homogenisation of this strongly differentiated group, a dominant image of the relations between science and women was and is constructed, taking into account neither the rather different conditions in which this knowledge would be taken-up nor the contexts in which it would be interpreted and used in taking actions. Through such a rather non-reflexive approach the existing, powerful dichotomy men-women is continuously reconstructed in a very stable and sustainable way.

[70] My favourite quotation comes from the renowned Physicist Ernst Mach, who explained the need for educated women the following way: „The uncivilised woman cultivates and preserves carefully all kinds of usual superstitious beliefs, down to the fear of the number 13 and of spilled salt, transfers them conscientiously to the future generations, and is thus always an object of attack for all movements of regression. How can mankind advance in security, if not even half of them is walking on enlightened paths!“ E. Mach (1896/1910): *Populär-wissenschaftliche Vorlesungen. 4. vermehrte und durchgesehene Auflage*. Leipzig: Johann Anbrosius Barth: VIII.

The second issue to take up is that women are often identified as target group, because they should be made interested in engaging into studies in the science and technology domain. At times when student numbers are decreasing in the core fields of science, women have become an important resource in order to assure reproduction of the scientific fields and thus indirectly also allow for future developments. In particular communication activities of universities aim at attracting this target audience. However it is often overlooked, that science as a way of working, thinking and being is communicated implicitly in many different places and dominant stereotype images of science with strong masculine connotations are omnipresent in the public sphere.

But women are often also addressed as a group that is said to be much more sceptical about technoscientific innovations than men. In particular the survey research exercises have often underlined the fact that women tend to be more critical about certain technoscientific innovations and express more clearly their doubts, ambivalence and fears than men. In that sense once certain issues – such as genetically modified food – have entered the arena of public debate and democratic deliberation processes will take place, information campaigning often tries to address women in specific ways.

Only rarely initiatives aim at fostering the empowerment of women with regard to science as an institutions where women should also get their places in the upper-levels of hierarchies, but also with regard to technoscientific issues that have a large impact on women in their personal development, on the female body and on the gender relations within society in general.[71]

Finally, if one wants to realise the project of embedding science and technology in general culture and to make society function along these lines, it proved important that also women would subscribe to these basic ideas and be supportive to them. In that sense efforts are made in order to convince this specific segment of the public rather than getting involved with their visions of technoscientific developments.

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[71] In recent years a number of studies in the STS field have tried to address the ways in which technological change is also transforming the gender relations on the personal and private level as well as at work.

CHAPTER 2

PUS Policies – Introduction

Maria Eduarda Gonçalves, Paula Castro

Throughout the twentieth century, concerns about the access of the public to scientific knowledge spread from the academic to the economic and political realms. This movement was directly related to the growing recognition of the role of science and technology in economic development and social welfare. The issue of *scientific and technological literacy* entered a new political discourse where it became linked with the notion that people living in a complex technological civilization should possess a certain degree of scientific and technological knowledge and know-how. In more advanced economies, the attention to the levels of the workers technical skills, and their impact on industrial competitiveness has been recurrent.

Since the mid-1970s, knowledge of science has become also associated with the understanding of science in the sense of *social acceptance* of technological change. In fact, the interest shown by political authorities concerning the levels of knowledge, as well as the attitudes of the general public towards science and technology may be explained by their need to obtain social support for their investments in research and development, especially at a time when the credibility of science was being challenged to some extent in technologically advanced societies. Policy action in this new field can thus be regarded as a prerequisite for reducing the distance and tension between science and society (Gonçalves, 2000).

By the same token, a wide set of arguments has been put forward in favour of the popularisation of science in a changing world: scientific, economic, military, ideological, cultural, intellectual, aesthetic and ethical arguments. These broad approaches meet the thesis of the well-known report by the Royal Society of London on “The public understanding of science”, published in 1985. According to this report, “better public understanding of science can be a major element in promoting national prosperity, in raising the quality of public and private decision-making and in enriching the life of the individual” (The Royal Society, 1985).

One should, therefore, not be surprised by the recognition, by the Organisation for Cooperation and Economic Development, since 1987, that governments, as part of their policies for science and technology, should play a role in the promotion of scientific and technological literacy through education and other means (OECD, 1987).

In the European Union (EU) scientific literacy has been the object of the Eurobarometer public opinion surveys since the late 1970s. Under the 5th Framework Programme, the

EU launched a specific research line into issues of public awareness about science and the public understanding of science. In July 2002, a plan of action was adopted by the European Commission to stimulate and to support popularisation of science activities as such at the EU level.

Notwithstanding the *common recognition* by governments of European countries of the need to engage in an active promotion of the diffusion of science in society, as well as the understanding of science by the people, the *variety of the approaches* adopted, and the means resorted to by public bodies to improve the relationship between science and the public should be acknowledged. A comparative overview of the policies carried out in this area in some Member States of the European Union (Austria, Belgium, France, Portugal, Sweden and the United Kingdom) indeed shows remarkable contrasts regarding, in particular:

- The concepts and goals underlying the policies;
- The institutional structures and instruments used to promote the policy objectives;
- The social actors involved; and
- How these policies are responding to the critical climate surrounding science in Europe.

As might be expected, these differences reflect the variety of national science histories, the relative strength of scientific systems, and the differing perceptions by public authorities about the social and economic role of science, and the various degrees of industrial and technological development.

The question may be raised whether these differences are being – or should be – reduced by European integration processes, and to what extent it may make sense to talk about best practices in this regard.

Historical background

One could point out at the outset that, whereas in some European countries, such as France, Sweden and the United Kingdom, science popularisation has a long history, going back to the Enlightenment, in others, such as Austria or Portugal, the diffusion of science has not been encouraged in a systematic manner until recent times.

The relevance assigned to people's access to scientific knowledge is not separable from the recognition, by the States and by economic actors, of the role of science and technology in social progress and in economic growth. In Belgium, France, Sweden and the United Kingdom, scientific institutions were, as a rule, supported by government, and benefited from a favourable educational and cultural climate, and a dynamic economy. Organised science communication through schools, museums and promotional activities of the professional societies has been ongoing in these countries for many years.

Understandably, Sweden and Britain, in particular, were also countries that witnessed the earlier and more active debates, both within the scientific community and the public sphere, concerning the risky or dangerous consequences of science and technology (e. g, the nuclear power debate in Sweden, the environmental debate in the U.K.), and suffered their impact on the erosion or collapse of public confidence in some science-based industries.

In contrast, in countries such as Austria and Portugal, political and institutional, as well as economic conditions have kept science and the scientists in isolation from society. In both these countries, public investment and human resources in research and development activities, as well as in education and training in science and technology, were low by European standards until the mid-nineties.[72] These factors, together with the lack of research-intensive technological industries, underlie the *fragility of structures and activities for the dissemination of science* until present times.

Deliberate governmental policies to facilitate or promote the popularisation of science appear, therefore, to be connected with particular political and ideological, as well as economic, social and cultural backgrounds.

The concepts and goals underlying the policies

Just like each painter possesses a favourite and distinctive palette of colours, by which he can be recognised, each culture has, in a particular moment in time, favourite words for describing and constructing its social reality. These words carry a history with them, and their meaning is a product of social negotiation. It also happens that for issues socially recognised as relevant, most of our words come in oppositional pairs, and each term of the pair can be used in different discourses. As a consequence, different cultures use different words, different opposition pairs of words, different expressions and thus different discourses.

Under the label of "scientific literacy", "scientific culture" or the "public understanding of science", in all the countries analysed both the governments and the scientific communities now share a *common concern* with the awareness and knowledge of science by the general public. As the relationship between science and society became politicised, a tendency developed to broaden the scope of the concepts used.

[72] Differences of degree between these two countries should, however, be acknowledged: whereas in Austria R&D industrial expenditures account today for 40% of the total R&D expenditures, in Portugal they account for just 25%; and whereas, in Austria, public investment in R&D amounts to 1,8% of GDP, it only amounts to 0, 65% in Portugal.

However, the contexts in which such concern was born and developed, and the underlying philosophies vary to a great extent: whereas in some cases, *civic and cultural* considerations have prevailed, in others, *economic and industrial* purposes predominate.

The United Kingdom is regarded as a pioneering and innovative country in both the theory and the practice of Public Understanding of Science (PUS), understood as a new field of public and political interest and of social research. In this country, the objective of the initiatives put forward in this field from the 1980s onwards was twofold: improving people's capabilities as active professionals and informed citizens in an increasingly technological society, and of securing the public's support for the State's investments in R&D. It was not a coincidence that the Royal Society of London's influential report on "The Public Understanding of Science" (the "Bodmer report") was elaborated and published at the time of Mrs. Thatcher's conservative government with its constraints on public funding and the corresponding pressures for public accountability of research.

In contemporary France, efforts to carry out an explicit policy designed to further the penetration of science in society may be said to have been pro-active, rather than reactive: they followed the options made by the socialist government which came to power in 1981. One of the outcomes of this policy was the establishment throughout the country of "centres de culture scientifique, technique et industrielle".

In Sweden, the relationships between culture and science have been credited as being of prime importance in the last two decades. The Council for Planning and Coordination of Research, established in 1979, has been the foremost actor to stimulate and support efforts to popularise science.

The actual political relevance of the "public understanding of science" in both Sweden and France appears to be a result of the recognition by law, as early as 1977, in Sweden, and 1981, in France, of a clear assignment (the "third assignment" besides teaching and research) for scientists and academics to become actively involved in the dissemination of the outputs of their work towards the general public. Similarly, the emergence of universities as a leading actor in this field in Belgium can be related to the implementation of their statutory mission to provide services to the community.

In Sweden, the third assignment was ultimately reoriented towards more practical ends: applied research, industrial R&D, commercial utility and competencies-building have gained momentum in the directions of policies for scientific institutions.

The decisive role played by Belgian regional and local authorities in the promotion of awareness about science can be related to a somewhat similar aim: that of encouraging an innovative and industrial culture among students and entrepreneurs. Emphasis has been placed on the building up of a scientifically and technologically competent workforce, combined with initiatives to raise awareness about science among the general public. It should be recalled in this connection that in this country business expenditure amount to 72% of total R&D expenditure. Besides, the ratio of researchers' vis-à-vis the active population is one of the highest in Europe.

A nexus can therefore be recognised between the levels of industrial development and industrial investment in research and development, and the emphasis of public policies on technical or technological, besides scientific culture.

This hypothesis is reinforced if one considers the Portuguese case. In Portugal, industrial expenditure in R&D amount to only 20% of total expenditure. The explicit "policy for scientific culture", led by the Portuguese Ministry of Science and Technology, was guided by an ideological frame of reference inherited, one might say, from the philosophy of "Les Lumières" according to which science is essentially the search for the laws of nature and of things, based on logic and deduction. The same ideology espouses the values of liberty and of democracy and takes them as intrinsic elements of scientific practice. The "Ciência Viva" (Science alive) programme, the major initiative launched in this context, lies on the notion of scientific practice as the understanding and manipulation of nature and of scientific instruments. One of its main underlying goals is to counter the traditional theoretically based teaching of sciences, by a methodology of teaching based on experimentation. Technological and industrial development provides, at the most, indirect or implicit goals of this policy.

It was also in the 1990s that the Austrian government (firstly through the Ministry of Science and Transport and since 2001 through the Ministry of Education, Science and Culture) acknowledged the need to invest in this new policy area. During these years, an increasing interest for science and technology was also perceivable in the Austrian media. Pressure for problem-oriented research combined with the decrease of public funding, and the intense public debate about science-issues such as GMOs and related scepticism and distrust towards science (triggered by applications by national and international research institutes to release GMOs in Austria) were at the origin of the recognition of the need to work out new forms of communication of science to the public. Their central objectives have been to attract young people to scientific professions, and to secure public acceptance of science and technology.

As it comes out from this brief sketch of the economic and social contexts, and the goals of national policies in this field, highly industrialised countries, namely France and Belgium, have actively promoted the dissemination of science and technology in society as part of broader public policies, at the central or regional levels, aimed at furthering the synergy between science and technology, *industrial growth and competition*, on the one hand, and at raising *awareness about science* and *bringing science into culture*, on the other hand. These options account for the fact that the concept commonly used in political and social discourse be "scientific, technological and industrial culture".

In Sweden, a combination of the civic tradition that relates science to democracy, and a more practical, economically oriented tradition of industrial exploitation of science can be observed as well. The *democratic argument* has played a major role in policies for the university and the public understanding of science: as early as the beginning of the 20th century, public university professors were seen as civil servants close to the people and undertook popularisation activities. The social and political culture that characterises this Nordic country underlies the positive receptivity of the general public to initiatives undertaken in this area.

A somewhat different path seems to have been pursued by the United Kingdom. Against the background of an old tradition of popularisation of science, recent efforts in this area, and the new language used to frame it (the "*public understanding of science*"), have been strongly motivated by the need to counter the retreat of the State from research funding. Here, public acceptance became a chief preoccupation of policy-makers and scientists.

In contrast, in Portugal, a country at an intermediate state of development, the new policy in this field "was born out of a decisive debate against Portuguese scientific backwardness", to use the words of the Science Minister. This policy found its origin in the recognition of the need to struggle for the "general appropriation of scientific culture by the Portuguese population". Popularisation is seen, in this context, as both a responsibility of the national scientific community, and a "collective responsibility". The concept most commonly used has been that of "scientific culture". This reflects both a cultural and a civic, but not so much a technological approach to the public understanding of science.

Despite the actual dilution of the left/right divide, one may wonder whether there is any link between the ideological or political beliefs of particular governments and their orientations in the field of the public understanding of science. At first sight, social democrats (in Sweden, for example) and socialist governments (in particular France and Portugal) attached more credence to this policy area than conservative governments did. This hypothesis needs a more in-depth inquiry in order to be tested. One would need to assess, in particular, whether the less active role of some governments is part of a more general political will to reduce the scope of public intervention or a genuine devaluation of the importance of specific policies for scientific culture as compared to education and training ones.

The institutional structures and instruments used to promote the policy objectives

The relevance assigned to citizens' scientific culture or the public understanding of science in different political systems may be assessed by looking at how Parliaments are organised and have intervened in this field. The House of Lords and the House of Commons' Select Committees on Science and Technology, and the Parliamentary

Office of Science and Technology (POST), in the United Kingdom, and the "Office parlementaire des choix scientifiques et technologiques", of the French Parliament provide examples of *parliamentary structures* that have actively encouraged reflection and discussion about the relationships between science and society, and public consultation exercises.[73] Reference should also be made to the Flemish institution for research on scientific and technological aspects, established in December 2001, within the parliament of the Flemish region. Its mission is not only to advise the members of Parliament, but also to organise public debates on science and technology issues and promote the involvement and participation of the public in these debates.

By contrast, in Austria and Portugal, the promotion by the Executive of programmes and activities in this area has not been paralleled by structural reforms of Parliaments designed to further improve the relationship between scientists and parliament, or public participation.

The establishment of *institutional structures at the governmental level* for co-ordinating the policy measures designed to further the scientific culture of citizens has proved to be a decisive factor of the policies' success. In France, a number of mechanisms have been created since the 1980s with specific informational functions, the most recent ones being the "Mission de la Culture et de l'Information Scientifique", and the "Conseil scientifique de la culture et de l'information scientifique et technique et des musées". In Belgium, a specific department for scientific and technical communication at Walloon Regional Ministry for Research and Technology was instituted. Sweden's Nordic Forum for Research Information was set up to stimulate greater interest and enhance quality assurance of knowledge diffusion. In Portugal, the establishment of the Ministry for Science and Technology, in 1995, was followed by the establishment, in the late 1990s, of an Agency for Scientific Culture whose main responsibilities have been to run the "Ciência Viva" programme and to manage the Knowledge Pavilion, an interactive science centre.

Public policies for the communication of science to the public may be characterised according to their more *centralised or decentralised* nature. The extent to which the political systems themselves are more or less centralised seems to explain, to a certain extent, the differences in the degree and the nature of public bodies' involvement in science popularisation. The Belgium case provides a clear example of how regional and local authorities can be in a good position to strengthen science and technology's visibility in the public arena, and to promote the consultation of social and economic partners.

Policies in this field have, in general, featured a *wide variety of tools*. Countries that have a longer scientific tradition and experience in the field of public communication of

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[73] Important initiatives have been, in the United Kingdom, the inquiry on Science and Society, by the House of Lords Select Committee on Science and Technology, the POST' review public consultation initiatives in S&T related areas; and, in France, the citizens' conference on GMOs organised by the Office parlementaire des choix scientifiques et technologiques, in 1998.

science exhibit a broader spectrum of mechanisms and activities launched either by governmental or non-governmental agents.

In Sweden, for example, the means used to raise the public understanding of science range from science festivals, magazines and newsletters, to the "science theatre", and scientific documentaries. Public service TV, the radio and the Internet, have also been instrumental in the diffusion of science in society. The Swedish Association for Science Journalism, since 1972, and the Nobel Academy have also contributed to give visibility to scientific developments and the social role of science, thus favouring the embedment of science into culture.

In the United Kingdom, apart from studies and debates held under the "public understanding of science movement", prestigious non-governmental associations such as The Royal Society, the Royal Institution and the British Association for the Advancement of Science regularly organise public lectures, open days festivals and science weeks. Governmental institutions such as the Office of Science and Technology and the Research Councils support small initiatives organised by practicing scientists to communicate their work to the public. The media, and above all, the BBC, have for many decades played a crucial role in the diffusion of wildlife and scientific development. More recently, Web sites and the Internet have also been used as means to promote public debate about science. These communication means have been complemented, in the last decade, by more discursive tools, namely consensus conferences (the first one on plant biotechnology, organised by the science Museum, in 1994, and the second one on management of nuclear waste, held in 1999 under the sponsorship of the Centre for Economic and Environmental Development).

Apparently, Portugal and Austria have hitherto resorted to a limited array of instruments, namely interactive museums and exhibitions, co-operative ventures between schools and universities and science weeks and days. The Portuguese "Ciência Viva" programme encouraged the formation of permanent networks among schools, through its special twining programme, and gave rise to the establishment of "ciência viva" centres, conceived as interactive meeting places. Every year, since 1997, a Science and Technology Week is organised by the ministry. During this week, which includes "the national day of scientific culture", a series of events are held, including admitting members of the public to some scientific institutions, and conferences and seminars on different scientific topics. These events take place all over the country. Remarkably, in Belgium, the privilege assigned to technological and industrial innovation is manifest in the holding of "technology weeks" rather than the "science weeks", more common in the other countries.

The policy instruments resorted to in order to promote the science-society relationship may be distinguished according to their *unidirectional* or *bi-directional* character. In the United Kingdom and France, scientific culture and the public understanding of science have followed predominantly unidirectional approaches in line with the "deficit model", whereby what is sought is mainly to inform or to educate people. In both countries, however, centralised activities combined with decentralised ones. In France, while the emblematic “Cité des sciences et de l’industrie” (“Cité de La Villette”), was officially presented as “the biggest CST centre in the world”, and strongly supported by the central state, the “centres de culture scientifique, technologique et industrielle” (defined as “sites for creation, confrontation, research, education and sensitisation, information and mediation”) provide illustrations of local dynamism as regards scientific and technological developments.

In Sweden, the intertwining of central and regional initiatives can be noticed, with regional universities, in cooperation with regional and local administration and industry, more inclined towards practical understanding of science, and traditional universities in larger cities developing cultural and civic forms of science popularisation.

Another interesting differential feature of national policies in this area is the underlying concept of science. Whereas Austria and Sweden tend to apply a broad notion, which includes the social sciences and the humanities - that, as a result, have also been the object of initiatives in this field - the other countries tend to limit them to the natural and exact sciences and engineering. The Portuguese “Ciência Viva” programme, for example, emphasises the experimental teaching of natural and technological sciences.

The social actors involved

As could be expected, the design and the operation of public bodies that formulate or implement policies in this area and the *relative role of the State and of scientific communities* do reflect the underlying cultures of both the political and the scientific systems. Contrasting social and institutional cultures also shape the involvement of *non-governmental actors* in decision-making.

In the United Kingdom, may be more than in any other country, *scientists* themselves have been pushing reflection and action. The Bodmer report was a product of the Royal Society in response to political and social pressures for increasing accountability of scientists. It led to the establishment of the Committee on the Public Understanding of Science (COPUS) under the auspices of the Royal Society and the British Association for the Advancement of Science. The “PUS movement” has been largely expert-led, and involved a dynamic bottom-up activity by schools, science clubs, industrial and professional associations, and even individuals. Public funding followed this movement, supporting mainly small activities by practising scientists to communicate their work often through schools.

Initiatives under the “PUS movement” evolved gradually into more *interactive exercises* involving dialogue between experts and lay members of the public. Both the British Parliament and the Prime Minister’s Office have taken a strong interest in participatory methods. At the level of the Prime Minister office internet-based consultation exercises have been carried out inviting public feedback as input to the development of a code of practice to apply to scientific advisory bodies, and a science forum website encourages discussion about the best way to communicate the benefits and risks of science and technology.

In Britain, as in other European countries, the *recent emphasis on public consultation* and participation, particularly since the late 1990s, has been a response to *social pressures* for increased social control of the use of science in decision-making. British administrative procedures and, in particular, those that frame the provision of expert advice, have traditionally been rather secretive. These procedures evolved to more transparent and open ones, in the aftermath of the crisis of confidence in science and governance that accompanied the BSE affair. Three official bodies set up by the British government during 1990s now have a specific remit to include *public consultation* in their decision-making processes: the Food Standards Agency, the Agricultural and Environmental Biotechnology Commission, and the Human Genetics Commission.

It has been at local level, however, and in the health sector that public consultation has been most highly developed and widespread. By 1997, over 40 local authorities had used *citizens' panels*. Science and technology related public consultation in the health sector involved the stakeholders in the processes of defining the content of the study, selecting the contractors, advising on the study programme, interpreting data, and drawing conclusions. In Sweden, the regionalisation of research and innovation policies facilitated the participation of local users in policy-making.

The *role of universities* has been very active in Sweden, a state of things that is not alien to the generous funding of information activities, leading to the establishment of information secretariats in all Swedish universities and colleges. In Belgium, universities have come to play a major role in science popularisation activities as well, partly as an element of their strategy to attract students to science faculties. Swedish activities in this area have been marked by both the active involvement of researchers, teachers, non-governmental actors, and a markedly extensive participation by civilians.

Belgium has an important tradition of consulting social partners (employers and trade unions). Consultation was included in the research and development policy system since it's beginning. The workings of technology assessment mechanisms (namely, the foundation for technology assessment under the Flemish socio-economic regional council) contributed to reinforce the involvement of social actors in the making of this policy. The increasing concern with public awareness about the role of science in development and competitiveness that gained momentum in Austria in the late 1990s also favoured participatory approaches in science-based issues of public relevance.

Contrary to this trend, in Portugal, the policy for scientific culture has been implemented mainly through *centralised initiatives*, namely, the "Ciência Viva", program and public lectures organised by the Science Ministry. The "Ciência Viva" programme whose objective is to mobilise the educational and scientific communities, gave a major impulse to cooperation between, primary and secondary schools, on the one hand, and universities and state laboratories, on the other hand. Governmental action has involved the scientific and academic communities, and enabled them to put into practice popularisation activities that they could hardly pursue on their own. Contrary to this trend, the involvement of social partners in policy-making has no significant expression in Portugal. Despite rising social pressure for opening the debate on science-based policy issues, no significant steps have been taken in this direction.

How these policies are responding to the critical climate surrounding science in Europe

"The crisis of trust has produced a new mood for dialogue", the British Parliament's House of Lords recognised in its report about science and society. In other countries, however, one might say that the "mood for dialogue" has more ancient roots. That is the case of Sweden, for example, where, in the late 1970s, the nuclear power debate paved the way for the perception by the authorities of the need to organise and give an impulse to the efforts being made to communicate science.

In France, the strengthening and adaptation of policies for science, technology and industry throughout the 1980s and 1990s were not indifferent to social pressures. "Citizens" replaced the word "public" in French political discourse. With a view to restore public trust in science and technology, new spaces where science and society interact were opened in France, and the actors directly involved in science popularisation modified their communication practices. One important expression of this trend was the Citizens' Conference on GMOs, organised by the "Office Parlementaire des Choix Scientifiques et Technologiques" of the French Parliament, in 1998. Ultimately, the attention paid, at the highest political level, to public awareness and understanding of science was manifest, for example, in the Conference on "Science and Society: The Public Understanding of Science", held in Paris, in 2000, under the French Presidency of the European Union.

The recourse to new modes of including citizens in science-based public debate as a means to respond to public concerns and the crisis of confidence surrounding science was also apparent in the United Kingdom, where, as already pointed out, two "consensus conferences" where organised on a national basis. In this case, as in the French one just mentioned, the topics discussed provide an indication of domains which have generated public concern: biotechnology, genetic engineering, and management of dangerous waste, among other.

In Austria as well as in Portugal, the emergence of critical attitudes towards science seems to be a more recent phenomenon, closely associated with recent food and environmental controversies. In Portugal, this evolution was largely driven by the media and was not indifferent to the struggle by the scientific community for political recognition and greater external visibility. But, as noted above, the public policy for scientific culture tended to exclude both the discussion on the nature of science and technology themselves, and the consideration of the respective social, economic and political contexts, from the learning and awareness processes. This policy is, therefore, out of phase with the public image that science is acquiring in the mass media in Portugal.

To sum up, if there is an area of policy-making in Europe in which homogenisation seems difficult, this area is the public understanding of science. As we have pointed out, notwithstanding a convergent discourse across Europe, which the European Commission had contributed to echo, policies and practices vary from one country to another in this field, to a large extent.

The importance attributed to the promotion of knowledge of science by the public, and a more direct involvement of citizens in science-based decision-making has different roots, and developed at different time. In some countries, one might say that the science-public relationship is an issue of traditional public and political concern, whereas in others it has only emerged in our times, against the background of ambivalent pressures: for technology-based national competitiveness, on the one hand, and for increasing public regulation of the uses of science and technology, on the other.

Is Europeanisation of PUS policy a desirable goal? To what extent is benchmarking appropriate in this area? One response to this question may be found in the recent efforts launched by the European Commission in the field of the relationships between science and society, such as the Science and Society Plan of Action, and the inclusion of a reflection on scientific culture within its exercise on benchmarking of science policies. [74]

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Austrian policies on Public Understanding of Science: Between policy discourse and its limited realisations

Ulrike Felt

A late start in addressing *Public Understanding of Science* issues

While in most European countries the issue of *Public Understanding of Science* or initiatives of similar kind emerged at the national policy level during the eighties, in Austria the government's awareness for the need of engagement in this area evolved only during the course of the nineties. During these years there was an increased interest in science and technology issues in the classical printmedia, more time was given to science on TV and in the radio, and public debates on science and technology issues linked with societal developments became more frequent. However, the first official statement made by the government concerning an Austrian policy in this area only appeared in 1999. This was closely linked to the exercise of formulating for the first time a more global science policy development plan.[75] The delay in the formulation of policies in Austria can also noted in Germany and it is surely challenging to investigate some aspects of cultural differences and similarities with regards to the way in which the *Public Understanding of Science* question is addressed in these two countries.[76]

Before entering a detailed discussion of the programmatic perspectives behind the *Public Understanding of Science* policies in Austria, the reasons behind the belated reaction to change should be analysed. They cannot only be found in the specific Austrian history and the inter-relation of science, scientific institutions and the public, but also of science and politics (for details see also National Profile Austria).

First, Austria seems to suffer from what could be labelled the "golden past syndrome". There had been a sharp decline of the Austrian science system following World War I, due to the exodus of most of the outstanding scientists, which started in the 1920s and was accelerated in the post-*Anschluss* period. Yet, despite the ubiquitous regret of having lost the status of scientific leadership, the Austrian government of the second

[75] This process lasted for several months and a number of consultation workshops were held in this framework. The "end product" was the so-called "Grünbuch" which is a unique document in the Austrian science policy tradition.

[76] It is important to remark that the very notion of *Wissenschaft* has a profoundly different meaning than *science*. It does not only embrace the social sciences and humanities, but it addresses also different features that were seen as central during the formation process of the science system, a fact which was also reflected in the German PUS programme. It is called "Public Understanding of Science and Humanities" (PUSH).Stifterverband (1999): Memorandum zum "Dialog Wissenschaft und Gesellschaft", http://www.stifterverband.org

republic made no concerted effort to compensate these cultural and human losses. There were no programmes for restitution or restoration by bringing exiled Austrian scientists back into their institutions.[77] The policy adopted was mainly to avoid addressing the problem explicitly. For the place of science in public perception, this meant mainly resignation with regard to the present situation. No efforts were made to actively communicate science to a wider public and where at all it was being communicated, the focus was on the far away past of science and its outstanding successes.

Secondly, the relatively slowly evolving Austrian Research and Development system – measured by the expenditure for R&D in percentage of the GDP – is far behind the average of European countries, a fact which could be interpreted in the light of the lack of public presence of science. After years of promises and some efforts undertaken by the respective governments Austria has just reached 1.8% GDP funding for R&D, however it is still lagging far behind the European average.[78] The explanations given for this situation are diverse: Many research-intensive fields of technological development like aircraft building, computer and office technology are missing in the Austrian industrial landscape.[79] Research in Austrian enterprises can be characterised as mainly taking place in small and medium sized enterprises and mostly in sectors with low level of innovation. As a result Austrian enterprises involved in research carry only about 40% of the overall expenses on R&D, which is far below the EU as well as the OECD average.

Furthermore many analysts of the Austrian situation stress, that a large segment of Austrian research is conducted in the universities, which are 97% state funded. For a long while research was – through the basic financing of the universities – "automatically" also financed without evaluation or submission to any accountability structures. This there was little competition between research institutions. As a consequence no necessity was seen to really engage with a wider public and regularly communicate about the work accomplished within the research institutions – a fact which is undergoing a dramatic change while this paper is written.

Finally the minimal efforts that were made to create/shape a clear and active science and technology policy should not be overlooked. Science and technology were seen more as to be administrated instead of being driven by visions and political engagement for future developments in this area. This would hold both for the governments, which paid little attention to elaborating policies in this domain as well as

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[77] Stadler F. & Weibel (1995): *The cultural exodus from Austria* (New York: Springer-Verlag)

[78] This statement would also hold if one takes other indicators such as number of scientists/working citizen. Here Austria is together with Spain, Greece and Portugal at the end of the ranking in European Countries. See B. Felderer & D.F.J. Campell (1994): Forschungsfinanzierung in Europa: Trends - Modelle Empfehlungen für Österreich, (Wien: Manz). For the most recent figures see http://www.bmbwk.gv.at.

[79] Forschungsbericht 2000, Bundesministerium für Bildung, Wissenschaft und Kultur

for the large majority of the institutions, which were not very active in this domain either.

The 1990s – a period of change

The situation started to change fundamentally during the 1990s and a number of elements within and surrounding the science system can be identified as triggering the rise of the *Public Understanding of Science* issue in Austria.

The first group of changes concerns the science system itself and the universities in particular – an important repositioning among the whole network of knowledge producing institutions was about to take place. One of the ever-present metaphors used in this context was the "ivory tower" which the university would have to leave. Scientists would have to meet "society" in a more open-minded and proactive way. The realisation of this aim was planned through a sequence of reforms. A structural reform of the university in 1993[80] was the first step, which aimed at implementing the idea of the entrepreneurial university, with evaluations of research and teaching quality becoming a new central element in this system. Until that time no regular quality assessments had taken place and the structures had not been analysed for their adequacy. These changes definitely followed an international trend and were reinforced by the fact that the Austrian government was planning to enter the European Union, and thus tried to improve its level of international competitiveness in the knowledge sector. The reform of the universities was accompanied by the putting in place of tuition fees during 2001. Simultaneously the legal regulations concerning the research staff of universities were changed for a first time in 1997 and then in a more fundamental way in 2001, offering for the sake of flexibility only short term contracts for junior researchers, no tenure track schemes and university staff would no longer have the status of civil servants. The next major university reform started in autumn 2002, entering into force on January 1, 2004 and should allegedly provide an increase of the institutional autonomy.

Linked to these above-mentioned shifts a second relevant element has to be taken into consideration: The gradual withdrawal of the state as the central financier for research becomes evident. This shift can be observed in most of the European countries and scientists and administrators of the research units start to realise the far-reaching consequences of this change. It means on one hand that "third party funding" will play in the years to come an increasingly central role for research and thus good strategies

[80] This law which was voted in 1993 brought along an important reorganisation within the universities. These include a slightly higher degree in autonomy, the abandoning of most of the democratic and participative decision making structures, the making of regular evaluations of research and teaching obligatory and installed clearly hierarchical structures in the decision making processes.

to argue for money and to create a far-reaching visibility appear central. On the other hand even basic financing will not be automatically guaranteed anymore and will need argumentative strategies in order to assure stability. In that sense raising public awareness about research being carried out as well as stimulating public debate about the need of science and technology seems to be an obvious, crucial strategic element for assuring future development.

The main policy guidelines of the Ministry for Education, Research and Culture make these issues even more explicit:

Research is funded to a highly significant degree from public funds: as a result there is an obligation to have a greater problem-oriented approach, where research commits itself to working on issues which affect society and seeking to provide solutions to areas of conflict. At the same time, this approach can promote communication with the general public and can raise the status of research. However, researchers themselves must contribute to this improved understanding by projecting the results of their activities "to the outside world".[81]

Three elements seem clearly present in this statement. First the importance of applied problem oriented research is underlined. Second both application- orientation and increased efforts to communicate with the public will assure a higher status of science in society. Thirdly, scientists should be the ones involved in the communication of their work.

A further important element triggering an increased need for science communication can be identified around the referendum against the release of Genetically Modified Organisms (GMOs) which took place in spring 1997 (and was extremely successful with over 1.2 million people signing). It became probably the most widely and emotionally debated "science-issue" in Austria and was only comparable with the debate over civil nuclear energy in the late seventies[82] in which scientific practitioners, non-governmental organisation members, media-representatives, politicians and all kinds of other actors engaged. The controversy was triggered by several applications from national and international research institutes and firms to release various kinds GMOs in Austria from 1994. It was mainly "settled" by an amendment to the genetics law in mid-1998, which established very strict (or better: expensive) liability regulations, and therefore turned GMO releases into a risky enterprise for firms in Austria. In this conflict two aspects became clearly visible: there was an increasing lack of readiness from the part of wider publics to simply accept scientific and technological

[81] BMBWK homepage: http://www.bmbwk.gv.at (2001).
[82] Perhaps it would be also relevant to add the "Anti-Temelin" Debate, although the structure of the debate looks different from a number of perspectives.

development, and there was/is a huge lack in the culture of information and dialogue between scientists, science policy makers and wider public. This clear refusal of genetically modified food was interpreted rather differently by the different actors involved, all of them however started to realise that part of the problem was the enormous lack of culture in publicly debating issues with regard to science and technology.

Finally, one should not overlook the importance and the impact of policies on the European level in the domain of science-society relations. The strong focus that appeared in this domain in the 1990s on the EU level and the explicit formulation of the "Raising Public Awareness" issue in the 5th framework programme, surely have contributed to the rethinking of Austrian policies in this domain.

A first explicit policy statement with regard to Public Understanding of Science

As has already been stated, it is in this climate of general change that the Ministry of Science and Transport undertook in 1999 for the first time the effort, after a period of consultation, to formulate an overall national science policy statement, which has become known as "*Grünbuch*"[83]. It was one of the last steps taken by the socialist/conservative coalition government in the science policy area. With this science policy document and the debates that accompanied its production, a first initiative was taken towards creating political and public awareness about the importance of adequate research funding for national development and international competitiveness. Further it addressed the difficulty of a national innovation system mainly based on state financing. With regard to science-society interactions, the *Grünbuch* expresses a clear statement towards participatory approaches in questions regarding societal issues of science and technology, in favour of more problem-oriented research as well as of a "stronger involvement of society".

A full chapter was devoted to the science-society issue and the following points were made:

- There should be wide ranging information available to the public and the possibility for a broad debate that does justice to the doubts and wishes of the people as well as to the matters concerning researchers.
- "An interesting dialogue relevant to the diverse groups involved" should be stimulated.

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[83] Grünbuch zur Österreichischen Forschungspolitik, Bundesministerium für Wissenschaft und Verkehr, Wien 1999.

- "The public within the democratic process has the role of contributing, from its everyday experience, knowledge that otherwise possibly remains unseen by politics, law and administration."
- Action is to be "taken in order to make accessible the work, results and possibilities of research in Austria to a wider public."

In addition to this rather ambitious sounding statement, some possible measures/-actions were listed as examples, like

- "the implementation of a Public Understanding of Science program to create a better understanding by the public of science, research and technology"
- "more co-operation between universities, schools and adult education centres"
- "co-operation between research and the media"
- a Science Week,
- Science Days
- Museums as platforms and fora
- an "Experimentarium to 'promote' interest in technological innovation".

Further, the *Grünbuch* stressed a clear weakness of the Austrian science system to which attention should be drawn, namely the high degree of centralisation of science and technology as well as of science communication in and around Vienna. While this is evidently also a historically rooted phenomenon, it is also linked to the role Vienna plays with regard to the rest of Austria. By its mere size (1.6 million inhabitants versus 8 million for the whole of Austria) and how 'embedded' it is in international networks it has become an attractive centre for all kinds of initiatives. Also, more than half of the national research sites are located in and around Vienna.[84] With regard to this aspect we can therefore find the following considerations with respect to Public Understanding of Science: "The centralised competence to be found in the East of Austria (i.e. Vienna and surroundings) should – via suitable measures – also be made accessible to the western *Länder*".[85]

The *Grünbuch* should at no time however, be considered as a concrete plan of action, but rather as the first formulation of the framework in which future developments could be seen. The political change in Austria with a new ÖVP/FPÖ government since February 2000, has for a number of reasons been followed with great concern by an international audience. These political changes have affected the science system in several ways. The former Ministry of Science and Transport has been split into a Ministry of Education, Science and Culture[86] on one hand and a Ministry of Transport, Innovation and Technology[87] on the other hand. Whereas the former promotes the

[84] "Forschungsstättenkatalog 1994", Österreichisches Statistisches Zentralamt, Wien
[85] Grünbuch, p.78;
[86] http://www.bmwf.gv.at/
[87] http://www.bmv.gv.at/

"classical" science domains like universities, university research and education, the latter is responsible for administering and promoting the domains of infrastructure, technology, applied and especially regional corporate research, following as can clearly be remarked the ideal of the "New Economy". Additionally, the new government has created the *Austrian Council for Research and Technology Development*[88], which consists of university and non-university research experts appointed equally by the two ministries.[89] This body has several functions, which include:

- Advising the federal and the regional governments with regard to issues of research, science and technology;
- To develop long term strategies for R&D in Austria;
- To strengthen the position of Austria within the international science and technology system and;
- To develop measures in order to improve the interaction between universities and industry/companies.[90]

The major shifts in the university system, which took place during the same period, have already been documented above.
With regard to the *Public Understanding of Science* issue the new government, the responsible ministries, and the Council for Research and Technology Development have remained largely in line with the ideas of the *Grünbuch.* The first official statement with regard to Public Understanding of Science by the new government was the 'Declaration of the Federal Government on Current Issues in Research and Technology Policy' from July 2000:

"Creating confidence, seeking dialogue, fighting scepticism against science, securing freedom for research – these are some of the objectives of a new Federal government programme for promoting 'Public Understanding of Science and Technology'. All competent Federal ministries are kindly requested to submit practicable suggestions for such a programme by the end of 2000."

It is interesting to note that from the point of view of rhetoric this declaration would allow the drawing of some parallels to the 1985 report on Public Understanding of Science by the Royal Society rather than following the conceptual framework developed in the documents of the EU. Although it is difficult to make clear

[88] With regard to the concrete composition of the Council shows however a clear bias towards integrating representatives from the industrial domain.
[89] It is revealing to remark that all members of the Council are natural scientists or engineers and there is no member part of the social science or the humanities. This clearly underlines a shift towards more application oriented research vision with a clear focus on science and technology.
[90] Bundesgesetz zur Förderung der Forschung und Technologieentwicklung, BGBl. I Nr. 48/2000, 11. Juli 2000

interpretations from these few sentences, such phrasing would hint at a relatively uncritical approach to the complex relationship between science and the different levels of the public and could be inscribed in the information/enlightenment paradigm.

Concrete policy measures

Since the beginning of 2001 different levels of policy were discussed to develop more concrete programmes or projects. The Ministry for Education, Research and Culture has developed such a policy paper for this area. Concretely the Ministry funded partly the new science internet portal maintained by the ORF (Austrian Radio and Television company) which should be underlined as a major innovation, which went on-line in January 2001, the *Science Week* (which was held annually from 2000-2002) as well as a number of other smaller initiatives. Also the federally funded and co-ordinated research programme on Genomics (Gen-Au) set accompanying measures to improve the public dialogue in the domain of human genetics. To this end they organised by the end of 2002 a so-called "Discourse-day on genetic diagnosis". [91]

The programme on science and society which is under preparation by the *Austrian Council for Research and Technology Development* – a newly created science policy advisory body -, carries the heading "Programme for the creation of awareness for research, development and innovation". This should run for three years and will be financed by public money with a sum of up to 6 Million Euro.[92] The programme – which is mainly geared towards promoting technological innovation and not science in its larger sense – has so far sponsored a PR-campaign for innovation, has financed partly a one-year training course for science journalists, the citizen conference on gentic data (www.dialog-gentechnik.at) and a number of other smaller initiatives. Although, it sponsors all kinds of initiatives, there is a clear bias towards Public Relation activities towards for science and technology rather than focusing on the more interactive components (see also governmental initiatives).

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[91] For the Science Week home-page see http://www.scienceweek.at; at the time when this report the organisational concept of the science week is discussed and a new concept should be put in place. An evaluation had been carried out during the 2001 and 2002 Science Week, The full reports: Felt U. et al. (2001*): Evaluierung der Science Week @Austria 2001: Ein Experiment der Wissenschaftskommunikation in Österreich* as well as Felt U. et al. (2002): *Evaluierung der Science Week @Austria 2002* can be found under http://www.univie.ac.at/wissenschaftstheorie/virusss (in the research section).
For the information on the Gen-au programme and the discourse day see www.gen-au.at; an accompaying evalution carried out; for the report see Felt U./Fochler M./Strasnigg M. (2003): Evaluierung des Diskurstages Gendiagnostik (Wien, 24.10.2002) can be found under http://www.univie.ac.at/wissenschaftstheorie/virusss (in the research section)

[92] http://www.rat-fte.at

Some general observations with regard to PUS initiatives

It is also worthwhile to draw attention to two other aspects. The first concerns the notion of science being applied in different contexts and communication setting. In both initiatives – *Science Week* and *ORF internet portal* – the humanities and the social sciences find their (although small) place side by side with science news, which is an important innovation in the Austrian context and which is explicitly fostered by the Ministry. The Austrian Council for Research and Technology Development programme however, is much more directed towards natural sciences and technological innovation and stresses in many ways the economic role public acceptance of science plays in future developments.

The second perspective to be considered concerns the **publics that are addressed** through these initiatives. In line with the debate on the European level two key-groups can be identified in this context. One consists of the **school children**, which should meet science in such a way that fascination is produced. This should assure an increase in the number of young people interested in following higher education in these domains and thus assure reproduction and stability in particular for the classical domains like physics, electrical engineering etc. The other group are **women**. Here the necessity for increased communication efforts to gain their interest is argued at least in two ways. First of all they represent an important community which might show resistance to certain technologies and thus more information should lead them to a better understanding, hence acceptance. Here we meet again the classical expectation that better understanding would lead to a higher degree of acceptance. Second, as boys seem to show a decreasing interest in certain fields of the natural sciences, women are seen as an excellent resource to compensate the decline in number of students.

To summarise, one can definitely say that there is still too little concerted, clearly stated policy concerning *Public Understanding of Science* Initiatives in Austria. However, it should be mentioned that many of the activities concerning Public Understanding of Science are nevertheless publicly funded, especially by the *Ministry for Education, Science and Culture* and more recently by the *Austrian Council for Research and Technology Development*. The broad variety of initiatives incorporating very different philosophies of science-communication – as we will see – can be taken as an indicator for a rather open attitude. Or to put it differently; they have not "done" Public Understanding of Science, but made Public understanding of Science possible on very different levels. It could be argued that this is positive or negative – most contemporary voices hold the latter – though it points to one of the basic features of the Austrian political culture: it is still extremely state-centred.

Conclusion

- One can definitely say that there is still little concerted, clearly stated policy concerning PUS-initiatives in Austria until the beginning of the 21st century.
- However, the activities concerning PUS were often (at least partially) publicly funded, especially by the Ministry for Education, Science and Culture. The variety of initiatives incorporating very different philosophies of science-communication can be taken as an indicator for a rather open attitude. Or to put it differently: Until the late 90ies the government has not "carried out" PUS initiatives, but made a few PUS initiatives possible on very different levels.
- Since 2000 one can say that PUS has entered the terrain of science policy and thus also different players become visible and formulate their policy. Besides the two ministries who are dealing with research and education, the Austrian Council for Research and Technology Development is now trying to position itself as key-player.
- With a few exceptions the initiatives are inscribed very much in the linear communication paradigm, enhancing the idea that what is needed for better positioning science in society is PR work
- Thus it is possible to conclude that there have been central changes taking place in the last three years; however we are still some steps away from a broader debate on public participation in science and technology issues and its realisation.

The Belgian policy context for "Raising public awareness on science and technology"

Gérard Valenduc, Patricia Vendramin

This paper deals with the institutional and political aspects from the Belgian perspective in the way that public understanding of science and technology activities are carried out. Since the mid 90's, S&T policies, as well as public awareness on S&T issues have been shaped by the new institutional context that is set up by the federalisation process of science, technology, education and culture. Besides these institutional aspects, the country is characterised by the co-existence of two main languages and cultures, which have closer links to the Netherlands and France, respectively, than to each other. S&T policies are therefore characterised by a high level of decentralisation. Policy initiatives and decisions in the areas covered by the OPUS project belong more to the federated entities than to the federal State [93]. Instead of a national policy context, it should be referred to as two regional policy contexts, receiving impulse or support from the federal level.

"Public understanding of science and technology" (PUST) is a seldom-used term in Belgium, in either French or Dutch translations. Discourses and practices are closer to the expression "public awareness on S&T", as used by the European Commission, and the most widespread term is simply "scientific and technical culture", such as in France.

1. Belgian institutional configuration in the area of S&T policy and public awareness of S&T

The process of federalisation of S&T policy is historically linked to the second step of institutional reforms (constitutional reform and regionalisation laws of 1988 and 1990), which aimed at transforming the whole structure of the State into a decentralised system, based on three territorial Regions (Flanders, Wallonie and Brussels) and three cultural "Communities": the Flemish and French Communities (overlapping each other in the bilingual Brussels Region) and the smaller German Community (belonging to the Walloon Region). Universities, education and culture were transferred to the Community level, while research and innovation policies were transferred to the Regions, except for some matters of national interest (for instance, nuclear research

[93] More precisely: the Federal State (federal government), the Flemish institutions (one single government for Flanders and the Flemish Community) and the Walloon and Brussels institutions (Walloon government, Brussels government and French Community Wallonie-Brussels government).

and technology, spatial research and technology, defence research, international scientific cooperation). This intertwined breakdown of power and competences makes S&T one of the most complex policy areas in Belgium. The process of institutional change started in 1988 and was only completely implemented in 1993.

During the transition period, few initiatives were undertaken in the area of S&T policy and there was no institutional dynamics for such topics as PUST. Prior to the transition, Belgium had known a period of neo-liberal influence on S&T policy, striving for a slow-down of public investment in R&D and universities and giving priority to industrial research and private investments. As a consequence, the ratio "public R&D expenditure / GDP" decreased during the period 1985-1990 and was among the lowest in Europe. Together with the institutional reforms at the beginning of the 90's, there was a policy agreement to catch up the gap, through higher public investments in R&D at the federal and regional levels. As a result, total public R&D expenditures grew from€ 847 million to€1387 million from 1989 to 1999. The current share of the federal State in public R&D budget is 32%, against 42% for Flanders, 25% for Wallonie and French Community and 1% for Brussels[94].

Moreover, the federalisation process refreshed several R&D institutions, increased the visibility of R&D policies for the general public and gave a new impulse to policy initiatives in various areas, including public awareness. Since the 90's, public awareness of S&T is not only considered a topical issue for media and communication, but also as a way to legitimate innovation policies and to develop an innovative culture. This is one of the reasons why regional institutions play the most important part.

Consultation of the social partners (employers and trade unions) was included very early in the R&D policy system, through consultative bodies at the national level and in semi-public funds for industrial research. The new institutions now overtake this principle of involvement of the social partners. Each of the Federal State, the Flemish Region and the Walloon Region has set up its consultative council on science policy. These councils are composed of representatives from universities and high schools, public authorities, employers' federations and trade unions. They have an advisory role, either on their own initiative or when the government requires advice.

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[94] Other key features of the Belgian S&T system are:

- Gross domestic expenditure in R&D (1999) represents 1.87% of GDP (EU average: 1.85%), among which 72% business expenditure and 28% public expenditure.
- Public research is mainly carried out in universities; other public research centres only represent a very small part of public research. There is no similar institution to CNRS in France or TNO in the Netherlands.
- Industrial research is highly concentrated in two sectors (chemistry and pharmacy: 35%; electronics and telecommunication: 34%) and in a limited number of enterprises (20 enterprises spend 50% of the total business expenditure in R&D).
- The ratio "number of researchers / working population" (1997) is 0.75%, which is one of the highest in Europe (EU average: 0.49%). Total employment in R&D (researchers and others) increased from 36799 to 43980 full-time equivalents, from 1993 to 1997, mainly due to employment growth in industrial research.

2. Walloon Region and French Community Wallonie-Brussels

In the area of public awareness of S&T, the policy of Walloon public authorities puts strong emphasis on the promotion of innovation and the creation of an innovative climate, involving enterprises, universities, research centres and to a lesser extent, social forces.

The Bulletin Athena is a good illustration of this combination of a shop-window for regional scientific and technological activities, with a wider promotion of scientific culture. Athena is a 48-page monthly magazine, created in 1984 by the first regional government, as a quarterly information support for a promotional campaign of technological innovation. This aspect of promotion of regional technology is still present in the bulletin, but the purposes have evolved. The bulletin also deals with general scientific subjects and regularly includes articles on science and society issues. It also includes bibliographical notes, accounts of scientific events, etc. Athena is financed by DGTRE and currently has approximately 33 000 subscribers (free subscriptions) and an estimated audience of about 50 000 readers. It functions mainly as an information tool, not a policy one.

The overall budget devoted by the Walloon Region to the promotion of innovation and the diffusion of scientific and technical culture is about € 5.4 M (2001). Only since 1999 has there been a dedicated department for scientific and technical communication within DGTRE.

The impulse role of the "Technology week"

'The Technology week', started in 1990 and consisted of a series of promotional activities for technological innovation in enterprises and research centres, widely open to the general public and supported by the Walloon Regional Ministry for Research and Technology (DGTRE). In 1995, the issues of scientific culture and science communication were included in the programme of the Technology week. Opinion surveys were carried out in the Region, on public attitudes and expectations towards science and technology, and on the attitudes of young students[95]. Debates were organised with science journalists, researchers and policy makers, in order to draw up a state of the art science communication in the French-speaking part of the country. Although the series of Technology weeks ended in 1996, most of the issues debated in 1995 have been overtaken in the following years.

[95] Dossier *Les Wallons, la recherche et la culture scientifique*, in Bulletin Athéna, n° 110, avril 1995.

Consultation and debate on regional S&T policy

From June 1996 to November 1997, the Walloon Council for Science Policy organised a series of 10 one-day meetings entitled "*Les rencontres de la recherche*", open to a wide public and including contributions from foreign experts, round tables with representatives of concerned stakeholders and discussion with the attendance. About 900 participants attended at least one of the debates. The subjects of the meetings were:

- Research listening to the civil society.
- Organisation of the regional research system.
- Scope and means of public R&D financing in the Region.
- Industrial cooperative research centres.
- Sectoral and thematic orientations of regional public research.
- Valorisation of research results.
- Evaluation of the impacts of R&D on society.
- Social and cultural conditions of innovation.
- Internationalisation of R&D.
- Role of the researcher in society.

The Council published a synthesis of the contributions and debates and issued nine key policy recommendations for the future of research and technological development in the Region[96]. The Prométhée project, carried out by the Region within the European programme RITTS (Regional innovation and technology transfer systems) in 1999-2000, can be considered as one of the follow-up initiatives of this broad consultation and discussion process.

Science centres as a tool for local development

The regional government used subventions from the European structural funds for the conversion of declining industrial regions (Objective 1), in order to support the creation of new science centres. The main regional initiative is the creation of the Park of scientific adventures (PASS), near Mons. The PASS is built on a former coal-mining site, classified as an industrial patrimony, and the project intends to bridge industrial history with new technology. It also aims at revitalising a less favoured area and creating new jobs and spin-off activities. Through the European programme Inter-Reg II, agreements are made with partners in France and Flanders. The schools are the primary target this includes children, students and teachers, who are estimated to supply about 40 % of the visitors. European structural funds were also used to support an initiative of the University Brussels (ULB), who created a new science centre in the suburbs of Charleroi (Parentville).

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[96] Graitson D., *Les rencontres de la recherche*, dans le Bulletin Athéna, n° 136, décembre 1997.

Increasing role of universities in raising public awareness

Several universities recently started new initiatives related to science communication, of the immediate purpose are to improve the image of scientific curricula and attract more students in science faculties. They however have another objective, in the long-term, which sees science communication as a "service from university to society" and which is to be integrated in a broader approach to the role of each university within the city and its local community. The main university initiatives are:

- The festival entitled "Science infuse", which has been held at the university of Louvain-la-Neuve (UCL) since March 2000, and the inauguration of a "House of sciences" in January 2001, jointly managed by university researchers, students and secondary school teachers.
- The joint bilingual event "Wetenschaps-FESTIVAL des sciences" organised by both free universities of Brussels (the French ULB and the Flemish VUB) since October 2000.
- The yearly exhibition "Oser la science" organised since 1998 by the University of Namur (FUNDP), and associating several enterprises of the region in the preparation and management of the event.

Universities appear as emerging actors in fostering the public understanding of science and technology. They are of course not impartial. They want to stop and reverse the disaffection of students as regards scientific curricula. The amount of students in science faculties dramatically decreased during the 90s, leading to a shortage of physicists, mathematicians, and chemists and, to a lesser extent, biologists, both as teachers and as researchers, in both Flanders and Wallonie-Bruxelles. However, the positive aspect is that universities became more aware of the image of science in society in general, and particularly in the youth.

Public policies towards the media

DGTRE is one of the sponsors of the monthly TV-programme "Matière grise", that has been broadcasted since 1999 at prime time by the public television RTBF, after a long period of pause of science programmes for the general public.

3. Flanders and the Flemish Community

In Flanders, popularisation of S&T is presented as a specific part of the regional S&T policy since regional R&D structures were implemented in 1993. The pluri-annual "Flemish action plan for science and innovation" relies on two programmes:

- "*Wetenschap maakt knap*" (science makes smart); this is mainly devoted to education, public awareness and the media.

- *"Durf innoveren"* (dare to innovate); this intends to stimulate innovative culture in business, research and public services. It replaces an older programme entitled "Third industrial revolution in Flanders", which had been criticised because it was too focused on industrial performance and economic competitiveness, and it undermined social, cultural and educational aspects of innovation policy.

Goals and means of an integrated policy of S&T awareness

The main policy goals and target groups of these programmes are:

- To increase workforce consisting of scientifically and technically schooled workers, aimed at pupils and students through specific actions embedded in their curriculum.
- To raise general awareness of S&T, including science and society issues, through broad or specific actions, aimed at the general public or subgroups of the public.
- To create a culture that welcomes innovation and technology, especially among entrepreneurs.

The budget devoted by Flanders to public awareness of S&T increased from about €0.75 M in 1994 to €6.2 M in 2001. It now represents 0.54% of the regional public expenditure in R&D. An important policy decision is to make a part of the annual budget (about €0.8 M) available through a call for proposals, open to any institution or group who wants to carry out targeted actions of S&T awareness. In 1999, 19 projects were selected from 40 proposals; in 2000, 25 from 61 proposals; and in 2001, 65 proposals were received[97]. A specific department within the Flemish administration for research and innovation manages the programmes of public awareness on S&T.

The youth as a specific target group

The young students and more specially those of the last two years of secondary school (16-18 years) are at the focal point of important projects for example:

- The science centre Technopolis, in Mechelen, is designed for the general public, but develops an intensive marketing campaign towards pupils, students and their families, just like the PASS in Mons.
- The Science week, which is organised bi annually by students and teachers of the last two years of the secondary schools.

In the Walloon region, universities play an important role in organising science festivals targeted to the young public. Flemish universities actively supported the organisation of the Science week 2000. In Brussels, the VUB inaugurated a science centre named

[97] Borey S., *Flanders: a case study*, in the proceedings of the conference *Public awareness of S&T in Europe and its regions: building bridges with society*, Brussels, December 2001.

"Pavilion of sciences", as a joint initiative of the science faculty and the government of Flanders, in order to promote Flemish scientific culture in Brussels.

Technology assessment and public debate on S&T

Stichting Technologie Vlaanderen (STV), a foundation for technology assessment created by the Flemish socio-economic regional council, has been developing several experiments since 1984 of participative technology assessment, however this is limited to the area of new technology and work. STV is actively involved in European networks on technology assessment. STV activities and methods directly address workers, trade unions and managers and try to involve them in a constructive assessment of technological options and their consequences[98]. However, there is little connecting generally speaking with public awareness on S&T. Since 2000, STV has been renamed *"Innovatie en arbeid"* (Innovation and work).

During the last few years, several proposals of law were debated in the Flemish Parliament, in order to set up a parliamentary office of technology assessment, following the models of similar institutions in many other European countries. The last one succeeded. In December 2001, the Flemish Parliament officially set up a new institution named *"Vlaamse Instelling voor Wetenschappelijke en Technologische Aspectenonderzoek"* (Flemish institution for research on scientific and technological aspects). This institution is financed by the regional parliament but independent from the regional government. Like similar institutions in the Netherlands and Denmark, the Flemish TA-institution's functions are not only to advise the members of the parliament, but also to organise public debates on science and technology issues and to promote direct participation and involvement of the public.

Public policies towards the media

The Flemish government also sponsors TV-programmes that are broadcasted on the national television channel VRT. These are in; a scientific series designed for 10-12 years kids and a monthly programme for the general public. It has also supported the production of a series of short films explaining technological innovations for the general public, and broadcasted on the local television network.

4. Federal policy level

Despite the high regionalisation rate of R&D (68% of public R&D budgets), the federal science policy office (SSTC/DWTC) plays an important part in the Belgian context of

[98] Berckmans P., *Stichting Technologie Vlaanderen and participative technology assessment*, in European Technology Assessment Panorama, European Commission, DG XIII, 1994.

R&D policy, as it remains the only reputed national institution in this area. The role of federal institutions may be characterised by three key words: subsidiarity, impulsion and coordination.

- Subsidiaries: in federalised matters, the federal level only acts when and where its intervention is planned to be more efficient than multiple decentralised interventions.
- Impulsion: SSTC often start new programmes and new research themes, from federal initiative in cooperation with the Regions: for instance in the areas of sustainable development, transport and mobility, social sciences.
- Coordination: the federal level has to coordinate regional authorities and to represent Belgian science policy abroad.

The restructuring of the Museum of Natural Sciences, in Brussels

This Museum created in 1846, is the only federal institution devoted to scientific culture. In 1997, the Museum got a fundamental “lifting”, aimed at rejuvenating and modernising its design and image, with a double purpose: to implement seasonal thematic exhibitions, in order to organise bilingual scientific and cultural events at the national level, to improve the provision of services for teachers and groups from secondary schools, and to get a more active involvement of the young public, through the organisation of holiday workshops.

Users involvement in accompanying research projects

The management structure of federal research programmes often includes accompanying committees at the level of the different sub-programmes. For many years, the accompanying committees of programmes such as applied social sciences, information society, sustainable development, transport and mobility, include users representatives, i.e. social groups that are directly concerned by the research topics. In some cases, these committees are also associated to the preparation of the calls for tender and the evaluation and selection of projects. There is a recent policy decision to include groups of concerned users in all the research project of the new federal programme of support to sustainable development (2002-2006). Each research team or network has to organise a dialogue with concerned users all along the life cycle of the project.

The Federal Council for Sustainable Development, which is not only composed of the social partners, but also of representatives of NGO’s, consumers and environmentalists, has a permanent working group on scientific research and sustainable development, who directly advise the federal Minister of science policy. As a means of support to this Council, SSTC implemented a research-action project on scientific communication in the area of sustainable development[99].

5. Final comments

Some concluding transversal remarks can be formulated:

- There is no leading institutional or political actor in the area of public awareness of S&T, and there has never been any. Initiatives in this area are however worthwhile, but highly decentralised. The question whether decentralisation is the cause or the consequence of the lack of leading actors is quite unclear.
- The Universities are emerging actors in the landscape of public awareness of S&T. This can be related to the implementation of “third mission” formally assigned to universities: services to community and society, besides teaching and research.
- The participation of social groups in R&D consultative bodies can meet several obstacles and be weakened by filtering and compromises. The pyramid of representation and delegation tends to filter out the “grass-root” questions. Consensus seeking is not always favourable to the emergence of new ideas, although occasionally the compromises may be on new ideas rather than established ones.
- Besides the institutional initiatives, initiatives that promote scientific and technical culture are also coming from associations (youth groups, cultural centres, etc.), even with punctual support of public authorities, but without really being integrated in any action plan.
- Moreover, recent huge political debates on food security (dioxins contamination, BSE, GMOs) have brought to the role of scientific expertise in policy debates and consequently, the question of the level of public awareness in these areas and the role of the media forefront. The precaution principle appears as an emerging theme in the relationships between S&T actors, policy makers and the public.

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[99] Mormont M., Zaccaï E., Loots I., *La communication scientifique en matière de développement durable*, SSTC/DWTC, AS/19/011, mai 2000.

"La mise-en-culture" of science: Public Understanding of Science in the French policy context

Philippe Chavot, Anne Masseran

During the long history of science popularisation in France, the very meaning of science and technology has hardly been questioned. They have continuously been associated with social progress. Their social usefulness appeared as a sufficient argument to promote their development. Science popularisation was supposed to enlighten or to educate the public, not to discuss the various stakes related to scientific and technological development.[100] Discussion on the benefits and threats related to science were only obvious after WW II and the use of nuclear weapons. Then criticisms against science started to emerge.

In the 1950s and 1960s, the left wing movements were getting more and more involved in the criticism of the expansion of capitalism. They considered scientific findings to be diverted from "fair" causes, and that only those likely to be "profitable" were selected. Hence, liberal capitalism was accused of ruining the development of "good science". Nonetheless, the legitimacy of science remained uncontested. It was the uses that the capitalists put sciences to which were considered perverted and so there was a need to purify science and ensure its autonomy. In the public space, science benefited from such a positive consensus that it was totally protected from political debates, or even from public debates.

The 1968 revolt led to a reform of the universities that reduced the power of mandarins and led to a growth in student population. In the same move, the operation of research and academic institutions[101], and the existing hierarchies within them, were directly questioned, i.e. the division of labour between scientists and laboratory workers and the exclusion of females from higher status). Other criticism, more related to the social function of science, was voiced by the radical left movement and then by ecologists. Both were struggling to make science and scientists responsible for the social, cultural and environmental consequences of scientific research[102]. Hence, a reflexive attitude tended to develop within the scientific community. It aimed not at questioning the core of scientific activities, but to discuss the possible threats related to scientific developments: scientism, but also potential risks related to nuclear research and

[100] In France, science popularisation started in the 17th century with the work of Fontenelle, among others. The 18th century was dominated by the large enterprise of building encyclopaedias within which science and mechanical arts occupied an important place. Popular education movements appeared in the 19th century together with the institutionalisation and the specialisation of science. They would be reinforced by the growth of positivism (see the chapter on National Profile France).

[101] In France, there is a clear partition between national research centres (CNRS, INSERM, INRA) and academic institutions such as Universities, Engineers schooners and Grandes Ecoles.

[102] See LEVY-LEBLOND J.M. & JAUBERT A. (textes réunis par), *(Auto) critique de la science*, Le Seuil, Paris, 1973.

genetics. This movement, carried by young research workers (who were labelled "scientifiques contestataires") influenced by the 1968 revolt, expressed their opinions through trade unions and several protesting publications (*Impasciences*, *Labo-contestation*, *Survivre et vivre*...). While some actors of this movement launched the first critical studies on science popularisation, others inspired today's initiatives to promote what is going to be called the *Culture Scientifique, Technique et Industrielle* (CSTI). From then on, the idea that the public demands more scientific and technological information was being taken for granted.

The first policies aiming at placing science and techniques into the general culture of the French population were designed in early 1981, a few months after the victory of the socialists at the national election. They led to the institutionalisation of *Centre de culture scientifique, technique et industrielle* (CCSTI). However, the first initiatives came from outsiders who aimed at de-localising scientific knowledge and expertise. In the early 1980s, law, health and management "shops" were flourishing in France, aspiring at helping citizens face institutions, law as well as orthodox medicine. The first French science shops were established in that context in 1981 and 1982[103]. Just like the Dutch science shops, the French structures were expected to listen to citizens' demands and provide counter-expertise that would challenge expertise offered by industries and institutions: this way, they would help people to defend themselves against risks related to scientific, technological and industrial developments.

The creation of science shops could clearly be related to the change of the political context. It was as if new spaces of negotiation that could transform the working of institutions had appeared. Scientists who had taken part in the 1970s criticism movement promoted these shops. They were either members of the *Amiante Collectif* of the Jussieu University or of the group *Biologie et Société* who had initiated the first courses Science-Technology-Society at Jussieu and Lyons. However, at the very time the first science shops were created, the new government promoted actions that would thereafter leave their influence on most CSTI activities of the 1980s and 1990s. These actions were part of a more general policy that aimed at putting science back "at the forefront in the international competition".[104]

The global aim was to "get out of the crisis"[105] with the help of science and technology. But it was necessary to ensure that the entire population be conscious of efforts made to develop science and technology, and of the results of these efforts. From then on, one could speak of a governmental policy towards CST. A "large" Ministry of Research

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[103] In 1982, there were five science shops in France and a sixth one was in the process of being established in Strasbourg. However, other shops existed: the same year 50 health shops and 20 management shops were in existence. Cf. A. Blanchard et al, *Le phénomène "boutiques"*, recherche collective de licence, Université Paris Val de Marne, December 1982.

[104] Fr. Mitterand, speech delivered on April 22th 1981. This speech, given a few days before the national election, would be used as a guideline by the new government.

[105] Jean-Pierre Chevènement, (Minister of Research and Technology), Opening speech at the symposium "Recherche et Technologie", actes du colloque, La Documentation Française, Paris, 1982, p. 58.

and Technology had been created to give a new impulse to French research and technology. Within this framework, the necessity of valorising and developing CSTI was underlined and became one of the crucial missions of the Ministry. In order to do so, the new government organised forums at local and national level,[106] which led to a first meeting with local actors and allowed the orientations for CST initiatives to be defined. They were also preparatory works of a sort for the two laws that had been voted for in 1982 and 1984 that have given scientists and academics a fourth assignment: to become active in "the dissemination of CST to the whole population and, more particularly, young people".[107]
At institutional level, several committees were established to manage the meeting between science and society such as, on one side, the *Office parlementaire d'évaluation des choix scientifiques et technologiques* (OPECST, Parliamentary Office for Scientific and Technological Choices) in 1983, and several ethics committees. Hence, reflexivity could be impinged on scientific and technological orientations. On the other side, two structures were established to coordinate CSTI initiatives: the *Mission Interministérielle de l'information scientifique et technique* (MIDIST) and the *Conseil national de la culture scientifique, technique et industrielle* headed by a former "scientifique contestataire", Jean-Marc Levy-Leblond. These structures were dedicated to enhance and reflect upon the local and national CST initiatives. They considered the 1981 local forums as starting points for the constitution of a dense web of structures promoting CST. They also encouraged actors to develop organisations – that were to be labelled CCSTI – to coordinate actions at local level. Although the concept of CST proved to be consensual, it concealed the multiplicity of initiatives that could be developed through the CCSTIs: these spaces were defined as "sites for creation, meeting, research, education and sensitisation (through exhibitions) information and mediation"[108]. Concretely, they often drew "initiatives" from older structures such as the *Association Nationale Sciences Techniques Jeunesse* (ANSTJ), the popular education centres, scientific societies… Hence, they permit the federation of efforts (when power conflicts opposing local organisations did not forbid such federation).
A 1985 report showed that by that time the CCSTI had yet to find a common ground.[109] They promoted a large number of actions ranging from the valorisation of Industry Museums to Science exhibitions. This situation certainly resulted from the difficulties of finding a model: CCSTI were French creations and they could not – as the science shops did – draw from any references for their development. Hence, the spectrum of

[106] As a first step, 31 forums were organised at regional level from October 2nd to November 21st. The conclusions of these forums were addressed during the national conference "Recherche et Technologie" held on 13-16 January 1982.
[107] Quoted from "Loi d'orientation et de programmation pour la recherche et le développement technologique de la France", Loi 1982-610 of July 15th 1982, article 24. Cf also, "Loi n° 84-52 of January 26th 1984 sur l'enseignement supérieur".
[108] Bernard Maitte, Les CCSTI, rapport pour le Ministère de la culture, October 1985, p. 26.
[109] *Ibid.*

activities they could favour often depended on local contingencies. However, despite their heterogeneity and the insufficient funding coming from the state and the cities, the CCSTI have multiplied, transformed their missions and progressively became the shop windows of local dynamism as far as scientific and technological developments is concerned.[110] Local dynamism has often been concealed by the most prestigious achievement of the government: the *Cité des sciences et de l'industrie de la Villette* (*La Cité*), which opened in 1986. It was designed to demonstrate the French ambition to become a leader in the concert of Nations in scientific, technological and related industrial developments. The *Cité*, as a showcase of French science, would benefit from large public funding and from sponsoring actions. Faced with this large enterprise – the "largest CST centre of the world".[111] – the local CCSTI would have to play only a secondary role. Hence, this paradox: the socialist government, and especially his Minister of research, Jean-Pierre Chevènement, aimed at decentralising CST actions, making them accessible in the provinces. But, the modern "concept" of CST would be built and inaugurated in Paris and would be considered, from then on, as an example for the development of CCSTI and other centres in the provinces. CST actions reflect well the force of the still patterning French centralism.

On another level, one can observe that while the CCSTI were multiplying and growing, the Science Shops were declining. This move from Science Shops to CCSTI can also be interpreted as a move from the ideal of participative democracy to a renewal of the linear model for the diffusion of scientific knowledge. In that context the so-called public demand is progressively reduced to a demand of scientific knowledge.

A new start was given to CST initiatives in the late 1980s, after the end of the first governmental left-right cohabitation. The new minister of Research, Hubert Curien, aimed at restoring a dialogue with the citizens and borrowed a concept already developed in other countries (in the Netherlands and the United Kingdom), the *Fête de la science* (Science week). While the *Fête de la science* often appears as a demonstration of scientific, technological and industrial developments, the government attempts every year to give it a new meaning and encourages actions to "make science go to the street and to the public". "Science, he said, should be closer and "convivial", shared by the whole society".[112] Also, if a hiatus exists between political discourse and concrete actions, it could be explained by the rhetoric that is being employed: encouraging a citizen-minded science without specifying what form it should take.[113]

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[110] In 1991 15 CCSTI where in existence. This figure increased to 29 by the year 2001..

[111] As it is claimed in *Lettre d'information du Ministère de la Recherche et de la Technologie*, n° 74, April 1991, p. 12.

[112] R. G. Schwartzenberg, Minister of Research and Technology, Discourse for the opening of the Science week 2001, Palais de la découverte, October 15th 2001.

[113] One may wonder what "sharing" within this quite unilateral communication means: the Science week is supposed to educate the publics to science without feedback, without the possibility for the latter to offer knowledge or insights to the scientists. For instance, in 2001, the organisation committee of the Science week included 9 scientists, 3 social scientists but no citizen.

A critical debate around science and technology surfaced during the 1990s. Scandals (such as the contaminated blood scandal in the late 1980s or, more recently the issue of mad-cow disease) and pressure from the public (such as AIDS activists aiming to establish a relationship of equality between physicians and patients, making patients take part in decisions related to clinical trials), show that a reflexive democracy is progressively taking root in France.[114] The equation scientific progress / progress of human condition are also being questioned. Citizens who do not base their opinions on scientific authority are also heard in public controversies. Expert knowledge is counterbalanced by other types of knowledge and the debates on scientific and technological developments are no longer limited to the scientific sphere, they are becoming political too.

Politicians have measured the weight of the pressure coming from society and have adapted their CCSTI policies. At rhetorical level, the "general public" is no longer addressed as such but rather as "citizens". However, even if the concept of citizen – as it is used – is equated with an ignorant public in search of scientific guidelines, this concept led actors involved in CSTI initiatives to transform their way of communicating science and technology. This rhetoric attests of a political willingness to recapture the issue and to secure the place of science in society. Different institutions commit themselves to affirm their legitimacy in the public controversies related to scientific and technological development: CSTI has become a priority in the spectrum of actions initiated by the Ministry of research, while other ministries are also active to face the crisis (such as the Ministry of Health and of the Environment). In 1999, the *Conseil scientifique de la culture et de l'information scientifiques et techniques et des musées* was created. Its pamphlet states that "the issue is not to enhance CST but to see that science benefits again from its true cultural dimension (to put science into culture)".[115] However, once again, quite different meanings could be given to this statement.

On one hand, the institutions attempt to restore the public's confidence by asserting the transparency, the integrity and the independence of science (mainly with regard to economics). In that case, they try "to domesticate" these protest movements by offering them new areas, which are also areas aiming at promoting science and technologies. For instance, a first – and unique – citizens' conference had been organised on GMO's in 1998. Although the concept was borrowed from Scandinavian countries, it has been largely adapted to the prevalent policy: the underlying aim of this conference was mostly to convince the public of the central role that science should play in such controversies and to reinsure the "consumer-citizens". This first experience was

[114] For an introduction on the concept of reflexive modernity, see BECK U., "Risk Society and the Provident State", in LASH S. & al., *Risk, Environment & Modernity,* Towards *a New Ecology*, Sage, London, 1996, pp. 27-43.

[115] Pour une politique de culture de l'information scientifique et technique", Document d'orientation du *Conseil scientifique de la culture et de l'information scientifiques et techniques et des musées*, November 15th 1999, p. 1.

followed by others consulting actions aimed at the public whose protocol was largely differing from the original model. Specific agencies have also been created, such as the *Agence Française pour la Sécurité Sanitaire des Aliments* (AFSSA), whose goal is not only to advice politicians on the right decision to take but also to inform/reassure the public on the validity of this decision.
On the other hand, critics are forcing open the doors of the institutional arenas to get their points of view across to the institutions (that happened during the recent public debates on GMOs that were aimed at collecting the "point de vue citoyen" but that were literally colonised by anti-GMO critics). In that case, science is equated with other forms of knowledge, and its status as an ultimate resource is negated. At least, new spaces have appeared that allow scientists and citizens to confront each other, such as, some of the *Cafés des Sciences* (Science Cafés).
In brief, the areas where science and society interact have been largely redefined during the previous years, and some of them are constantly colonised by different pressure groups. Also, after a long history in which science was both protected and kept at a distance from critics, science is finally questioned in the public space.

Most recently, several CST forums had been organised between November 2001 and January 2002 during which various issues were addressed.[116] They demonstrated the multiplicity of views, of actors and of meanings that are attached to CST. The first forum gathered institutional actors (coming from Ministries, Research institutions, National Museums, CCSTI…) and aimed at drawing up the states of art. Two others addressed specific questions: science on TV and women in science and technology (during which the disaffection of young people from scientific studies was addressed). Finally, a last forum organised by the Association Science-Technique-Société (ASTS), gathered 1200 people. It led to the diffusion of a call aiming at organising a public consultation on "Society, Science and Technology". Stating that the "gap" between science, technology and citizens is growing wider than ever, this call is a plea for actions in order to protect society against two resulting "risks": scientism and obscurantism. Hence, the solution, it is said, is to promote a large cultural enterprise that would reinstate the true meanings of science, technology and industries.[117]
Hence, the success of such forums should not mask that the prevalent ideas of CST are based on robust representations of the public and of the role of science in society: the public is seen to demand knowledge needed to help them to face the evolution of society. Science and technology remain central references for political decisions and to establish "a new humanism".

[116] See http://www.recherche.gouv.fr/manif/2001/assises/default.htm and http://assises.sciencecitoyen.org/
[117] See http://assises.sciencecitoyen.org/centre.phtml?edito=9.

In addition, France attempts to get closer to other Europeans countries and work on CST issues. It is within the French presidency of the EU, in 2000, that an international meeting was organised "Science and society: the public understanding of science". However, in the same way that the concept of CST is clearly detached from other federating European concepts – such as PUS or Raising public awareness of science – the policies of French "cultural exception" still place France apart from European policies.

Policy-public interface in Portugal

Maria Eduarda Gonçalves, Paula Castro

1. Introduction

In Portugal, public investment in research and development activities, as well as in education and training in science and technology, were rather low by European standards until the mid-nineties. Human and material resources available to research institutions have been insufficient for them to be more than dependent and marginal participants in the international production of scientific knowledge.[118] Portuguese research institutions, and other scientific institutions (namely, scientific societies) have also been socially and politically isolated for a long time. All these factors underlie the fragility of structures and activities for the diffusion of science until present times. No modern science museum was established until the mid-nineties. A limited number of initiatives in the popular science press survived only for a short period of time for lack of support, as well as of market.

In October 1995, a Department of Science and Technology was established, for the first time in Portugal, within the government formed by the Socialist Party. The role of this Department has been instrumental in the ongoing process of growth and institutionalisation of scientific and technological research in this country. Growth indicators of scientific development, such as the number of PHDs in science (12% per year) and of scientific production (16% per year) are the highest in Europe (EC, 2002: 8, 12). The Department of Science and Technology has also introduced as one central axis of its policy the promotion of scientific culture of the general public.

The involvement of the Portuguese government in the launching of programmes and measures aimed at the popularisation of science underlies the higher visibility acquired by science and new technologies in Portuguese society, particularly among the youngest segments of the population. The apparent evolution of social attitudes towards science in recent years should not be separated either from the increasing number of science-based public controversies, widely covered by the mass media, which have ocurred in the country throughout the 1990s (on environmental policy issues, on BSE, on the Foz Côa dam, and so on).

[118] Recent studies have shown the contradictions involved in the "intermediate" role of Portuguese science within world science (Nunes and Gonçalves, 2001).

2. The public policy for scientific culture

Main goals and instruments

One can say that a “public policy for scientific culture” has been undertaken in Portugal since the mid-nineties. The goals of this policy have been implemented mainly through the “Ciência Viva” (Science Alive) programme, launched in 1996. Besides, every year since 1997, in November, a Science and Technology Week is organised by the ministry. During this week, which includes “the national day of scientific culture”, a series of various events are held, including the opening of the doors of some scientific institutions to the public, and conferences and seminars on different scientific topics. These events take place all over the country.

The “Ciência Viva” programme is essentially a programme for the popularisation of science, which relies on the cooperation between, on the one hand, basic and secondary schools, and on the other hand, universities and state laboratories. This programme, therefore, aims to mobilise the educational and scientific communities. Its main targets are students of basic and secondary schools. Its methodology emphasises the experimental teaching of natural and technological sciences. The “Ciência Viva” programme has been the object of generally very favourable assessments, namely by its international evaluation board, with regard to both its workings and efficacy.

The “Ciência Viva” programme has also encouraged the formation of permanent networks among schools, through its special gemination programme, and has given rise to the establishment of “ciência viva” centres, conceived as interactive meeting spaces. Examples of these centres are the “Centro Ciência Viva” of Algarve, the Planetarium of the Centre of Astrophysics of Oporto and the Infante D. Henrique Exploratorium of Coimbra. The “Pavilhão do Conhecimento” (Knowledge Pavillion) created in 1999, in the setting of EXPO-98 (“The Oceans – A Heritage for the Future”) at the ”Parque das Nações” (Park of Nations), in Lisbon, has been presenting a number of temporary exhibitions on science themes, most of them “imported” from other museums or similar institutions of foreign countries. Near Oporto, an interactive science space has been established as well, the Visionarium, under the initiative of a private body, the Industrial Association from Oporto.

In the words of the Minister for Science and Technology, the “Ciência Viva” programme found its origin in the recognition of the need to struggle for the “general appropriation of scientific culture by the Portuguese population”. “This programme was born out of a decisive debate against Portuguese scientific backwardness”, the Minister added (MCT, 1999).

These popularisation activities are seen as “a responsibility, in the first place, of the national scientific community” being also understood as a “collective responsibility”. In fact, the government has played a decisive role, since the mid-nineties, in encouraging scientists and scientific institutions' involvement in the diffusion of science to the public.

The policy's rationale

Policy and programmes for scientific culture undertaken by the Department for Science and Technology are guided by an ideological frame of reference inherited, one might say, from the modern philosophy of "Les Lumières" according to which science was essentially the search for the laws of nature and of things, based on logic and deduction. The same ideology espoused the values of liberty and of democracy and thought of them as intrinsic elements of scientific practice. The "Ciência Viva" programme relies on the notion of scientific practice as the understanding and manipulation of nature and of technical objects. One of its underlying goals is to counter the traditional theory-based teaching of sciences, by a methodology of teaching based on experimentation.

The programme's emphasis on experimentation and on technology manipulation tends to exclude from the learning and awareness processes both the discussion on the nature of science and technology themselves, and the consideration of the social, economic and political contexts of their production.[119]

To the extent that it does not consider the social and political dimensions of scientific activity, this scientific culture policy is out of phase with the public image that science is acquiring in the mass media in Portugal. Because this is an image of science that views it as, on the one hand, something increasingly relevant to people's lives and, on the other hand, as something uncertain and controversial.

It should be added that the very use of the word "experimental" in describing the turn towards "science as it is actually done"[120] tends to reinforce the epistemological primacy of those scientific disciplines organized around laboratory and experimental practice, such as physics, chemistry and some areas of biology. Subsuming under "experimental" the practices of observation, documentary and archival work, fieldwork, modelling and others, as often suggested by officials from the Ministry of Science, tends to conceal the diversity of scientific practices associated with different disciplines and, in the end, had the (unintended, for sure) effect of contributing to the emphasis on "traditional" disciplinary hierarchies, as well as to the "two cultures" split.

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[119] It should, however, be pointed out that there has been one, but just one, experiment of the programme in the field of sociology: the initiative was taken by the Centre for Research and Study in Sociology (CIES), of ISCTE, in 2000.

[120] This was the title of a cycle of public lectures organized by the Ministry of Science, in Lisbon, between October 1996 and January 1998, which brought to Portugal a number of philosophers and historians of science, as well as many of the most prominent names in STS. The lectures, which consistently had a high attendance of students and high school teachers, were published shortly after the cycle ended (Gil, 1999).

The scientific culture survey

As part of its concern with the scientific culture of the general population, the Portuguese government has carried out, regularly, a scientific culture survey. This Survey was first conducted in Portugal in 1990 and 1992, under the responsibility of Eurobarometer, the research instrument being the Portuguese version of the Eurobarometer questionnaire. After these first years, problems with both the methodology and the rationale were largely invoked and the survey was discontinued in Europe. Portugal, however, decided otherwise. From the mid 90s onwards, the Science and Technology Observatory (STO) – a structure of the Department of Science and Technology – assumed the responsibility for these surveys, and a new one was conducted in 1996/97, and another in 1999/2000. These followed both the same rationale and the same methodology of the previous Eurobarometer ones, with only minor changes in some questions. According to the STO, to maintain these national surveys served an important comparative aim, since they are an opportunity to analyse the evolution of the scientific culture of the Portuguese. It has also been suggested that these surveys are still important in a country like Portugal to legitimate more investment in scientific culture.

The role of the Department of the Environment

In view of the importance of present debates concerning the environment, which are so closely related with issues and expertise of scientific nature, one would expect that the Department of the Environment (established in 1990, in Portugal) would promote action in the field of the popularisation of science, for the clarification of the scientific issues involved in such debates. However, initiatives in this area are not being pursued in a direct, but rather in an indirect manner.

This is the case of the Environmental Impact Assessment (EIA) procedures and hearings. These procedures and hearings, and mainly those connected with the EIA studies, have brought scientific issues to public reflexion and discussion.

A recent EIA process, concerning the incineration of toxic waste, clearly illustrates this point. In the beginning of 2000, the Environment Minister, faced with strong public protest against a co-incineration project of toxic waste, decided that an Independent Scientific Committee (ISC) would study advantages and disadvantages of co-incineration in cement factories, and come up with a recommendation that would be followed by the government. Nevertheless, an even stronger public and parliamentary contestation followed the ISC recommendation favouring co-incineration, and choosing the factories where it should be done. Several debates and interviews both with the Minister and with public figures opposing co-incineration, took place. And, to make a long story short, another Independent Committee, this time with public health specialists, was appointed.

The main dimension that seems worth mentioning in connection with the question of the public understanding of science, is the one pertaining to the intense use by the Minister of the idea that science and scientific expertise can decide environmental matters via a direct transposition of its findings to public policy. Translation and interpretation from the scientific data realm to the public policy realm were thoroughly constructed by the Minister as inexistent. Science was presented as something specialists do in their offices and is able to come up with unproblematic answers. These unproblematic answers were, afterwards, to be used as the basis for governmental decisions. Since the local authorities and the populations from the chosen places were not “illuminated” by science, but instead “obscured” by local interests, their voices could not be taken into account for an informed governmental decision.

This version of science – and of scientifically informed policy - echoed positively in large sectors of public opinion, and even strengthened the Minister’s position in his own party. He is now often presented in the press as someone who is capable of informed decision-making, even if facing public (defined as local) contestation.

3. Conclusion

In attempting to articulate a brief conclusion about the intersection the role of the Portuguese state vis-à-vis the public understanding of science in Portugal one is forced to acknowledge the central role played by the government in this field.

The Science Ministry has been the main actor in the promotion of the various initiatives devised to foster a scientific culture in the public and is responsible for the main reflexive instrument for the assessment of this culture, the scientific culture survey. Governmental initiatives in this field have involved the scientific and academic communities, and enabled them to put into practice popularisation activities that they could hardly pursue on their own.

This central role of the state is of course neither new nor specific of this field, since ours has traditionally been a centralized society highly dependent upon state’s financial and institutional support.

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PUS-Policy: The Swedish Context

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

To understand the specific set-up of public understanding of science (PUS) in Sweden, it is useful to start with some of the fundamentals of Swedish culture, its research and policy contexts. Sweden is a large and relatively sparsely populated country (8.8 million). It has a total land-surface area of 450 000 km^2, making it in this sense one of the largest countries in Europe, with boundaries stretching from the Baltic Sea in the south to a point in the north well above the Arctic polar circle. There is a long coastline that circumscribes much of the country's contours. This geographical and demographic setting has always been problematic: large distances have to be covered in order to connect various cities and regions.

When it comes to education and public understanding of science, this is still a notable aspect. 85% of the population is concentrated in three major urban areas, and of these three one stands out. Stockholm and its surrounding area host two of the country's four traditional universities. It also has as many inhabitants as the two other major regions together, west Sweden and the south of Sweden. Most of Sweden's political, intellectual and cultural resources are invested in Stockholm. State-driven PUS efforts therefore mostly originate in Stockholm in a context where the political, cultural and commercial powers are top-heavy.

For the majority of the 20th century, Sweden was ruled by strong Social Democratic governments. After World War II, in which Sweden was not directly involved, a thorough welfare state was created. This meant large investment in the public sector. The distribution of science to citizens and the use of scientific findings in public administration were seen as important parts of democracy and rational governmental ruling. However, in the 1990's Sweden as an industrial country experienced a deep structural crisis. Half a million people were pushed out of work, mostly coming from the traditional manufacturing industries. Governmental policy was to redefine Sweden as a knowledge based economy and the Swedish labour market was geared towards the expanding information technology area. This shift has of course changed the way knowledge is viewed. Increasingly, it is seen as something that can be commercially exploited. In Sweden there has been, as we shall see, an interesting merger of the civic tradition of public understanding of science with a more practical and economic tradition of industrial exploitation of science.[121]

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[121] Talerud, B, 2000, Högskolans arbete med sin samverkansuppgift. (University strategies for interaction) National Agency for Higher Education, 2000:2 AR, p. 24-27.

As will be evident, both the features of the traditional welfare state and the changes due to the crisis in the 1990's have influenced science policy and PUS in Sweden. Questions of democracy, social relevance and economic growth have directed the governmental efforts in different ways and at different times. However, initiatives on PUS in Sweden since the early 1970's are many and diverse and are not connected to a particular actor.

It should also be noted that the Swedish concept "Vetenskap", like its German counterpart "Wissenschaft", is much broader than the English notion of "Science". It includes not only the natural sciences, medicine, agriculture and engineering sciences, but also the humanities and social sciences, legal science and theology. This broad conceptualisation means that issues of PUS are potentially connected to every important societal issue within the public sphere. There is thus also a certain potential for topics to be popularised through several distinctly different perspectives, i.e. highlighting social aspects when dealing with the natural sciences.

The Research System: Universities and Colleges

Sweden has four large traditional universities which also act as generators of scientific information to broader publics. Two of them lie in the Stockholm region (Stockholm University and Uppsala University). One is situated in the west of Sweden (Göteborg University). The fourth is located in the south (Lund University). In addition, one university was created in 1965 in the northern part of Sweden (Umeå University). There are also a number of colleges that have experienced gradual growth, culminating in their assumption of university status; Karlstad, Växjö and Örebro are recent successful cases. Linköping University earned its university status as early as 1975.

During the last decade there was a thorough discussion on the governmental policy of decentralising university funds from the traditional universities to the new colleges.[122] The proponents of this policy have suggested that the state give research resources to these areas so that the intellectual capacity in the surrounding region can be stimulated. Opponents on the other hand have maintained that Sweden is too small a country to disperse its research funding in this way. In order to produce university departments of international excellence, they say, one has to focus resources on a few places in a sparsely populated country. Colleges do not have the right to award PhDs, thus candidates have to be linked to a university, which supplies the necessary training.

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[122] *Tvärsnitt*, 1994, no 3-4.

By and large the Swedish research system continues to be dominated by the old universities, which are characterised by well-established disciplines.[123] The new colleges for their part are much more geared towards interdisciplinary institutional forms and toward crossing the boundaries between academia and the rest of society. Together with the County Councils and Regional Districts (*landsting*) they often promote regional and local development policies to stimulate industry and the public domain. With these newer institutions a different style of scientific information is brought to the fore, more commercial in tone. While the traditional universities highlight their international research links, the newcomers are integrated into regional settings and are motivated into supporting regional growth. Seen in another way, the traditional universities have taken a national responsibility for PUS, but this task has never been very high on the priority list. The colleges have taken a regional responsibility and this kind of interaction has from the very start been of great importance.

Apart from the tensions between new and old institutions, another important factor for understanding the Swedish context is the deeply rooted academic chair system. Traditionally, one professor led the department and was responsible for quality and academic orientation. In many cases a university department would only have this one professor. This old system is a survivor from the time when one professor was supposed to know “everything” in his field. In today's specialised science, this system has become obsolete. Professorships, as they had been so scarce, were extremely sought after and the basis for many academic conflicts. With the new system, established in 1997, the title of professor is awarded not on availability but on merit. Whilst in recent years, many researchers have acquired the title of professor, the fundamentals of the chair system still remain. The new system, which bears some resemblance to the American tenure track system, does seem however to exacerbate one of the problems in the Swedish system, namely the lack of academic mobility.[124] For the future the new tenure track system is an important feature when it comes to different PUS initiatives, since teaching is counted in merit portfolios.

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[123] Wittrock, B & Elzinga, A, (eds.) 1985, *The university research system: The public policies of the home of scientists*. Stockholm: Almqvist & Wiksell International; Agrell, W, 1990, *Makten över forskningspolitiken.* Science and technology policy studies 1. Lund: Lund University Press.

[124] In the Swedish research system, it is very common to take your degree at one university and then stay put there for most of your academic career. One of the few incentives to move has been the chair system with very few positions available on the national scene. These have been so attractive that it has seemed to be worth the move. In the new system this impetus seems to have lost some of its attractiveness.

Social Relevance, Democracy, and Economic Growth

Three aspects of Swedish science policy and its connection to general policy and PUS will be highlighted here: the sectorial principle, the "Third Assignment", and recent changes in the research funding structures.

The first general science policy reform of interest here is the sectorial principle, a Swedish variant of the Rotschild principle [125], and introduced in the early 1970s. In accordance with this idea, the university is the main public repository for science that may solve problems within various societal sectors, be it housing, supply of energy, national transportation and local systems, environmental protection, health and welfare, etc.[126]

In the Swedish context it therefore became important to view research in the academic domain as open to public scrutiny and transparency. This means that efforts must be made to inform a wider audience about the existence of this kind of research, making it accessible particularly to various *user* categories.

The way this sectorial principle has been played out in the Swedish context makes for a very special situation. In most other countries a wide array of special research institutions and in-house research units have been created. To a large extent, these will then supply specified knowledge to users within government. This relieves a burden from university scientists, who in general can focus their work inside academia. However, many Swedish researchers, it has been claimed, work within two different worlds and are continuously asked to fulfil the needs of both the university and the outside world.[127] It is interesting to relate this to the ideas of PUS. As many Swedish researchers work within these two worlds, the task of communicating with the public is not as well motivated and at best comes third on the list.

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[125] Elzinga, A, 1993, "Universities, Research, and the Transformation of the State." In Sheldon Rothblatt & Björn Wittrock (eds) *The European and American University since 1800. Historical and Sociological Essays.* Cambridge University Press, p 191-233. The Rothschild principle is a policy initiative, which entail a contractual relationship between researcher and funder, in which the latter supplies resources on the condition that the knowledge produced has specific policy and social relevance; see *A Framework for Government Research and Development*. London: HMSO 1971, usually referred to as the Rothschild report.

126 See Elzinga, A, 1980, "Science Policy in Sweden: Sectorisation and Adjustment to Crisis", *Research Policy,* vol 9, no 7, April, p 116-146; 1990, "Triangeldramat bakom forskningspolitiken", (Triangleplay in research policy), in Wilhelm Agrell (ed), *Makten över forskningspolitiken* Lund: Lund University Press, p 41-60. This means very little applied research is done in special government laboratories or institutions that fall under the direct authority of one or another ministry. Instead ministries support special research funding agencies that receive both unsolicited and solicited grant proposals from universities. These are sometimes called "sectorial research councils" to distinguish them form the more traditional basic research oriented councils which continue to allocate funds on the basis of a pure peer review process. The sectorial councils combine criteria of societal relevance and scientific excellence in their review procedures. In some cases the former dominate over the latter, in other cases the two-tier approach starts with scientific merit. Of course there has been a lot of debate around these procedures, they may be compared to the notion of "extended peer review".

[127] Flodström, A, 1999, *Utredning av vissa myndigheter.* Näringsdepartementet, 19 nov. See also Talerud, B, 2000, *Högskolans arbete med sin samverkansuppgift.* National Agency for Higher Education, 2000:2 AR.

During the 1970's, a number of new sectorial funding councils were created. With this came an increasing attention to *user information*, both before projects were begun and indeed after they were finished.[128] For example, information was transferred via contacts with the media, special brochures, research catalogues, and the creation of sectorially oriented publications funded by the sectorial councils themselves.

A second general and a very important policy initiative is the requirement for researchers to disseminate their results.[129] In the new University Act of 1977, a new task supplemented the earlier two officially proscribed responsibilities assigned to the universities, teaching and research, and was thus called ”the Third Assignment” (*tredje uppgiften*). Such disseminated research information (*forskningsinformation*) should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have come to modify the text, changing somewhat its intended aims. Some core ideas are, however, still present, which goes back to the fact that the universities are part of a unitary national system and publicly funded.

An important element of the "Third Assignment" is the emphasis on the democratic significance of research-based knowledge. Research as a resource for changing society produced two democratic problems from a political perspective.[130] One of them was that the citizens needed to increase their awareness and control over these changes. As knowledge increasingly became important for the possibility of citizens exercising their democratic rights, it also seemed increasingly problematic that dissemination processes were traditionally relatively marginal and skewed in favour of those in power, at the cost of the broader public.

The roots of this view are sometimes said to go back to the previous century when the Swedish democratic movement sought legitimisation by reference to contemporary scientific knowledge and scholarship. An important part of their argument was that education and not revolution is better for empowering people to change society and become democratic beings.[131]

The notion of an officially stipulated "Third Assignment" is not as alien as might appear. Because the universities are national institutions, the Swedish academic tradition has,

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128 Several studies have been carried out during the 1980s on research utilization and modes of disseminating results linked to sectors: Björklöf, S, 1986, "Byggbranschens innovationsbenägenhet." *Linköping studies in management and economics, no 15*, Diss; Boalt, C & Lönn, R, 1987, "Forskningsanvändning." *Tidskrift för arkitekturforskning,* vol 1, nr 1; Ericson, B & Johansson, B-M, 1990, *Att bygga på kunskap. Användning av av samhällsvetenskaplig FoU inom byggsektorn.* BRF Rapport R 3; Nilsson, K & Sunesson, S, 1988, *Konflikt, kontroll, expertis*. Arkiv, Lund.

129 *Svensk författningssamling* 1977:218.

130 *Om forskning*. (About research) Forskningsproposition 1986/87:80.

131 Se e. g. Gustavsson, Bernt, 1991, *Bildningens väg: Tre bildningsideal i svensk arbetarrörelse 1880-1930.* ("Bildningens" way: Three ideals of educative formation in the Swedish labour movement 1880–1930.) Stockholm: Wahlström & Widstrand; Wallerius, Bengt, 1988, *Vetenskapens vägar: om akademiker och folkbildningsarbete*. (The ways of science: On academics and popular education) Stockholm: Folkuniversitet.

since the beginning of the 20th century, prided itself on professors being “civil servants close to the people” (*folkliga ämbetsmän*). In the 1920’s and 30’s, this ideal was perhaps more prominent than it is today; at Göteborg University, for example, professors held annual public lectures which were then published in a special university series.[132] Now that universities are under pressure to define their identities, profiles and *raison d’être* more clearly, mission statements or ‘visions’ in some cases find encouragement from this chapter from the past.

Over the years, the “Third Assignment” has been criticised for being powerless.[133] Very little money has been allocated to support what is a monumental task. In addition, there has been very little pressure put on researchers to invest in popularising their research. It is still common in some disciplines to find that popularisation is detrimental to ones academic career. The universities have for the most part been satisfied by delegating “Third Assignment” to specific information units. Furthermore, some researchers, very good at popularising, are frequently used by the media consulting them free of charge since it is taken for granted to be part of your duties as a scientist. Other colleagues not burdened by such assignments can dedicate more time to research. This reinforces the prejudice that popularisation efforts on behalf of scientists are far from meritorious within academic credibility cycles.

A new formulation of the “Third Assignment” (1997) was intended to foster a more intense interplay between the universities and society at large but in particular with industry. In the Ministry of Education’s directive it was apparent that universities and colleges are meant to increase the extent of their collaboration with industry, public administration, organisations, cultural life and popular education. The objective of the most recent Science Bill is not only the dissemination of research information to the public, it now explicitly states that industry must be a recipient in the dissemination process.[134] To make this easier, it is proposed that universities may create subsidiary companies, co-operating with industrial partners.[135] At the same time it is underlined that these collaborations should not be allowed to compromise the freedom of science.[136]

However, many now interpret the “Third Assignment” as a demand that universities and colleges should interplay more intensely particularly with industry.[137] This associates

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132 Se e. g. Olsson, Björn, 1998, ”Att torgföra vetenskap: Det vetenskapliga föredragets och populärföreläsningen teori, praktik och kultur.” (To promote science) *Svensk sakprosa*, nr 24, Lund; Poppius, Ulla, 1991, *När lundaprofessorerna höll bondföreläsningar: Centralbyrån i Lund för populära vetenskapliga föreläsningar, folkbildningsavdelning vid Lunds universitet 1898-1970.* (When Lund professors held lectures for the peasantry.) Lund: Skånes bildningsförbund.

133 *Högskolans samverkan med näringslivet* (Interaction between higher education and industry). Riksrevisionsverket, RRV 1996:53, RRV 1996:56.

134 *FoU och samverkan i innovationssystemet* (R&D and cooperation in the innovation system). Regeringens proposition 2001/02:2, p. 31.

135 Ibid., p. 44.

136 *Forskning och samhälle.* (Research and society) Regeringens proposition 1996/97:5, s 60.

137 Brulin, G, 1998, *Den tredje uppgiften: Högskola och omgivning i samverkan* (The Third Assignment: Higher Education and its surroundings in interaction). SNS Förlag och Arbetslivsinstitutet.

the "Third Assignment" with forms of interaction that go beyond informing about R & D results. One of the driving forces is globalisation, which is often referred to as a motive for developing university-industry landscapes to improve local or regional competitiveness in the marketplace. In addition, the government has recently stated that the "Third Assignment" has been important to foster the new entrepreneurial spirit in universities and colleges.[138]

A third general policy regulative is the change which Swedish research funding is currently experiencing. Research granting agencies, of which there were previously many, are now brought together into a small number of integrated agencies. Earlier the responsibility of allocating research grants was divided between the *Swedish Council for Planning and Coordination of Research* (FRN), the *Swedish Council for Research in the Humanities and Social Sciences* (HSFR), the *Swedish Medical Research Council* (MFR), the *Swedish Natural Science Research Council* (NFR) and *the Swedish Research Council for Engineering Sciences* (TFR). In the beginning of 2001, a new body, *The Science Council* (Vetenskapsrådet) was established, taking over all of the commitments of the previous agencies.

The Council has three divisions: one for humanities and the social sciences, one for medicine and one for the natural and engineering sciences.[139] The objectives of the Council, in addition to "supporting research" and "promotion of the scientific quality and renewal of basic research in Sweden", also include a responsibility "on a national level for general information on research and research results".[140]

At the national level a number of new strategic research foundations (Strategiska Stiftelser), independent from the government, have also been created. Their mandate is to fund long-term motivated research that can provide added value in an economically or socially beneficial sense. These foundations require matching funding and partnering with industry or other "users". Besides foundations which stimulate a science base for generic technologies and environmental concerns, there is also a specific foundation for knowledge and competence development (KK-Stiftelsen). Here the task of partnering includes attention to dissemination of research information that will be conducive to the development of regional policies for innovation.

With the introduction of the strategic foundations some funding has been shifted away from the basic research councils.[141] In addition, the earlier funding to the universities, earmarked for supporting efforts in 'research communication' at the universities during the years 1993-96, has now been terminated. Within the universities this has given rise to some protest since 'research information' is still very much regarded as an 'added

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[138] *FoU och samverkan i innovationssystemet* (R&D and cooperation in the innovation system). Regeringens proposition 2001/02:2, p. 6.
[139] Information gathered from the homepage of the Council; see http://www.vetenskapsradet.se.
[140] See http://www.vetenskapsradet.se.
[141] *Forskning och samhälle.* (Research and Society) Regeringens proposition 1996/97:7, p 45-47.

on' to other, (in the minds of faculty) more important activities. In a recent Science Bill, notably titled *The Open Higher Education*, it is explicitly said that the "Third Assignment" must take resources from teaching and research.[142]
Another interesting change is the creation of *The Research Forum* (Forskningsforum) with the task of creating dialogue and collaboration between researchers, funders and others affected by research.[143]
The results of these changes in research funding and their effect on the initiatives of public understanding of science are yet to be seen. However, there is a clear adjustment in the funding system toward further economic exploitation. However, the objective of *The Science Council* to take responsibility for research information in a more traditional manner may indicate that the commercialisation of the "Third Assignment" for example is best viewed as a supplement to the original intent rather than a fundamental change.

Notes for comparison: the Swedish case

To be used to evaluate the different national settings, the following points briefly summarise the most important PUS initiatives and themes in Sweden. The first three are of a more general character, followed by a number of specific initiatives of PUS.

General aspects

Vetenskap/Wissenschaft. The Swedish concept of *vetenskap* is much broader than the English notion science. Including both the natural sciences, the social science and the humanities, this broad conceptualisation actually means that issues of PUS are possibly connected to every important societal issue within the public sphere. There is thus also a certain potential of topics to be popularised through several distinctly different perspectives, i.e. highlighting social aspects when dealing with the natural sciences.

Democracy and the legislation of the "Third Assignment" (1977). In addition to the traditional obligations of education and research, the University Act of 1977 added a third mandate to the universities. The universities in Sweden would henceforth be responsible for disseminating research information to the public. The idea was connected to democratic ideals: 1) it was necessary that the public was aware of the

[142] *Den öppna högskolan* (The Open Higher Education). Regeringens proposition 2001/02:15, p. 220.
[143] *Forskning för framtiden: En ny organisation för forskningsfinansiering.* (Research for the future: A new organisation for funding research) Proposition 1999/2000:81

role science has in social changes; 2) scientific knowledge should be disseminated to all citizens and not only to those traditionally well-informed of science.

The reformulation of the "Third Assignment". Connected to the structural crisis in Sweden in the 1990's, the "Third Assignment" was broadened. No longer is the objective of the "Third Assignment" to educate the lay public; rather, communication is seen as more interactive than previously. At the same time, there is a shift from a democratic focus with the general public as the target towards a more commercial conceptualisation in which industry is regarded as a main recipient of the dissemination process. This will, it is said, improve the competitiveness of regional business.

Specific initiatives

The Council for Planning and Co-ordination of Research (FRN). Created in 1979, this Council was established to support among other things the "Third Assignment". In relation to the Swedish referendum on nuclear power, a publications series called *The Fount* (Källa) was launched, focusing on controversies amongst experts. As of January 2001, FRN has been integrated into the larger *Science Council*.

Humanities days (Humanistdagarna). Since 1985, the humanities faculties at the traditional universities have opened their doors to the larger public, featuring popular lectures and opportunities to visit various departments. Due to the broad Swedish concept of *vetenskap*, initiatives such as these are seen as placed within the mainstream popularisation of science.

The Nordic Forum for Research Information. In 1970, this forum was established to create networks of researchers and practitioners. It focuses on discussions of knowledge transfer and theoretical and methodological questions in this area.

The Swedish Association for Science Journalism (1972). The Association organises science journalists, informateurs at the universities, colleges and public agencies. It also produces a newsletter called Ugglan (*The Owl*).

The Museum of World Culture. As in most countries, Sweden has a rich body of museums. In recent years, a large project has been the creation of *The Museum of World Culture* (Världskulturmuseet). Set to open in 2003, its aim is to promote public understanding and appreciation of different cultures

Universeum. There exist some 20 different science centres in Sweden, most of them established in the 1980s. A more ambitious centre (Universeum) has recently been created in Gothenburg, required to have a national responsibility. Location wise *Universeum* is placed adjacent to *The Museum of World Culture*. This was originally seen as a way of making the two cultures interact or at least appear together as twin institutions to the general public.

The Nobel Museum (Nobelmuseet). Opened in 2001, this museum has an emphasis on the great men and women of science. The Nobel Museum is a very different kind of science museum, since it contains the special categories prize-worthy in the will of Alfred Nobel. This makes for a special mixture dominated by the hard sciences of chemistry, physics, and medicine. These are then mingled with literature and issues of politics (the Peace Prize). In order to make this heterogeneous assembly congruent, it was decided to create a permanent exhibition of creativity. This theme was seen to link all dimensions of the Nobel Prize.

The International Science Festival in Gothenburg (1997). The Science Festival in Edinburgh served as a model for the Swedish festival, attempting to popularise an image of science as being fun. It is now also being copied in Stockholm. Amongst its sponsors are the universities, whom see contributing to such schemes as a way of fulfilling the "Third Assignment"; other sponsors are interested in attracting good will.

Media. There have been many different attempts to popularise science in the Swedish media. Science is visible and present in the press, books, and in broadcasting. A common feature for all these media types is a boom in the 1980s. This includes both publication of popular science journals and books and a larger coverage of science in the press and broadcasting. This boom may in some respects be linked to the referendum on nuclear power in 1980.

Public Understanding of Science and the Policy Context in the United Kingdom

Josephine Anne Stein

Introduction

The Public Understanding of Science movement in the United Kingdom, dating from the mid 1980’s, was closely associated with the promotion of an informed, democratic society as much as it was with the promotion of science as a “public good”. More recent emphases on public consultation, particularly since the late 1990s, arose as declining public confidence in expert advice and authority more generally placed increasing strains upon traditional forms of science-related governance. Science policy and scientific advice to government, which had hitherto been constructed around expertise offered by a patriarchal and stable self-validating elite, began to face accelerating demands for more direct forms of democratic accountability and control.
At the formal, institutional level, the UK has a highly developed set of governmental, government-supported and independent organisations devoted to improving public awareness of science and technology. Academic research on and critiques of “traditional PUS” have also emerged from the UK, which have not only influenced intellectual currents far beyond its shores, but have influenced national policies. More consultative forms of PUS and dialogue with the public have become more common - but whether they influence policy is still an open question.

The Public Understanding of Science Movement

Although organised science communication through education, museums and promotional activities of the professional societies has been ongoing in the United Kingdom for centuries, the birth of the PUS movement in contemporary Britain can be ascribed to a report produced by The Royal Society in 1985 entitled "The Public Understanding of Science". This report, often referred to as the "Bodmer Report" after Sir Walter Bodmer, the chairman of the working party that produced the report, established a rationale for PUS and touched off a series of new or re-invigourated bodies and activities that are known collectively as the Public Understanding of Science movement.

The Public Understanding of Science movement arose from a perceived need in the scientific community to increase public knowledge of science in order both to improve the basic competence of the citizenry and to promote public support for government R&D expenditure. PUS was animated by observations of public "scientific illiteracy" as measured by surveys that revealed extensive public ignorance of specific "general knowledge"-level established scientific facts and theories. This ignorance, it was feared, indicated an inability of the citizenry to exercise responsible democratic influence over public issues increasingly based on science and its applications.

The Bodmer report was very much a product of Thatcherite Britain, in which public expenditure of all kinds had to be justified in terms of its contribution to national prosperity. The Royal Society, the UK's preeminent professional scientific society, responded to political pressures for public "accountability" by setting up the committee on PUS, with a mandate to examine the interface between scientific knowledge, the public, and the scientific enterprise (ie, the creation of new knowledge). The main conclusions of the Bodmer report are summarised in the UK National Profile section of this OPUS report. Suffice it to say here that the "bottom line" of the Bodmer report was that there being few public issues *without* some scientific content, public understanding of science was essential to the proper functioning of Britain as a democracy. The scientific community was called upon to simultaneously come to the aid of the ailing British economy -- and an ailing British democracy.

The Bodmer report came as a tonic to the British scientific community. Although cutbacks continued in public funding for research, scientists did receive a form of public approbation. The call for relevance and accountability struck a chord with both the public and the scientific community, and once sounded, the policies (and the funding priorities) followed. In a time of declining budgets, one couldn't affort *not* to subscribe to the new orthodoxy. Whether reluctantly or enthusiastically, the scientific community responded. PUS activities began to flower.

In specific terms, the Bodmer report laid the groundwork for a new body, the Committee on the Public Understanding of Science (COPUS), which was established jointly in 1986 by The Royal Society, the Royal Institution and the British Association for the Advancement of Science (BAAS). COPUS has provided a focal point for the expert-led PUS movement, coordinating a stream of activities. Both the Bodmer report and COPUS served as a catalyst for a more widespread and diffuse movement to promote science: the Public Understanding of Science movement.

Traditional or standard PUS activities have not acknowledged the public's less formal understanding of everyday phenomena; nor have they examined the public's capacity to absorb and deliberate on scientific theory and evidence when offered in a balanced and interactive format. The PUS movement drew criticism for its failure to acknowledge lay competence in absorbing and assessing scientific evidence in context, and for its

failure to recognise the ability of social movements and individuals to undertake their own research and form their own working models of, for example, reliability and risk.
Wynne and Irwin's critiques[144] of the so-called 'deficit model' (the idea that PUS consists of experts conveying knowledge to an ignorant public) argued for valorising local, experiential or non-credentialled lay knowledge, while calling for greater reflexivity within the scientific community. However, even these critiques implicitly espouse a form of scientific rationality, formal or informal, as being the appropriate basis of sound decisionmaking in the real world. The debate centres more on credentialism than on how to reconcile scientific rationality with social values in public affairs.

Technology Foresight

The Technology Foresight exercise of 1994-1995 was a major consultation exercise designed to improve linkages between the research community and those using new knowledge, and to inform priorities for public R&D spending. Technology Foresight was explicitly expert- and producer-led, and participation was controlled throughout, with no significant public consultation element[145].
The failure of both Technology Foresight and standard PUS activities to achieve two-way directionality of information flow (ie, to include "scientists' understanding of the public") led to many other initiatives designed to achieve mutual understanding through interaction between scientists and the public, often with an explicit objective to influence policy. However, the bulk of PUS activities in the United Kingdom continue to fall under the rubric of the Public Understanding of Science movement as characterised by the deficit model. Many PUS activities have become more entertaining and more interactive, but retain more of the traditional "mission to explain" (a phrase often employed by the BBC) than a "mission to understand" in a mutual sense.

Mainstream British PUS

The PUS movement in the UK is underpinned by both implicit and explicit policies, most of which are framed at national level but with important policymaking powers and initiatives delegated downward through all administrative and organisational levels to that of the individual. It is impossible to do justice to the extensive British PUS

[144] A. Irwin and B. Wynne, eds, *Misunderstanding Science? The public reconstruction of science and technology*, (Cambridge: Cambridge University Press, 1996).
[145] J.A. Stein, "Technology Foresight (UK)", in P. den Hertog, J.A. Stein, J. Schot and D. Gritzalis, *User Involvement in RTD: Concepts, Practices and Lessons* (Luxembourg: European Commission, 1996).

movement in a short report, especially as so much activity is organised in "bottom-up" fashion by schools, universities, research institutes, companies, industrial and professional associations, museums, libraries, the media, the arts and letters, community associations, regional authorities and individuals. The following organisations are a *very* abbreviated list of *some* of the main actors:

- The Royal Society
- The British Association for the Advancement of Science (National Science Week)
- The Royal Institution
- The Office of Science and Technology and the Research Councils
- Science festivals (Festival of Science, England and Wales; International Science Festival, Scotland)

More information on each of these are contained in the UK National Profile section of the OPUS Report, as well as overviews of the main categories of actors in the “spaces” chapters.

PUS as an expression of British culture

The *First Global Cyberconference on Public Understanding of Science*, organised by Steve Fuller of the University of Durham with the support of the ESRC, ran from 25 February to 11 March 1988[146]. Thirty-five selected expert commentators from countries around the world were invited to make opening statements, after which the cyberconference was open for unmoderated electronic discussion. Although some have long regarded science itself as a cultural phenomenon, the cyberconference extended this idea to Public Understanding of Science as well; it is one example of the leadership position that the UK has achieved in PUS research.

The British Council, an organisation that promotes British culture, commissioned a six-week cyberconference *Towards a Democratic Science* in September - October 2000[147]. The "e-conference", as the organisers called it, covered a different topic each week:

- Perceptions of science
- Risk and uncertainty

[146] www.dur.ac.uk/~dss0www1/
[147] www.mailbase.ac.uk/lists/democraticscience-all/files/volume1.htm
www.mailbase.ac.uk/lists/democraticscience-all/files/volume2.htm

- The need for regulation
- Ethical responsibility
- Public consultation
- Consumer protection

and the results of each week's electronic discussions were summarised and posted to conference participants. While neither the content of the conference nor the conclusions were particularly original or surprising, what is striking is how Public Understanding of Science has come to occupy such a central position in British life that the British Council should choose to organise such a conference as an expression of British culture. And this was not an isolated exercise.

As a follow-up to the e-conference, the British Council sponsored an electronic *International Seminar on Democratic Science* involving scientific experts from 17 countries around the world. The week-long "e-seminar", which ran for the week of 12 March 2001. The UK is clearly eager to establish itself as a leader in world electronic discussion fora on PUS issues.

Public participation in policy debates

Some activities within the PUS movement have gradually evolved into more interactive exercises involving dialogue between experts and lay members of the public. Most examples can be considered experimental and are not embedded into policymaking structures. However, the Parliament has taken a strong interest in participatory methods, a necessary - though not sufficient - prerequisite for more influential forms of strong or direct democracy to develop in the UK. Some of the major activities are described briefly below and in more detail elsewhere in the OPUS report.

Consensus conferences

There have been two consensus conferences in the United Kingdom, both organised on a national basis. The first of these, on Plant Biotechnology in 1994, was sponsored by the Biotechnology and Biological Sciences Research Council and organised by the Science Museum. The second, on the management of nuclear waste, was sponsored by the Centre for Economic and Environmental Development in 1999. In both cases, the organisers were satisfied by the outcomes; the citizens' panels in both cases expressed both concerns over the applications of science and technology while supporting further research. In both cases, the House of Lords had conducted their own inquiries in these areas prior to the consensus conferences.

Studies, meetings, public consultations and opinion polling

Biotechnology is such a controversial topic in the United Kingdom that it is not suprising that so much PUS activity and public consultation exercises centre around issues such as human cloning[148], genetic testing, genetically-modified food and agricultural practices such as feeding natural herbivores animal-derived products.

Although many variants of public understanding/public consultation exercises have been tried in the UK, most of them are carefully constructed and conducted according to parameters set by the organisers. Market research-led exercises and passive opinion polling are notoriously poor indicators of the public's capacity to understand complex, science-based issues. Experiments in deliberative polling have been carried out, and the broadcast media have developed successful formats where members of the public can challenge experts. Explicit efforts are made to balance the composition of expert steering groups and citizen panels, for example. But in almost all of these examples, the terms of reference, the methodologies employed, and the selection of the participants generally remains firmly in the control of the organisers.

Websites and Internet-based PUS activities

As more and more UK residents get access to the Internet, a flourishing business related to PUS is developing on-line. There are now so many Websites with science-related information that the Wellcome Trust Information Service operates a service that vets and catalogues relevant Internet Resources. It offers guidance to the public on how to assess the reliability of scientific information posted on the Web, and makes its own catalogue available through a searchable database known as *p*UBLIC **sci**ENCE **com**MUNICATION[149].

PUS in Government and Parliament

Under the banner "Have Your Say", the Prime Minister's office launched an Internet-based consultation on "Scientific Advice and Public Confidence" in November 2000. The Website invited public feedback as input to the development of a new Code of Practice to apply to all scientific advisory bodies (released in December 2001). The 10 Downing Street Science forum Website[150] provided links to some of the main S&T-related government departments and activities, and identified six specific issues for public feedback. One of these related directly to PUS itself: "How do you think the risks and benefits in science and technology might best be communicated?"

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[148] S. King, I. Muchimore et. al., *Public Perspectives on Human Cloning*: *A Social Research Study*, (London: The Wellcome Trust, 1998)

[149] www.omni.ac.uk/psci-com/

[150] www.number-10.gov.uk/default.asp?PageID=2846

The main stated objective of the exercise is in itself is a fitting encapsulation of the state of British Public Understanding of Science:

> *"The Government wants your views on how science is handled. We want to know whether you are concerned about current developments in science and what you think about the ways that the risks are controlled."*

At the end of the Home Page, it said "**We want to know what you think.** Click here to join in the discussion."
Whether this initiative will lead to new public understanding of science, or new understanding of the public by scientists and government, remains to be seen. Whether it genuinely improves democratic processes for public "ownership" and "management" of science is an even more open question. It does, however, convey New Labour's strong predilection for public relations.

The Parliament:
The House of Lords Select Committee on Science and Technology undertook an inquiry into Science and Society, drawing upon not only the ESRC Programme but a great body of additional studies and PUS activities. The report[151] took a comprehensive look at:

- Public attitudes and values
- Public understanding of science
- Communicating uncertainty and risk
- Engaging the public
- Science education in schools
- Science and the media

The Lords Committee heard or received written evidence from over 100 professional associations, S&T-based companies, agencies, research institutes, media companies, non-governmental organisations and individual experts. The House of Lords' report recognised the existing crisis in public confidence in S&T and science advisory systems. It endorsed earlier calls for openness in the UK scientific advisory system, and while vigorously supporting the need for independent advice, encouraged scientists to be explicit about their sponsorships and affiliations. The Lords acknowledged and supported the PUS movement, although the report significantly

[151] United Kingdom House of Lords, *Science and Society: 3rd Report,* (London: HMSO), 23 February 2000.

finds that "the crisis of trust has produced a new mood for dialogue." Traditional forms of PUS, in other words, are no longer enough, according to one of the most elite and exclusive bodies in Britain.

In response to the House of Lords' report, the Parliamentary Office of Science and Technology (POST) undertook a review of public consultation initiatives in S&T-related areas, looking also at experience of consultation exercises in local government and health care. The POST report[152] examined instances of deliberative polling, standing panels, focus groups, citizens' juries/panels, consensus conferences, stakeholder dialogues and internet dialogues. While the POST report found evidence of growing interest in engaging the public in dialogue, it also found that the quality and utility of such exercises were variable, concluding that well-organised deliberation, appropriate institutional culture and evidence-based discussion were most important to success.

Conclusions

At the same time that the United Kingdom has put enormous effort and resources into Public Understanding of Science activities and research into PUS, it has experienced one crisis after another in public confidence in science, technology and the ability of the government to support and regulate S&T-related industries in the public interest.

The Public Understanding of Science movement was intended to improve communication between scientists and citizens in a way that would strengthen the basis for informed citizenship and improve responsible governance. However, secularisation and post-modern scepticism characteristic of the late 20th century generally has led to a self-reinforcing dynamic in which scientists increasingly need to explain and justify their activities and conclusions to the public, while publics increasingly regard both the promotionalism and the content of the scientists' messages as suspect, requiring further explanation and justification. The decline in trust between scientists and the public is a natural outgrowth of this dynamic. But is this recognised as problematic?

It would appear that the UK has wound itself into an inescapable dilemma. The British public would appear to be very volatile at present, with mass protests on "countryside issues" in 1999 and on fuel prices in 2000 both catching everyone by surprise and immobilising much of the country, albeit for a short period of time. For vulnerable science-based industries, such as the beef industry, such expressions of public frustration can be catastrophic. Will more, and more "reliable", scientific information,

[152] Parliamentary Office of Science and Technology, *OPEN CHANNELS: Public dialogue in science and technology*, Report No. 153, March 2001.

serve to reassure the public, or will efforts to communicate merely arouse further public suspicions and lead to further consumer and citizen revolts?

Has the recent flourishing of public consultation exercises in S&T had identifiable influence on science-related policy? Will consensus conferences come to complement other types of expert-led science advice, or will they become regarded as costly exercises that merely broadly replicate the results of House of Lords inquiries? It may be too soon to say. However, there are some indications that the current interest in public dialogue may turn out to be a passing fancy. The POST Report on "Open Channels" was launched on the same day as a House of Commons S&T Committee Report on "The Scientific Advisory System", but at a separate event. One might infer that public consultation is fine but the decisionmaking process will remain firmly under the control of the policymakers on the basis of expert advice, as it has been "all along".

Meanwhile, plans to massively increase investment in Public Understanding of Science activities arouse suspicion that the public will be presented with a surfeit of new museums and exhibitions. Investment of money from the National Lottery must be matched by other sources of funding and revenue, and is not intended to cover operating costs. Many people are asking what fate will befall all these new science centres, which may well go the way of the Millennium Dome. Are they merely a sponge to soak up both public and private funds for the benefit of a relatively small (and invariably underestimated) segment of the British population, and would they in reality cater to the "converted" at the expense of the "masses"? Is the balance between conveying knowledge and sheer entertainment appropriate?

What of public funding for research, one of the primary objectives of the PUS Movement? The election of New Labour in 1997 did not result in any significant changes to the structure of the national budget. Science, and academia, continued to suffer cuts. Only in the budget year 2001-2002 has the 20-year decline in research and academic funding been reversed. There have been small increases throughout the system since, but actual receipts of government funding have not always matched the figures given in the budget statements, especially since the war in Iraq. Recent world economic conditions, combined with the political sensitivities associated with increasing taxation levels do not bode well for most Western governments primary sources of income, and the UK is no exception. The political will to increase funding for education and science may have recovered, but if the tax base does not recover, political backing may be of only “academic” interest, while real-life academics and researchers themselves see little change.

Public Understanding of Science in the UK has become an issue of national importance, and it has become embedded into British culture. But, somewhere along the line, science itself would appear to have been forgotten.

CHAPTER 3

Spaces where publics encounter “their” sciences

Ulrike Felt

With the third chapter of the report we enter the concrete settings in which the sciences encounter their publics in different ways.

We will start by elaborating a model that aims at structuring and understanding the multi-layered interactions that take place between different publics and sciences within the national contexts. This way we try to avoid simply describing a large number of singled out activities in this domain; such an approach should allow us to get a clearer picture of a particular national setting, of an overall “culture” of science communication, of innovative approaches and it can give us a possibility of analysis and comparison.

In the seven subchapters that will follow – media and Internet; museums and exhibitions; science weeks and festivals; universities/research institutions; public consultation and foresight exercises; non-governmental initiatives; governmental initiatives – we will then analyse different sets of actions in the domain of public understanding of science in detail. Each national setting is presented in its basic structures, in the central initiatives that have taken place, as well as in its specific approach. In each case, the six national perspectives are introduced by a chapter summarising and analysing similarities and differences between them.

Structuring the diversity of science–society interactions

Our basic starting assumption is that the science system has to be understood as embedded into society at large. Science and society are thus neither understood as homogeneous nor clearly separated entities, but are tied together in multiple ways. In that sense we could use the image of Jean-Marc Lévy-Leblond: “Science is not a large island separated from the mainland of culture, but a vast and scattered archipelago of islets, often farther apart from one another than from the continent.”[153] While science and technology shape the societies in which we live in a very important way, society also exerts a formative force on the development of science and technology.

However, while we stress this intertwined relation of science, technology and society one should not overlook that at the same time the technoscience system has managed to draw a border-line around itself, to define rules of access to this created space and to claim authority for the explanations of “the world” it produces. This boarder, however,

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[153] Lévy-Leblond, J.-M. (1992): About misunderstandings about misunderstandings, *Public Understanding of Science*, 1: 17-21.

is never a sharp, clear and stable one, but has rather to be seen as a grey zone in which different actors try to stabilize, question or negotiate it. In that sense it is always contingent and flexible.

Yet while this border exists and exerts its power, it does not become visible and is virtually never debated in the every-day context, as it is tacitly assumed that everybody implicitly knows how to distinguish science from non-science. However, as the American sociologist Thomas Gieryn[154] has pointed out convincingly, “boundary-work” – i.e. the negotiation of the border-line between science and society – „occurs as people contend for, legitimate, or challenge the cognitive authority of science.“ If there is interest from the part of scientific and/or societal actors in „claiming, expanding, protecting, monopolising, usurping, denying, or restricting the cognitive authority of science“ then pragmatic demarcations of science from non-science all of a sudden become very important. In such a perspective science is seen as a field „that acquires its authority precisely from and through episodic negotiations of its flexible and contextually contingent borders and territories.“ The meaning of science and of the science system and with it the authority and power it holds in explaining and modelling the world around us, remains thus rather vague and implicit until there is a need for definition and „its borders (get) drawn amidst context-bound negotiations over who and what is ‚scientific‘“.

Given the fact that the boundary of science is negotiated simultaneously in different places and by different actors all along the border, there never is one clear definition of science which can be regarded as stable over time. And even if the border would be unanimously accepted within the scientific field, this would not necessarily hold for the societal actors that find themselves “outside” the science system. This explains the importance of understanding the interaction processes that take place along this border: How does science manage to position itself in the societal field and what impact does this have on both the possibilities and the restrictions of its development?

Science communication – and we subsume a large variety of activities under this notion – is one privileged setting in which the meaning of science in society is negotiated. This is why it seems central to understand how these communications and interactions participate in the construction of the meaning of science.

In order to investigate the different places, settings, forms and actors which can be observed in the communication of science in a more structured way that goes beyond the mere enumeration of activities, we need to develop a better understanding of the basic logics that drive these processes.

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[154] See Gieryn, Thomas F. (1995) "Boundaries of Science". In Jasanoff, Sheila, Gerald E. Markle, James C. Petersen, Trevor Pinch (Ed.), *Handbook of Science and Techology Studies* Thousand Oaks/London/New Delhi: SAGE: 393-443. See also Gieryn, Thomas (1999): *Cultural Boundaries of Science: Credibility on the Line.* Chicago: University of Chicago Press.

One could achieve this by describing the different types of media (like print media, exhibitions, talks, brochures, web-pages, etc.) that are used in these interactions. In this perspective the possibilities and restrictions of these media would be in the focus of our description. Or we could focus on the single actors and then study the different ways that exist for them to shape their environment and to intervene in the attribution of meaning to science in the public sphere.

In this project a hybrid-way was taken. The model on the basis of which our description and analysis will be built, has at the centre the notion of "**spaces of encounter between science and publics**" and focuses on the different "**communication paradigms**" that define and largely structure these spaces. The introduction of the metaphor of "spaces of encounter" tries to subsume several characteristics, which we observed in the concrete settings. First the notion hints at the fact that communication of science and technology is always taking place in specific settings, with rather concrete barriers of entry and with an implicit or explicit limitation of access. These barriers of access can be understood in a physical sense, i.e. who goes to a museum, has access to internet, can afford to buy popular science journals etc., but can also be realised on a more symbolic level i.e. through the kind of language chosen to communicate science. Second, the notion of space stands for the multidimensionality of the interaction processes that take place as well as for their heterogeneity. Finally, the notion of spaces was used because the interactions between the science system and the publics do not take place in the same way all along the border. Rather, there are "agglomerations of interactions", which play a dominant role in these border-drawing processes. Needless to say that these agglomerations have fuzzy boarders and partly overlap with each other.

What specifies and differentiates these "dominant agglomerations"? We introduce the second notion here: the term **communication paradigm** which is used in parallel to Thomas Kuhn's notion of paradigm in science, meaning implicit values and aims behind the communication (why does a certain actor do communication and what is expected to be reached as a goal through this communication?), methods used to structure the interaction with the public (from different written genres, to talks, exhibits, etc.), questions that are put at the centre of the communication (what topics or features of science are put in the centre for these kinds of communications and interactions), tools applied (e.g. the use of metaphors, images, ….) as well as ways of acting (what roles are claimed by the communicators?) that are prevalent in a specific space. Each space, we argue, has a dominant communication paradigm, which is then developed by a variety of actors into a broad spectrum of rather different initiatives.

All the interactions to be found in the model which is presented in Figure 1 are taking place more or less at the same time, sometimes they overlap in the sense that the same groups of people are involved or addressed, sometimes they reinforce each other, at other moments they create a contradictory cacophony of voices which causes more confusion that creating anything like a clear picture.

Yet, besides these more structured interactions between sciences and publics every single member of society, be he/she a scientist, a science policy maker, or of whatever position or profession, holds experiences of a very personal kind with science and technology in the everyday context. Out of that develops what Jean-Marc Lévy-Leblond[155] describes as „practical (...) skills, without being integrated into an overall consistent theoretical frame – but (which) constitute a working knowledge and (...) belong to the general culture". He labelled this ensemble of culturally rooted know-how with regard to technoscientific issues „spontaneous technoscientific culture".In science and technology classes at school, when using technology throughout the everyday life, from the working context to the home, in meeting professional experts such as for example medical doctors etc., we always encounter science and technology in its various forms. In parallel people are involved in different phases of their lives in "collective educational experiences" which definitely shape their visions of science and technology. The term educational stands for a certain ideology of enlightenment and also has a strong normative connotation. As a consequence the position citizens take with regard to science and technology is always a result of various interactions and forces, different forms of knowledge and experiences that overlap. Thus it is not a simple MORE in communication or the use of ONE particular method or setting of communication which will manage to shift the public perception of and attitudes towards science and technology in a predictable way. This explains very nicely why in controversial situations information campaigns often do not yield the results expected by those who believe in them.

In the following we have differentiated five such spaces in which sciences and publics encounter. The distinction is based on the respective fundamental underlying paradigms of communication. Yet these categories should – as is the case for all classifications – be understood neither as clear-cut distinctions nor as the only way to structure the material. However we believe that the following categories will help us to get – beyond the description of the single events – an impression of the power distribution in this field of negotiation, we will see in which spaces most of the energy and finances are invested and we will be able to understand the different kinds of impact these spaces will have.

1. Space **explicitly devoted of science communication**:

Under this heading we summarise all sorts of institutionalized and semi-institutionalized forms of communicating science and technology, ranging from the classical media

[155] Lévy-Leblond, J.-M. (1992): op.cit. note 1:19.

(print, TV or radio), over science exhibitions and museums, to the internet and many more. The basic paradigm is that they understand themselves as diffusing scientific information and that they often measure their success through the readiness of people to read, visit or watch their products. They are platforms for others to present science while at the same time also being actors in forming the public image of science. They generally work on a market basis needing to “sell” science in the sense of making science communication a good, which can be positioned in the public sphere. The detailed logic behind these enterprises ranges as widely as do the different formats in which science is communicated.

Further it is important to differentiate this space into those initiatives that offer a direct contact with the publics (like museums, science weeks and festivals, etc.) and those where direct interaction is impossible because of the specific production and distribution processes (like printmedia or media). However it is important to say that, even though this process is interrupted, that does not mean that there are no feed-back loops implemented and that not at least some interaction does take place.

2. Spaces of **scientific knowledge production and diffusion**

The specificity of this second kind of space lies in the fact that scientific knowledge is not only diffused, but at the same time also produced there. Thus we move rather close to the epistemic core of science and technology in these activities. In that sense institutions and actors which belong to this field always have a double vocation, which sometimes causes an increasing blurring of the position they are speaking from.

The basic paradigm behind their communication activities is thus definitely guided by the wish to optimise the societal environment in which they have to work. By engaging with publics they hope to render their research visible, to demonstrate the societal value of the work accomplished, to show the attractiveness of science, to account for the public money spent and to legitimate themselves for getting further support. The strategies chosen, the time and energy invested from the side of these actors can thus be seen as aiming at improving their own conditions.

3. Space of **hybrid-actors**

This third space tries to regroup all those actors and initiatives which are not scientific institutions, but which explicitly aim at developing their own position and expertise with regard to technoscientific issues. We call them hybrid, because they can neither claim the label of being a scientific institution/actor, nor do they accept to be put in the passive role of being only informed about science. They are both rooted in the public sphere, but active in producing knowledge and know-how of relevance to technoscientific questions. Actors in this space try to break with the asymmetry between science and other forms of knowledge, to offer new, different and more interactive settings of communicating about science and technology and to develop alternative forms of expertise.

In fact it is interesting to state that in recent years more and more such institutions have been founded and they have become important players in certain national contexts. Examples of these institutions would be environmental organisations, consumer organisations, self-help movements in the medical domain, and other kinds of NGO's. Indeed the importance of their role has become clearly visible in recent controversies on scientific and technological issues. The knowledge they have gained over the years dealing with a specific issue and the wide practical experience they can draw from has allowed them to occupy this hybrid position between science and the public sphere. While speaking for a particular sector of the public, they can at the same time also claim to be sufficiently knowledgeable to question and /or stimulate scientific research. Cases like the GM food debate have shown very clearly how important this role has become.

4. Space where the **public meets professional expertise**

While the second space was looking at the scientific institutions, our focus here is on knowledge that is created in **professional settings** at the border-line between the scientific space and the public space. The medical profession is one example, but also numerous others, such as the chemical industry, could be mentioned here. The paradigm behind these kind of communication activities around technoscientific issues is clearly led by the idea that they should support the work in this professional area (i.e. through info campaigns in the health sector), should convince people of the know-how that is available there and should be used, and should help implement the authority for the position of these actors.

5. Science and technology policy arena

In the last space that should be considered the communication activities are mainly driven by the paradigms of policy-making, i.e. they are meant to explain, justify, support, or impose certain decisions that have been or are to be taken in the policy domain. Again some more fine-grained distinctions need to be made here. First there are more stably implemented settings such as participatory policy-making procedures (like the more established forms of participatory technology assessment) in which science and technology are negotiated. Very different functions and logics are to be observed in information campaigning linked to issues that have been put on the public or the political agenda (e.g. food labelling, issues around radiation thresholds, or even general science policy decisions). And finally moments of public controversies, where one hopes to convince the public of a particular position through the public positioning of particular kinds of scientific expertise, need to be considered.

Having made these distinctions in order to identify major approaches to the science-society interactions, we have to be aware that the borderlines between these categories are not as clear-cut as it might seem. In the case of the science centres and museums – to give an example – some would be rather situated as mainly being engaged in communication of scientific knowledge, while others would still have their identity rooted in the traditional concept of the museum, which saw the museum as both, a place of knowledge production as well as a place of knowledge dissemination. The borderlines between the categories also get blurred once certain actors start to play their roles in different spaces. And complexity rises if the explicit self-positioning of the actor tends to claim a more interactive component, while we as analysts would identify his/her activities mainly as top-down, unidirectional communication.

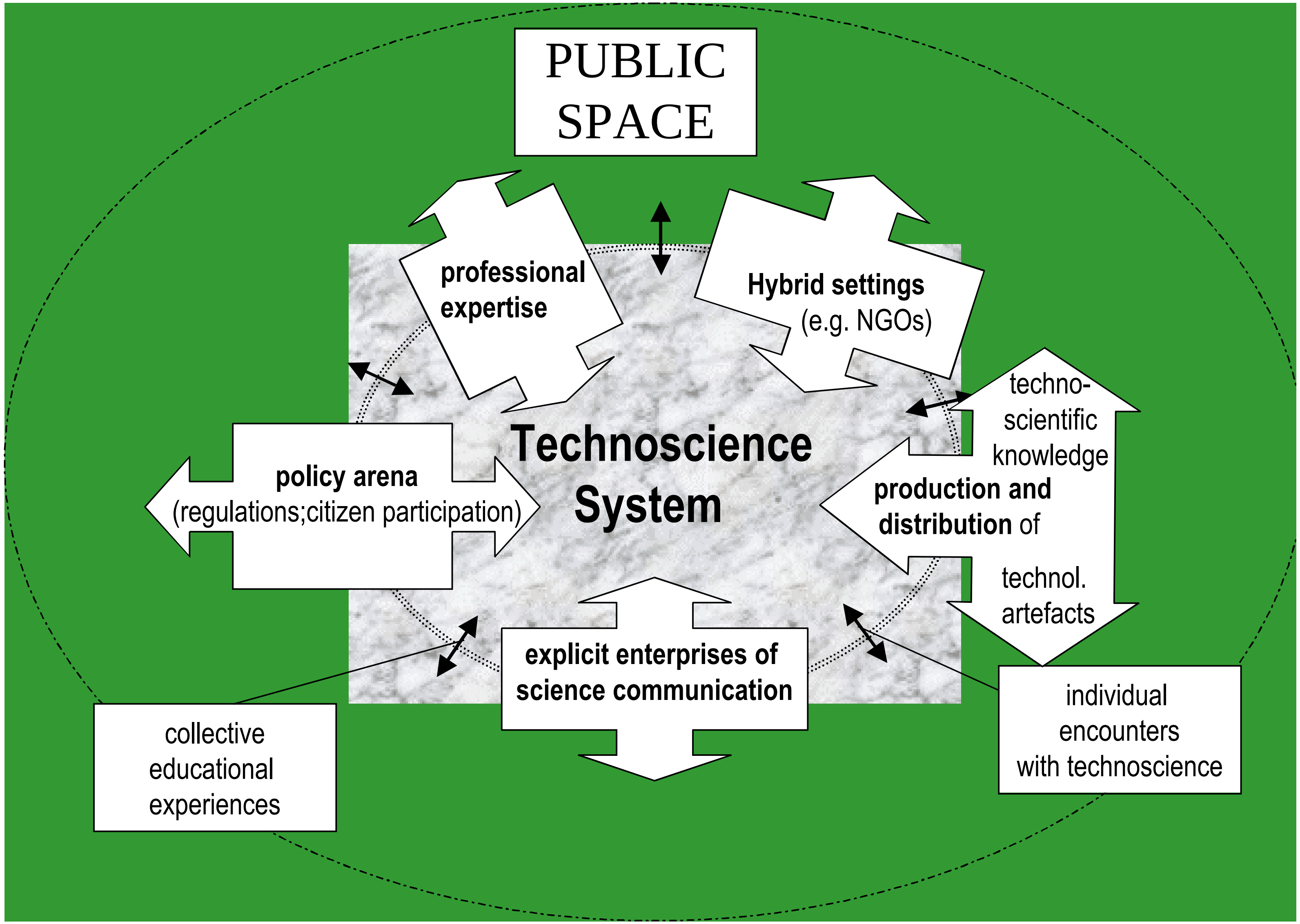

Figure 1: Spaces of interaction between the Technoscience System and the publics

Given the large diversity of possible places to observe how science and different publics interact, and given the limited resources available in a network, we decided to make choices and elaborate mainly on those spaces where we had know-how in the team.

In order to cover the first space, which is explicitly devoted to science and technology communication, we have described and analysed three different settings: **media** (including the internet), **museums and exhibitions** and **science weeks and festivals**. While the first group is a classical representative for this kind of space, museums and science weeks/festivals can partly also be seen as belonging to the second space. While we have already shortly explained the different developments in the sector of museums, important differences are also to be observed for the science weeks and festivals. In fact in many countries the main actors in science weeks are universities and thus they partly follow the communication logics that is more typical for the second type of space than it is for the first. Science festivals, however, have often a clearer market orientation.

For the second space we take a close look at the **universities** (and partly the governmental research institutions) and at their initiatives in science communication. Universities fulfil the classical characteristics of a place where knowledge is produced but which increasingly realises that it has to become more active in communicating the knowledge not only to its students, but far beyond that to society at large. We did not take into account the industrial actors as virtually no research on these actors exists so far. However it would definitively be rewarding to work on this question.

Space three, the hybrid-space, is covered through at least two bigger subchapters, one on **public consultation and foresight exercises** and a second which is concerned with the science communication aspects in the work of **NGOs and other non-governmental actors**. Here we will analyse the more interaction-oriented approaches on the one hand, while on the other hand also the efforts to develop alternative expertise will be highlighted. Part of the initiatives dealt with here are also initiated by organisations or groups representing a particular profession. The fourth space is thus also covered in these two above mentioned subchapters.

Finally the concrete **governmental initiatives** will be described and analysed, which typically fall into the space we labelled the “science and technology policy arena”.

CHAPTER 3.1.

Science, technology and the media in the six countries: Differences and common trends

Philippe Chavot, Anne Masseran

I. Science, technology and the media

The way the media are covering science and technology seems to be caught up in a somewhat paradoxical situation at the moment. On one hand, the media are regularly under attack, accused as they are – particularly by scientists and politicians – of betraying the contents or even the very purpose of scientific specialities. On the other hand, however, the government has never made so much effort to increase and improve the production of scientific "information". Two main characteristics have to be taken into account to understand why the media have crystallised the interests of both scientists and politicians, and how the public can figure out the way the media cover science and techniques. Indeed, the media represent a specific space in its own right, regulated by a professional logic and with its own set of rules. It is a non-specialised space in which science and techniques are presented in more or less the same way as other topics. It is also a kind of frontier, interacting with all other fields of activity related to scientific and technical popularisation (museums, institutions, universities, NGOs, etc).

Therefore the media is, in the first instance, a specific space. This fact bears several consequences. First of all, it affects the way science and techniques are covered – an area in itself subjected to general rules: i.e. the journalists' agendas, the investigation, possibly an intention to make science spectacular – modes of presentation used in the fields of science do not differ much from those used in the sphere of politics. When science and techniques are "on the agenda" of a news report or magazine the objective is rarely to undertake a popularisation action *per se*. In some cases the efficiency of some technique or medical approach is brought to the fore in order to demonstrate its interest to society. At other times the objective is to report on an innovation or some world first and, in this case, it is the spectacular aspect of the progress achieved in some field of knowledge that will constitute the entry point. The rivalry existing between scientists or laboratories may be treated as "affairs", as happened in France in the early 80s with the intense media cover given to the conflict between Gallo and Montagnier on the paternity of HIV. Finally, a mention of the existence of risks, concerns and controversies regularly comes out of editorial lines and non-specialised programmes: in this case the subject dealt with is social acceptability… The public's representations of the way science and techniques function is therefore directly built around other representations, referring to non-scientific subjects and depending on domains of knowledge far removed from scientific knowledge (politics, agriculture, food…): there is a permanent social re-contextualisation of scientific and technical information. This essential fact is often ignored by scientific and political institutions and it partially explains why the media can be so criticised – accused as it is of fostering mass panic, tarnishing the benevolent image of science and its actors: labelled as too alarmist, too simplifying, providing too much misinformation, … the media is then suspected of betraying "real science". In 1999-2000, the debate revolving around GMOs in Britain and the way the media were accused by scientists and by the Prime Minister is an excellent illustration of the distinction existing between "science distorted by the media" and "real science". Whether this issue, which seems to be of so much concern to the scientific community, is really bothering the general public is a question worth raising.

Indeed, non-specialised media (such as the press, radio, television,…) constitute the main access route for the public to reach science, these media being as they are: so integrated in our daily life that no specific step is necessary to access scientific information. Watching televised news, for example, is enough for the public to have access to scientific news without even choosing it. Yet Dorothy Nelkin suggests that for the public at large, science's "reality" *is* the reality proposed by the media[156]. However, one ought to question the degree of trust that the public grants to the media as a specific institution. On one hand, if we are to believe recent studies, the degree of trust is relatively low; on the other hand, it seems that the public perceives some media, like the radio, to be more trustworthy than others, particularly the press[157]. In this respect the "reception" of scientific news *via* the main non-specialised media, as well as their public apprehension, could be closer to defiance or even indifference, than to sheer interest.

Secondly, recent controversies revolving around technical-scientific developments (GMOs, mad cow disease, nuclear energy, etc) are turning the media into an actual public stage. In this respect, it is a space taken over by increasingly diversified categories of actors: politicians and scientists of course, but also NGOs, associations, unions, etc. Although they are meant to represent a "third power" exerting an influence on decision-makers and the public, the press, the radio and, above all, the television

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[156] NELKIN, D. (1987): Selling Science: How the Press Covers Science and Technology. (New York: Freeman and Co.).

[157] See L'opinion publique dans l'Union Européenne, Eurobaromètre report n°55, 2001. http://europa.eu.int/comm/public_opinion/archives/eb/eb55/

channels represent a major issue as it seems essential to have a presence on their stage to express opinions and to claim membership relation to an institution, etc. However, the media are far from being a passive scene: the various perspectives are re-worked upon as journalists are essential actors in the construction of the representations of science, particularly when public controversies arise.

Furthermore, the media do not represent a uniform ground. Indeed, they are made up of sub-elements, each having its own characteristics. Beside the generalist media, some non-specialised media (magazines, popularisation programmes, etc) seem to perpetuate the educational tradition of an enlightenment given to people already aware of science and technology. Such diversity is also clearly visible in the medium used (book, press, radio, television, electronic means) and in the purpose of the media and its products (specialised or not, didactic, informative, entertaining, etc). The manner in which a given media operates as an institution is also important: is it a private body or a public institution? What are the editorial lines? One should also identify the functions of media production: are the objectives to be mainly educational, entertaining, awareness-raising, critical? … (Note that these functions are often interwoven). It seems difficult to assimilate what goes on in the press with what happens on television, or what is said in a specialised television programme and in the news, without running the risk of becoming over-simplistic. We therefore propose in this introduction to consider only the main developments, transnational trends and national characteristics.

II. Current trends in the media cover given to science and techniques.

A – Transnational trends

Two transnational trends may be identified in the analysis of the media cover given to science and techniques in the various countries under consideration: on one hand the strength of traditional popularisation and, on the other hand, the increasing development in the scope of current affairs, of a debate surrounding scientific and technological progress. Both presentation modes coexist in all the countries examined, sometimes even overlapping. Thus the linear model of a transmission of "information", which seemed however to be a characteristic of popularisation, is still predominant in the way science and techniques are covered when they are related to current affairs.

1. Popularisation

The history of the media and that of popularisation have been interwoven for a long time. From the major French and English encyclopaedias of the 18th century, for example, all the way to the most recent developments of media spaces dedicated to scientific popularisation, it seems that a manner of continuity is enduring as regards the presentation and purpose of the way science is staged.

- Continuity in the manner contents are presented: each of the countries examined favours certain disciplines (natural history, astronomy,…) which have always been popularised before others. Indeed, the history of amateurism as well as an assumed “natural” interest of the general public towards animals tends to reinforce the idea that these disciplines are answering a kind of popular “curiosity” (even though this has never been defined) – and in this case, the increasing number of means (TV, radio and now multimedia) does not seem to be making a difference.
- Continuity in the purpose of popularisation: what these articles, books, programmes and CD-ROMs all have in common is the will to provide scientific explanations on themes related to natural history, the human body or the stars with the intention of educating the public. Thus each country favours educational programmes revolving around natural history. These are often well established from an early date, such as *Le jardin extraordinaire* in the Walloon area of Belgium, *Universum* in Austria, *Zooquest* in Britain, … Furthermore, it should be mentioned that a large proportion of these initiatives are aimed at family audiences.

Indeed this mode of presentation is perfectly adequate to cover non-controversial issues. The point is to shed light in a rather linear way, involving all knowledge producers with a view to perfect public education; we are in the presence of the master-pupil pattern. On the other hand, this causes a problem when, away from plant life, we turn to environmental issues, i.e. when there is a public controversy as to the legitimacy or the safety of scientific and technical developments. Furthermore, specialised journalists find it difficult to go beyond the linear model and to consider that, when it comes to controversial issues, science may be considered only as a reference amongst others and that it is, in itself, in the very midst of the debates (as the producer of a disputed innovation).

2. Science and current affairs.

In all the countries in the OPUS network, a strong and renewed interest in scientific and technical issues may be perceived through non-specialist media. Columns and programmes dedicated to science have increased. Also, in some countries, a specialised press which did not exist previously, or existed to a lesser extent, has appeared.

This development may be explained with two factors that may be considered to be linked. On one hand, since the beginning of the 1990s (or since the 80s for some nations), governmental initiatives aiming at improving the quality of the dissemination of scientific information have been on the increase. This support may take a variety of formats, for example, an award granted to the best journalists or popularising scientists in Austria and in France; a considerable financial support in Belgium; the development of "good practices" in Britain … On the other hand, public controversies revolving around scientific and technical developments have been considerably increasing in all countries since the middle of the 90s (even if the major controversies of the 70s and 80s seem to have brought about a split, for example, the contaminated blood controversy in France or, in Sweden, the referendum on nuclear energy). These affairs share the fact that they place techno-sciences on a hot seat and also that they are transnational by nature, the controversy on GMOs, for instance, affected virtually all European countries. In fact, science and technologies enter journalists' agendas and become current affairs. Indeed, this fact is carried to the extreme when science is on the agenda of the tabloid press: in this case, the sensational dimension is clearly a priority and the consequences may be serious for the public image of scientists and politicians. It is then important to differentiate between countries where this type of press is widely present, such as Austria and Britain and, to a lesser extent, Sweden. The power of the press becomes in these cases much stronger than when a "milder" press covers contested scientific innovations.

Even if it is difficult to prove that both dimensions are interacting, there is no alternative but to notice that political efforts aiming at improving and increasing actions to promote the public understanding of science occur in times of crisis. Yet although means are indeed deployed to "increase" the scientific awareness of Europeans, methods remain in general largely traditional. Indeed, what is aimed at is to provide the best possible scientific information to a given type of public but, in many cases, the objective is also to convince the public that innovations are justified. Furthermore, this type of media production is still widely based on the model of a deficiency which takes into account neither the pre-existing knowledge the public may have, nor the non-specialist nature of the media. Finally, interactivity is rarely appropriate: the media seem to be used by institutional bodies for their role in mass "broadcasting". This presupposes that (1) the public is homogenous and receptive and (2) the existence of a "passive mass" which is not in a position to discuss scientific and technological information.

However, despite these efforts and the strength of the deficiency model, science does not seem to be considered as the ultimate reference anymore. Indeed, the media, as a public space, is relatively open at times when controversies do arise: this is what seems to have been understood by dissident actors who are less respectful and more critical of science and technology. Thus, on the media stage the official voice of science is confronted with other forms of knowledge to which journalists sometimes grant a high level of legitimacy.

B – National characteristics

These transnational trends are balanced by the specific traditions and contexts of each country (which may even vary from one region to another) and these will influence the specific format of media production.

1. Traditions of scientific popularisation

The press and specialised publishers, programmes and even multimedia products dedicated to scientific popularisation have been partially formed by more or less ancient traditions. Within this framework, two groups of countries may be clearly identified.

On one hand, popularisation activities have, in certain countries, the benefit of having strong prestige. However, these very traditions are of a diverse nature. In Britain, for instance, the development of popularisation cannot be separated from the long-term relationship existing between amateurs and scientists; in France, there is a continuing spirit in line with the Age of Enlightenment and encyclopaedism. Furthermore, it may be mentioned that preferred means of communication are also variable: where in Britain the BBC has been able, as early as the 40s, to dedicate much airtime to popularisation (television and radio), in France however, this role is given to magazines, most of them long established such as *Science et Vie* (1913) or *Science et Avenir* (1947). Furthermore, popularisation publishing, which has a long tradition in this country, remains flourishing despite the problems experienced by the publishing market in general. It is therefore important, in addition to taking into account the history of science and popularisation, to understand the way the various media have developed.

On the other hand, an increasing development of popularisation publications and programmes may be observed recently. In Sweden, for example, the popularising press was absolutely booming in the 1980s and this may have been related to the fact that the issue of nuclear energy had entered the public debate. Considering the number of publications with a short enough life time, one could legitimately wonder if this market is all that large and if it answers a genuine demand. Similarly, in the Walloon and Flanders regions of Belgium, the main popularising publications have been established recently (*Bulletin Athena* in 1984 and *Mens* in 1992). These publications more readily welcome relatively plural perspectives (science/society issues, industries, …) than older publications do which, in France or in Britain, give priority to an approach focussed on the excellence of science and techniques. It is therefore essential to understand why integrating popularisation into modern media (specialised press, television, radio, multimedia) occurs in certain contexts earlier than

in others. Indeed, one could not understand the small output of popularising media in Portugal without taking into account the political history of this country.
A second factor comes into account when we consider the development of scientific popularisation. Larger countries with strong traditions develop their own products and import few programmes or publications. Indeed, the BBC, for example, even exports its products on the basis of its prestige. On the other hand, in Belgium, Austria or Portugal, home products remain scarce. Popularisation, in its various forms, is usually imported from "bigger" neighbouring countries (France and the Netherlands for Belgium, Germany for Austria). Thus a third of Walloon readers of popularising publications receive their information from French publications. Written media are not the only ones concerned as television programmes work, to a lesser extent, according to the same principle. This assessment brings us to moderate the idea of a strict contextual specificity of popularising activities in the field of science and technology. Indeed, it seems that on the strength of a long tradition ensuring both know-how and prestige, some countries have managed to adopt a position of exporters of media products whereas others remain, to a certain extent, dependent.

2. Contextual variations factors

Beside the weight of traditions and the history of science and media, several variation factors may be identified as influencing the way science and technologies are presented in the media.

- The structure of the media scene plays a predominant role. Thus in Austria, and to a lesser extent in Belgium, free to air hertzian television channels are the monopoly of the State. Admittedly, ORF1 and ORF2, for instance, do develop a few programmes dedicated to science and techniques but these remain, however, rare. Television viewers interested in such topics have to turn to private cable or satellite television channels. In other countries, a mixed system is implemented where a manner of balance is sought between the private and public sectors, both entities exerting an influence on each other. This mixed system goes back some length of time, Britain being a pioneer in the matter since, as early as the 1970s, the public sector was complemented by the private sector. Sweden and France followed the move in the 80s. Note, however, that in France it is the public sector who initiated the creation of a cultural channel where scientific education plays a major role: *la Cinquième* (renamed "France 5" in 2002), which in 2000 was dedicating 34% of its airtime to popularising science and technology. It is difficult to assess the influence of the public/private distribution of the science and techniques media cover but a number of questions are raised by this diversity. Are the programmes offered by specialised cable or satellite channels (such as *National Geographic,* *Planète*…) of a more innovating nature? Are editorial lines more likely to respect scientific agendas? Do commercial logics bring about an opening towards industry or applications? In view of competition, do public programmes tend to give priority to spectacular science in order to increase their audience?

- The countries' geopolitical situation represents, in itself, an element to be taken into account. Indeed, we can clearly see that "smaller countries" such as Austria or Belgium, are in a situation of relative dependency as regards media productions. On one hand, a linguistic community links them up to more powerful nations on the European arena and, on the other hand, it is often technically possible to pick up the channels of neighbouring countries. Such a factor may slow down the development of home productions.
- Finally, let us mention specific and structural difficulties which influence the format, contents and diversity of media productions such as the crisis of the press in Belgium and the dual geopolitical structure of this country, or the fact that in Portugal the media cover dedicated to science represents a belated concern influenced from the outset by various European experiences. In Austria, the low level of professionalism observed in scientific journalism is also an issue.

3. Natural and human sciences

The meaning given in the various countries to the notion of "science" seems to be affecting the contents of media productions. On one hand, in France, Portugal, French-speaking Belgium and Britain the word *Science* and *Sciencia* has a rather narrow definition, namely natural sciences and mathematics. On the other hand, in Sweden, Flanders and Austria words like *Wissenschaft*, *Vetenskap* or *Wetenschap* embrace a much wider meaning and include humanities and social sciences. These various definitions have an influence on the contents of popularisation: in Sweden, natural and human sciences are popularised in much the same way, without entering a hierarchy. In France or Portugal, however, a much wider media cover is given to natural sciences. In France, the only popularising publication which attempted from the outset to offer a "human science" perspective on natural sciences did not last very long. However, it should be mentioned that this distribution is not always as clear as may be assumed and, above all, it tends to become increasingly blurred.

Finally, the main actors should be identified, with their alliances in matters of media production relating to science and technologies. There again, several factors should be taken into account:

- the prestige and image the scientific community in general has in society: is this community involved in productions? On what basis? What is expected of it? Thus in Austria a better interaction between scientists and journalists is supposed to improve the quality of information (and remedy the problem of training scientific journalists);

- the prestige and image of the community of researchers specialised in natural sciences and those of researchers involved in human and social sciences. Sweden seems to be the only country where a symmetrical treatment is implemented in this respect;
- the relationship between the media and institutions producing scientific knowledge, in particular universities. In Austria, such a relationship has led to the establishment of a publication, *Heureka*, which proposes to integrate human and natural sciences with a view to discussing their issues.

III. The media facing the critics: challenges and institutional answers.

The main problem which runs through the media cover of science and technology finds an echo in all the countries under review, namely that the agendas of journalists, scientists, politicians or even the media's "new actors" such as NGOs and associations, seem irreconcilable. Where scientists are working on long-time events, journalists follow the rhythm of current events, scoops and "hot" topics. Both worlds, that of journalists and scientists, are obviously moving further apart.

This discrepancy generates a manner of tension which then translates into accusations, or even condemnations, against the world of media. This tension is all the stronger that controversies around scientific and technical developments are on the increase and the politicians making decisions should be in a position to take sides. In our opinion, the reconciliation of these agendas is a challenge to which the actors of scientific media coverage will be increasingly confronted, both at national level and, *a fortiori,* at European level.

Measures which have been implemented up to now in order to solve tensions remain very traditional, it could even be said that these solutions demonstrate the strength of the deficiency model which, this time, is applied to journalists:

- the objective is, by using training and exchanges, to educate journalists considered as "ignorant" of scientific facts, to assist them in understanding scientific theories and life in a laboratory;
- vice versa, communication techniques are taught to some scientists considered too "clumsy" in their approach. Furthermore, this type of measures is accompanied by the creation of communication cells turned to the media, in the public as much as in the private sector of scientific research;

- a complementary solution aims at designing and implementing guides of “good practices” in scientific journalism and to elaborate codes of ethics;
- decision-makers, journalists and scientists often feel that they are going to be in a position to take advantage of new information technologies, hoping that these will make communication easier within the journalists' community, between journalists and scientists and between institutions and the public. This solution, however, still seems to be somewhat remote as the challenge of adapting traditional media to NTIC will have to be addressed first, which is far from being done yet;
- finally, associations and clubs of scientific journalists are developing and being increasingly interlinked with the EUSJA network (European Union of the Societies of Science Journalists). One of the main objectives is to encourage professionals from various nations to share their experiences and facilitate the emergence of a genuine professional identity at transnational level.

The first three solutions under consideration are raising new problems. First of all, they seem to be built around assumptions which are rarely challenged, namely:
- the reason why journalists mistreat science, or even criticise certain scientific products, is due to the fact that they don't understand enough of it;
- it is assumed that scientists are not "cut" for communication;
- the way science is dealt with should necessarily be different from the way other fields are covered, such as politics, etc;

Secondly, these answers are hiding deep problems and what is at stake is of primary importance. Indeed, who are the actors who will decide of the criteria according to which a practice will be deemed to be "good"? They will come under the authority of which institutions? These issues have to be raised if one doesn't want to get lost in generalities and truisms. Scientists and journalists have specific skills which have to be integrated into the way the media cover science. However, does this call for the journalist to be trained in basic scientific knowledge in all fields? Beside the fact that this does not seem to be feasible, it may not even be desirable. Indeed, the closer scientific journalism gets to scientific contents, the higher the risk of seeing priority being given to this perspective, maybe at the expense of the citizen role played by the media.

Finally, one wonders if the tensions existing between different agendas and competencies should really be solved with training actions which seem to privilege the sole scientific approach. This is particularly relevant where topics are controversial. The media scene remains one of the spaces most open – relatively speaking – to an interaction between the various interpretations of issues related to the development of science and technology. Such wealth implies that the debate can revolve around issues that are not only scientific but which often become political, in the widest sense of this term. This being accepted, one has to acknowledge the fact that the journalist brings about a manner of complementary "proficiency" to the official scientific expertise.

Technoscience in the Austrian media landscape: Mass-production of public images of science and technology

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Introductory remarks

Before entering into the details of the Austrian media landscape, we would like to shortly reflect on the difficulty of conceptualising media spaces as national. While this problem holds for all the countries, it gains a particular weight in the case of smaller countries, where the same language is spoken as in the neighbouring bigger national settings. Indeed in recent decades – through developments like cable-TV, internet, etc., but also through accelerated newspaper distribution across European countries – the question of national territories cannot be posed anymore in the same way as before. People do not necessarily stick to their national information-sources, but draw on all kinds of international contexts. For Austria in particular Germany plays a rather dominant role, as there exists, partly shared cultural values, common histories and above all a common language.

It thus seems important to ask in how far this changes and redefines the concept of the "national" with regard to communication with wider publics about science and technology. Whereas a context of national production of activities, programs and sites is manageable, the context of their consumption becomes increasingly blurred, internationalised and difficult to seize. Foreign magazines and newspapers are bought, German and also foreign language TV and the world-wide web have entered Austrian homes. In particular, the latter shows a clear tendency to overcome language barriers by e.g. offering optional languages on web-sites which accentuates the described trends further. An important segment of Austrian population – in particular the younger generation – has a sufficient command of English language in order to make use of these multilingual offers.

Secondly it should be considered that the different actors in the field of media do not restrict themselves to using one type of communication medium: Print media for example maintain at the same time web-sites where they can permanently update the latest news and can offer a larger diversity of shorter as well as longer articles. Radio and TV stations offer next to the schedules and program outlines also introductions to oncoming radio and TV emissions on the web. This web presence in classical media like newspapers, TV or radio allows not only to establish an additional communication

channel with wider publics, but through the introduction of electronic discussion forums the lack of interaction with the consumers is partly compensated.
The chapter will cover print media, followed by electronic media (television, radio and internet as new medium of science communication) and will close by some reflections on science journalism in Austria.

1. Austrian print media and their science communication activities

In what follows we will clearly focused on the production and not on the reception side. For the latter we have virtually no qualitative information, which could give a refined picture on how Austrian citizens consume science information offered in the media.[158]
Further it should be stressed that the English term science is used in this part equivalent to the German notion "Wissenschaft" thus including all scientific disciplines and not only the "exact" sciences.

Newspapers

One of the special features of the Austrian media landscape is the quasi-monopoly of two actors, namely Mediaprint and News-Verlagsgruppe, the latter being nearly exclusively owned by the German holding Gruner+Jahr. This close relationship to Germany has however not only to be understood in terms of ownership, but Austrian magazines (mainly produced by the News Verlagsgruppe) are (and have also been in the past) partly modelled along German examples. This quasi-monopoly, however, also leads to a low level of competition between the different journals and to more mutual arrangements of the actors.
The way science and technology are covered in the newspapers spans a wide spectrum ranging from the newspapers which have regular science sections (sometimes even with different special foci), over papers where science only comes into focus when techno-scientific controversies with political impact are at stake[159], over those who give only occasional news about science, to those that focus on certain aspects of private life trying to give a partly alleged "scientific" treatment of the issue, such as health, wellness or social life[160].

[158] Most of what is pretended to be known about public understanding of science in Austria stems from Eurobarometer and other survey research. This learns us, however, very little about the more subtle mechanisms that are at work when people are confronted with technoscientific knowledge.
[159] Such instances are e.g. the legalisation of medical use of embryonic stem cells, the political conflict on the nuclear plant Temelin.
[160] Concrete examples are recommendations about the daily need of vitamins, news on the impact of dieting on cancer or "scientific findings" about heterosexual fidelity.

Table 1 shows the range of coverage by the different newspapers, we have taken into consideration from which one can get a hint on the potential impact they have on the science communication landscape as a whole.

Name of the daily newspaper	Range of coverage[161] %	Coverage in absolute numbers x 1000
National quality press		
Der Standard	5,7	383
Die Presse	5,3	361
Salzburger Nachrichten	4,5	301
Wiener Zeitung[162]		25
Regional press		
Kleine Zeitung	12,4	835
Oberösterreichische Nachrichten	5,3	355
Tiroler Tageszeitung	5,1	345
National press		
Der Kurier	11,1	748
Tabloid (nationally sold)		
Kronen Zeitung	43,4	2.930

Table 1: Austrian newspapers considered in this analysis (Data 2002)

The Austrian **daily quality press** with nation-wide distribution is represented by four newspapers: *Der Standard*[163], *Die Presse*[164], and the *Wiener Zeitung*[165] all of them published in Vienna as well as the *Salzburger Nachrichten*[166] which is published in the region of Salzburg.

The **coverage of science and technology has experienced a clear rise in this segment of newspapers** over the last few years, both in quantity and quality. What they all have in common is a designated section for science news, which is predominantly placed in the weekend-issues as well as separate pages one or two days a week with science reporting. Also, on the level of journalists writing for the

[161] See www.media-analyse.at/frmdata2002.html; the percentage given in the column “coverage” is calculated on the basis of having reached these people at least once. For details see http://www.media-analyse.at/frmdefinitionen.html

[162] For the *Wiener Zeitung* there doesn’t exist any data of coverage since this daily paper is not recorded by *“media-analyse”*. Thus the circulation, e.g. the number of copies printed, is indicated in the table. For comparison, the Standard has a circulation of about 69.000 copies.

[163] http://www.derstandard.at

[164] http://www.diepresse.at

[165] http://www.wienerzeitung.at

[166] http://www.salzburg.com

science sections there is a clear tendency towards professionalisation and specialisation.
Science and technology reporting by the quality press has a number of clear orientations: Topics are favoured that can be presented as "research milestones", like major awards and prizes, important international conferences or fundamentally new scientific discoveries. In particular those issues are underlined, that are supposed to link up with potential interests of the readership (e.g. medical discoveries in particular in the field of genetics, information and communication technologies as well as space research). Favourites are findings that are perceived as sensational breakthroughs and in which Austrian researchers were involved. Moreover commemoration of birth and death of prominent (Austrian) scientists trigger science reporting.
Der Standard has probably the densest science reporting in the Austrian quality press. Its science and education section started with a quarter of a page and tripled over the last few years. When *Der Standard* in 1999 asked its readers in an opinion poll about what field they would like to read more about, science ranged just after the classical domains of politics and economy and on an equal level with cultural events[167]. So far the “science page” is included in the "culture"-section where it first shared one page with the technology oriented "communication"-column two to three days a week. Now has become a whole page on its own. Sporadically a supplementary page with science reports sponsored by the *Fonds zur Förderung der wissenschaftlichen Forschung FWF (*Fund for the Advancement of Scientific Research) is edited. Additionally *Der Standard* has also a weekly supplement, the *Album*, where science and technology issues are treated in form of feuilletons. This corresponds to a trend also observable in the German context, namely that science and technology is discussed in more heterogeneous contexts, its social implications are questioned and ethical dimensions are reflected in a broader way. This explains also why controversial issues are often treated in the *Album.* A few times a year this newspaper also produces special so-called *Beilagen* (added issues) on education and universities.
The *Salzburger Nachrichten* prints daily science and technology news on one page titled with "Knowledge, Medicine, Environment" that is placed in the first bound of the newspaper. The weekend-issue supplies one extra page concerning "Science" and "Health". It is important to underline that *Salzburger Nachrichten* has a very long-standing tradition in high quality science reporting, well ahead of other newspapers in Austria and was for a while a privileged source when people wanted to get news about scientific developments from daily papers. The *Salzburger Nachrichten* however also plays an important role for the local universities as it offers the possibility to present the work of the university publicly through the co-operative production of the magazine of the Paris-Lordon University Salzburg which is then added to the journal 4 times a year.

[167] Media Analyse MA '99

Also *Die Presse* allocates pages to longer science reporting in its weekend supplement called "Spektrum", which also includes other topics. Additionally, one can find a one mid-week page treating "Education" and "Health". The space allocated to science was doubled over the last years.
Similarly the *Wiener Zeitung* offers a Friday-supplement "Extra", with a feuilleton-like section with essays, book reviews, cultural affairs, including alternating one page about "Astronomy" and "Science". Medical subjects are placed also in the "Society", "Magazine" and the "Today's life" section. There is also a "Research" section being published on Wednesday. Scientific topics appear quite regularly in varying sections throughout the paper. It is interesting to note, however, that the selection of topics is not so closely linked to the value of novelty the same extent as in other papers of the quality press.
Overall one can say that scientific journals like *Nature* and *Science* serve as reference journals for the quality press. Besides the regular science sections, techno-scientific aspects appear also in the political sections once there is a public controversy over such issues. There science is often represented in form of producing strategic expertise, decisive for problem-solving.
During recent years all the **quality newspapers have started to offer online versions** of their newspaper, all having science sections. Using new-media however does not only allow to increase the potential number of readers, but also facilitates quicker up-dating of information, permits the allocation of more space to news and offers the possibility of discussion forums. So far however the latter idea has not really worked out, as qualitative debates on issues regarding science and technology are still extremely rare.
With regard to the **regional newspapers**, the *Kleine Zeitung*[168], the regional newspaper with the most widespread readership, the *Oberösterreichische Nachrichten*[169] and the *Tiroler Tageszeitung* should be mentioned. The first provides two pages "Health special" on a Sunday insert called "Extra Blatt". In the second only short news about science are offered, usually placed in a small section taking up a quarter of a page on Saturdays, called "Science compact". The last shows clearly the more regional perspectives of science and technology and holds a good co-operation with the local university in Innsbruck. It publishes four times a year a special supplement dealing with university and research issues.
Somewhere **between the quality press and the tabloids** we find the second biggest newspaper in Austria with regards to the number of readers, namely the *Kurier*[170]. In contrary to the newspapers mentioned above, the *Kurier* has not a separate science and technology section. Although there is a debate about establishing one, scientific

[168] See on http://www.kleinezeitung.at
[169] See on http://www.nachrichten.at
[170] http://www.derkurier.at

topics appear irregularly and dispersed over the "News"-, "Life"- or "Business"-sections as well as in the Sunday special, where longer series on various topics – both from the natural sciences and the humanities – are published. More regular science reporting only can be observed during public controversies or in areas of broad public concern such as health care and alimentation.

The **tabloid sector** in Austria is more or less **monopolised by one single newspaper**: *Die Kronen Zeitung*[171] is the most read Austrian newspaper (see Table 1) and is, concerning coverage, allegedly the most successful paper in the world. In the print version science and technology are not featured regularly and find place only when it can be staged as of immediate relevance to peoples lives (cancer and other wide-spread diseases, genetically modified food, mad-cow disease) and where it contains a high level of newsworthiness (e.g. "The Killer-Potato" also known as genetically modified potatoes). In the online version there is – although hard to find on the site map of the *Kronen Zeitung* – a regular science section with about 10 science news articles. This newspaper is however of high interest – not for the quality of its science reporting – because of its capacity to influence public opinion in Austria also with regard to science and technology issues. Therefore in public controversies, the position of the tabloid is rather crucial. This has in the past become especially important when there are public or political decisions to be taken, as it happened in the GMO-debate in 1997[172].

Weekly Newspapers

Two weekly newspapers should be mentioned here, the *Falter*[173] with a relatively low range of coverage not exceeding 10% (1,3%[174] on a national scale) for the area of Vienna[175] (42.000 circulation). The *Falter* has no specially labelled section reporting science and technology news related topics, which are treated mainly in the political sections. **Six time a year** they produce, however, a **supplement** called *Heureka,*[176] dealing with more critical analyses of scientific practise, science policy, science/society issues and university. The authors are mainly social scientists being partly also from the Science and Technology Studies field and therefore trying to present science and technology in its social and societal contexts. Each issue has a thematic focus, e.g. Genetics, Science and Politics, Science and the Third Reich or Public Understanding of Science. The magazine does not only reach the Falter-readership, but is supposed to

171 http://www.krone.at

172 Weber, Stefan (1995) Nachrichtenkonstruktion im Boulevardmedium. Die Wirklichkeit der "Kronen Zeitung", Wien: Passagen. One could observe that this right-wing newspaper entered a coalition with the left-wing actor Global 2000 in order to fight the release of GMOs in Austria.

173 http://www.falter.at

174 http://www.media-analyse.at/frmdata2002.htm

175 This number is also due to the fact that the Falter provides a complete weekly schedule for cultural events, cinemas, theatres, concerts etc. and this being the incentive to buy this weekly paper.

176 http://www.fcc.at/heureka

be also distributed to university departments, the relevant ministries and other institutions[177].

The highest coverage of readership has *Die Ganze Woche* with 19,9%. While it has no science section, it is interesting to remark that in articles dealing with health and wellness issues, diets and physical training, alleged "scientific facts" are often used in order to push particular recommendations.

To sum up, one can say that the sector of weekly newspapers is not very active with regard to science and technology.

News Magazines

The segment of weekly news-magazines is mainly represented by *Profil*[178] (8,1% coverage[179]), *Format*[180] (5,5% coverage) and *News* (17,8% coverage)[181]. The first two magazines have a separate section on science and technology situated in the last quarter of the issue. They have in fact both, a regular page on science news and more extensive features of several pages if there are more controversial issues or hype-stories. In *Profil* the science section is combined with an IT-column and overall clearly technology dominated. *News* only reports on science if "hot issues" (e.g. BSE or the nuclear power plant Temelin in 2002) come up.

It certainly also holds, for Austrian media, that as soon as issues that are related to science and technology, allegedly concern the national or even international public, like in the cases of BSE, Temelin or climate change, science reporting makes its way into politics, business and recently also to the front pages.

Popular Science and Special Interest Magazines

There is, a very small number of Austrian popular science magazines that aim at presenting and analysing issues in the field of scientific and technological development. This is partly linked to the fact that there are a number of German popular science magazines (GEO, P.M. etc.) that are sold in Austria. Thus the potential market for new products of that kind is extremely small.

The only magazine that could be designated as a popular science magazine in a broader sense is the *Universum Magazin*[182], which appears 10 times a year (70.000 circulation), in parallel to the TV series with the same title. Being sponsored by the *Austrian National Science Foundation* (FWF) it features documentations to the

[177] It is sponsored by the Federal Ministry for Education, Science and Culture.
[178] http://www.profil.at/aktuell/index.html
[179] The figures given for the coverage are taken from http://www.media-analyse.at/frmdata2002.html
[180] http://www.news.at/format/ or directly http://www.format.at
[181] http://www.news.at/ via this site, Format as well as some other magazines can be accessed; not the least it gives one example of the high concentration of the Austrian news magazine industry.
[182] http://www.universum.co.at/

corresponding TV series (which is mainly on nature and animal life) but also on general issues of science, technology and nature. However the themes are selected according to the criteria of being non-conflictual and pleasure/aesthetic-oriented, this policy being reflected in the magazine's subtitle ”The most beautiful magazine of Austria”.

In the medical sector there are two magazines *Gesundheit* (Health) and *Gesünder Leben* (Healthier living) with a rather broad distribution. They do however not understand themselves as popular science magazines.

In addition to those there exist several magazines focusing on specific leisure activities that integrate also scientific knowledge directly linked to specific topics. Thus in the area of hunting, gardening, or domestic animals one finds science communication from the fields of zoology, ethology or veterinary science. Of course the audience is in those cases extremely selected.

An example of **magazines** with a **clear stakeholder orientation** (entrepreneurs, managers, engineers, scientists and students) is *Austria Innovativ* published six times a year (12 000 circulation). It cannot be bought issue by issue in book stores or bookstalls since it is distributed to selected consumers directly. It contains news from the – mainly Austrian – science and technology field with a clear focus on technological issues, presents new research projects and products, highlights their use and implementation, and regularly features articles on policy issues, sometimes also on the meaning of certain technologies for society at large.

When dealing with issues printed by small research institutes one should mention the example of *Soziale Technik. Journal für sozial- und umweltverträgliche Technikgestaltung* (Social Technology. Journal for the Shaping of Socially and Environmentally Sustainable Technology)[183]. It is issued by the IFZ[184] (Interuniversity Research Centre for Technology, Work and Culture) four times per year and has a circulation of 1500. The journal is divided into the sections "new biotechnology", "environment and energy", "women and technology", "information and communication technologies" and additionally hosts a guest-editorship where national and international research departments get the opportunity to present their work. The basic idea of the journal is to socially and politically contextualize S&T while at the same time advocating practical solutions and approaches. The publics addressed are also already quite specialised thus it is not available in the ordinary press shop.

2. Electronic Media in Austria and their role in science communication

[183] http://www.ifz.tu-graz.ac.at/sote/
[184] http://www.ifz.tu-graz.ac.at/

Television

Although formally the national broadcasting monopoly of the *Österreichischen Rundfunk ORF* (Austrian Broadcasting Corporation)[185] fell a few years ago, there is nationwide still only little competition when it comes to the Austrian news sector on TV and radio. The ORF still has the right to charge fees, and, despite the quasi-liberation of the market pretends to continue to fulfil its task of playing a central role in education and culture (*öffentlicher Bildungsauftrag*). At the same time it tries to adapt, especially in the entertainment field, to the new requirements emerging through competition with private channels that mainly broadcast from/in Germany. However one can definitely state, that features and series on science and technology are not perceived as attractive enough to a wider public, and thus this domain remains rather marginal in the overall program.[186]

Science popularisation produced for Austrian national TV (ORF 1 and 2) mainly consists of short breaking science news during the general news (which happens rather rarely), of the Friday night so-called "Future Magazine of the ORF" entitled *Modern Times,*[187] of a main evening nature oriented documentary series called *Universum*[188] and of a nearly one hour long late-evening broadcast called "Kreuz und Quer" (criss-cross). *Modern Times* aims at producing techno-science news in an entertaining way and claims promoting ”new developments and tendencies that will concern larger audiences”.[189] This is perceivable in style as well as in content, as the image of science produced is that of a problem solver. Recently, there is trend towards addressing more of Austrian science and technological issues in order to create a positive image of Austrian research and its positive societal and economic impact. Also, environmental and "sustainable" technologies are at the centre of interest. Every two weeks this broadcast is focused on health issues and technologies. Modern times has a strong internet presence with audio and video technology, it has already published two CD-Roms, the latest called "Planet Erde 2000". Both could be labelled as infotainment having roughly the same design, focusing on ”all important questions of the future at the end of the century”. These products are advertised on ORF TV, and it is important to note the mutually reinforcing nature of these activities within a quasi-monopolistic set-up as described above.

Universum is transmitted two times during the week in the main evening time slot at a quarter past 8 pm. The topics chosen come virtually exclusively from the domains nature observations and wildlife in the style of ”celebrating the beauty of nature”.[190] Science is thus represented in an extremely uncritical way using the image of science

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185 http://www.orf.at/
186 The TV series *Universum* is the only exception.
187 http://www.orf.via.at/modern.times/
188 see also the popular science journal mentioned above
189 See on http://kundendienst.orf.at/sendungsinfos/sendungsprofile/orf2/mt.html
190 See on http://kundendienst.orf.at/sendungsinfos/sendungsprofile/orf2/univdi.html

as ”solving secrets and enigmas of nature”. In their profile the producers state that this design aims at motivating people to preserve nature or how they call it "the miracles of the blue planet”. The editors clearly avoid any intrusion of environmental problems/catastrophies as having an all too negative connotation. The Tuesdays' series are mainly on topics in zoology and biology, the documentaries on Thursdays focus on the earth and the cosmos, that is on the geo-sciences and space sciences.
"Kreuz und Quer" touches on a large variety of issues regarding from humanities and social science issues over philosophical topics to science and technology.
Besides the two Austrian channels there exists broadcasting co-operation with 3sat and BR Alpha. BR Alpha is the educational channel of the Bavarian television. Each day of the week 3sat broadcasts – similar to *Modern Times* – a series about science, technology and medical issues at early evening-time, called *Nano*. Regarding the subjects there is a topical focus on new media and telecommunication. Once a week “HiTec features news from the technology sector. Since 2002 Alpha Austria broadcasts daily at 9 p.m. with a science focus on Mondays. These are partly retransmissions, partly special productions for Alpha Austria.
Overall one can say that there is little space attributed in the Austrian TV to science and if so, it is generally placed in the late evening slots, where the audience is rather limited. The only exception is *Universum*, where its nature orientation seems to make it suitable for a main evening programme.

National Austrian Radio

A more varied approach is taken by Austrian national radio. It is an important space of innovation in institutionalised communication channels of science and technology to wider publics. Apart from the classical radio transmissions it co-produces the new science internet portal maintained by the ORF and which has gone on-line in January 2001.
Until the privatisation of Austrian radio four years ago, there was no other national competitors in existance. With the liberalisation of radio broadcasting a number of new stations were created, all trying to compete in the domains of pop music, light entertainment, traffic news, etc. Thus the ORF Ö1 Programme remained more or less the only one broadcasting more high quality programmes featuring classical music and jazz, longer and specialised news programmes, and science features. While, in contrast to the TV programme, natural sciences and humanities/social sciences get approximately the same amount of time allocated there is still a slight bias towards natural science and technology.
There are about 30 programme points around scientific issues per week plus 25 shorter items in the regular broadcasts. The first category includes the *Radiokolleg*, a daily programme with the intention of education and information featuring three topics

throughout the week. Furthermore there is *Dimensionen. Die Welt der Wissenschaft* (Dimensions – The World of Science), a daily magazine of 30 minutes in the early evening giving an overview on a specific research topic from the sciences or humanities or discussing scientific products, their generation, their practical and sometimes societal implications. A slightly different approach towards science and the humanities has *Menschenbilder* (Images of the Human) that portrays specific professionals, mostly social scientists. Here, instead of scientific outcomes and research results, the biography of the portrayed scientist stands in the foreground. It is the only emission where scientists from a human perspective come into focus. Two regular broadcasts touch very shortly on science and nature: *Vom Leben der Natur* (The Living of Nature) where – mostly biological – scientists talk five minutes about animals or plants, the other five-minutes-long program is called *Wissen aktuell* (Knowledge up-to-date). Other specialised programmes are *Matrix*, a journal on computers on Sundays and *Von Tag zu Tag, der Radiodoktor* (Day by day, the radio doctor), a forum where the auditors can pose questions via telephone abut medical subjects. The *Salzburger Nachtstudio*, a programme mainly for a rather educated audience deals among others issues with philosophy and humanities, as also does *Diagonal, Radio für Zeitgenossen* (Diagonal, radio for contemporary people). Both present science and humanities in a feature-like way.
Another important field of activity of ORF radio (mainly its department of Science, Education and Society) is the organisation and documentation of symposia and so-called "Enqueten" (investigations into specialised subjects). The latter are mainly one-day fora where invited guests – mostly scientists – give talks that are then discussed by a broader audience. Past events have been for example on "Molecular medicine and the new human being" or "Austrian language in the Age of Information". Seen from the advertisement and the level of presentation and discussion it clearly aims at touching an interested, rather educated audience. Three times a year, international symposia usually lasting for two or three days are organised (e.g. "The Future of the Cities"; "The Future of Youth" and "The Future of Information"), where international experts in the field are invited to discuss these issues. These Symposia raise more specific questions and become, in part, fairly academic, but seem to attract a large part of the respective local professional communities around a certain topic of interest. These events are all documented on audio and video, the longer features of them are then broadcast on Ö1 and/or on TV summarising the argumentation and trying to make it accessible to a wider audience.

Internet as a new medium

The internet is becoming a more and more important tool in communication technology processing a twofold function: As a topic of the many discourses around modern science and technology but also as a forum and information resource for those discourses.

From being a rather specialized tool, the internet has meanwhile been ascribed as being a motor of societal democratisation, a shift that means an extreme change in functionality.[191] It is stated frequently that everyone who seeks for special information via the web is seen to be able to do so and likewise everybody would have the right to give whatever information about whatever topic onto his/her website to be read by the web-public. Therefore a widespread argumentation on the impact of the internet on society goes as follows: The web would offer possibilities to overcome societal, sexual and racial constraints and even the construction of virtual identities should allegedly now be possible. Especially, the opened and freed access to information resources would imply an emancipatory effect on the public. The openness or "freeing" is often seen as subversive in a political sense in the way that it will change the society at large. But, when actually looking into these media one gets the impression, that the expectations are by and large not really fulfilled. The discussion fora are a good example for that. So far they are widely offered, but not widely accepted and used by the public.

For our purpose it might be important to recollect the web as a medium where science and technology can be communicated under special conditions and in which way benefits are taken from it. The permanent stressing of the increasing meaning of the internet for modern life has presumably lead to a pressure on organisations, companies and institutions to design their web presence as well to create spaces (e.g. internet portals) on the web where they can optimally profit from the communication possibilities provided by the internet.

It must however be stated that still in Austria, the rate of people with internet facilities is (still) relatively low, especially home “connections”. Further the "medial internet-literacy", as one could call the competence of using the web, is not given among large parts of the population, depending on age, gender and class. In particular people with a higher educational level get easier access to the information present on the web. Furthermore it should also be taken into account that obtaining a piece information is not the same as acquiring knowledge which would then allow people to make decisions or set actions. The question of how people manage to convert the information they find on the web into applicable knowledge remains still open and unpredictable.

Nearly all the media, organisations and institutions mentioned in other chapters can also be accessed through the web. In addition, it is getting more and more common for Austrian quality newspapers to refer to web sites at the end of articles where further information about a topic, full versions of an interview or other hints can be found, not to mention their online-services with additional link-collections or the maintenance of

[191] Nowadays the internet is often equalised to the world-wide-web that we describe here since it is the primary information medium transported via the internet.

online-archives in order to make search possibilities available to externals. Similar tendencies can be observed for scientific institutions. A lot of communication and promotion is made via partly rather sophisticated and multi-functional home-pages – the electronic equivalent to the printed information folder – where also printed material can be down-loaded directly.
In our portrait of the Austrian internet and multimedia space concerning science-communication we have to be rather selective and will restrict ourselves to web pages whose function and aim is a PUS action. That means we exclude web pages whose aim is only to install the web presence of a PUS-actor as an "electronic information folder". The following part is thus dedicated to the internet as a forum for communicating science and technology.

Internet Portals

The ORF's internet site has installed an online-portal on science under the address http://www.science.orf.at, the *Science ORF Portal.* This project was mainly implemented by the science department of the ORF radio station, but includes now also the work of the ORF TV station's science department. To realise this project the ORF co-operated with a lately founded firm called "ORF.ON". It is in the Austrian context the largest initiative in this sector and thus shall be described in more detail here
The portal consists of three components:

1. Announcements and documentation of the events organised by the ORF like symposia and enquetes: The idea behind it is to have in the long run a full documentation of all past events as an archive. Also the abstracts of all talks and contributions are collected there, especially in advance to current events. Thus interested persons can inform themselves more thoroughly.
2. The science news channel maintained under the co-operation with the science departments of ORF radio station and TV station. Scientists have been largely invited to become authors of contributions to the news section.
3. The so-called "forum" which is designed as an interactive space between science and the public with discussion rooms about science beyond the usual practise of science reporting. Austrian natural scientists, social scientists and representatives from the humanities take on the position of ”hosts” and – ideally – independently produce input concerning their work, their academic life and the assumed implications of their work for society. They are free to design and appropriate this space, so that they can invite guests or involve their students in the discussion. The public is invited to comment and enter the discussion via emails that are published online. Also, the chosen group of scientists should be personally accessible for interested readers via email.

In the whole the *Science ORF Portal* has become a major information source with regard to science in Austria – and beyond –, as well as links connecting to the broad spectrum of institutions and initiatives concerned with science and technology. Since the launch of the portal roughly two years have passed. It is interesting to see that the forum idea has not been worked out as what it was initially proposed to be as most of the news are produced by the ORF journalists themselves and not by scientists. The same holds for the discussion discussion-fora which are not used in a very extensive way. If it comes to a debate, the quality is extremely varied which is also due to that the forum is not moderated.[192]

Moreover, there have been constructed several internet services that are exclusively online and can be classified as active attempts to contribute to a public understanding of science however all of them having a bias towards medical and health subjects. One is *surfmed*[193], which went online in late September 2000. It is a kind of health site – this style being very common in the US – run by a company that provides extensive information on health prevention, healthy diet, balancing life style, beauty, consultations for "love and life" and spiritual wellbeing going along with a hypertext structured handbook on all kinds of illnesses, their symptoms and treatments. Also, a medical practitioner specialised in the relevant field and practising geographically close to the patient can be chosen via the web site. A "surfmed-club" can be joined at a certain fee which gives access to the following services: individual health and diet plans, personal expert advise obtained electronically within 48 hours. Further health video tapes can be borrowed by members, and a personal email-service gives news and updates tailored to the member's fields of interest and medical conditions.

From a quite different perspective the *Gesundheitsinformationsnetz GIN (*Health Information Net)[194], is also an internet information resource on health, medicine and social welfare, maintained by the medical faculty of the University of Innsbruck in co-operation with the company *Prodata* that supported the web pages. It aims at providing information on and linking to a large amount of institutions in the Austrian health and social services structure. Different form the former the services of a health information site are designed from a medical professional perspective.

A third so-called Health Server is *Gesundes Leben* (Healthy Life)[195] with up-to-date health news as the organisers put it. It was founded by the *Fonds Gesundes Österreich* (Fund for Healthy Austria)[196] which is a platform for "supporting health" as it is stated on its website. The fund provides listings of projects and activities concerning health

[192] Bernhofer, Martin (2001): Cyberscience – Was macht die Wissenschaft im Internet?, Gegenworte “Digitalisierung der Wissenschaften .

[193] http://www.surfmed.at

[194] http://gin.uibk.ac.at/

[195] http://www.gesundesleben.at

[137] http://www.fgoe.org/

prevention, maintain a service for self-help-groups and launches requests for project-proposals in the health sector.
The Health Server *Gesundes Leben* which is one of the central activities of the association informs about health prevention, fitness, alimentation and healthy lifestyle as well as about illnesses and its therapies. Also, one can find an event calendar with dates of medical congresses and lectures, courses, spiritual seminars and sports workshops and also longer articles on special topics reaching from backbone exercises over the danger of tick stabs up to how to make an ecological compatible spring-cleaning. Spaces of interaction with the audience are given by an email service tailored to the interests of the user and a discussion forum. The former is a newsletter whose topics are personally chosen in advance by the user as being of interest and comprehends an event calendar and short news concerning health. The discussion forum provides an "open-accessed, democratic discussion platform" for users where they are invited to discuss on given topics such as depressions, diets or allergies. Comparing to *surfmed* which has a similar aim at providing a health information service, *Gesundes Leben* stresses the plurality of opinion that would inspire the discussion on contended issues as it is said on the website. At *surfmed* the interaction space does follow the common pattern of "patient asks– expert answers".

Multimedia Products

Regarding the multimedia product sector the market is also, like the print media market, dominated by foreign companies, mostly German and English-speaking products are offered. A mentionable exception are some CD-Rom's by the ORF that are for sale. The already mentioned TV emission *Modern Times* published both, the first one, *"The Modern Times CD-ROM"* in 1997, was based on contents of their regular emissions; the latest one being called "*Planet Erde 2000*" (Planet Earth) is a guided tour throughout the new millennium, its "challenges of science" and its "most spectacular missions of research". Both contain interactive applications where the user "could verify his knowledge about the future"[197]. The design is a composition of educational and entertaining elements, "infotainment" if one wants to put it in buzzwords.

3. Some reflections on Austrian science journalism

If one wants to understand the relation of science and media in Austria, it is quite revealing to look at the situation of professionalisation of science journalism and of other science mediators. Indeed for quite a long time there were no science journalists

[197] All citations from http://www.orf.via.at/modern.times/magazin/ausgaben/archiv/mt118.html

in the strict sense, instead journalists covered among other issues also science and technology. Thus this topic was seen as of minor importance and could be treated for many years only on a spot basis.

Despite this more marginal role played by science journalism there existed a Club of Austrian Education and Science Journalists, founded in 1971, which is member of EUSJA, the European Union of the Societies of the Science Journalists, since 1973. In 1991, it initiated the Central European Association for Science Journalism with the members Austria, Hungary, Slovakia and Slovenia.

Another indicator for this lack of importance attached to science journalism is the fact that the Austrian programme that counts as internationally accredited and is described as an all-round training for future journalists[198], offered no special focus on science journalism. (It is organised by the Danube-University in Krems and its International Centre for Journalism.) No other professional school for science journalism or an academic education in this domain existed in Austria until recently.[199]

Thus most science journalists in Austria come from the disciplines or fields they eventually write about and have usually acquired their skills "learning by doing", i.e. while already working in the media field. It means however also that there is neither debate about common standards in science journalism nor is there any corporate identity developed in this area.

Things started to change during the last years, as the need for specialised science communicators was gradually perceived as crucial. A first such training course in science communication started – largely funded by public money – in autumn 2002, its prolongation for another year is still unclear by the time this report was written.[200]

Finally, it should be mentioned that efforts are made to advance quality in science journalism by the Ministry of Education, Science and Culture. They award a biannual State Prize for Science Journalism to individuals who "take up issues of science and research in a generally comprehensible and competent way to raise and deepen the interest in and acceptance of science and research among the public".[201]

Summary and general observations

- The situation of media is in many ways rather curious in the Austrian context: quasi-monopoly of two media groups; TV and partly radio there is still in a situation of quasi state-monopoly; among the daily newspapers one tabloid holds a quasi-monopoly on mobilizing a broader public on controversial scientific or technological

[198] http://www.donau-uni.ac.at/journalismus/

[199] Hömberg, Walter (1990) Das verspätete Ressort. Die Situation des Wissenschaftsjournalismus, Konstanz: Universitätsverlag

[200] http://www.scimedia.at/

[201] Ministry for Education, Science and Culture

issues; there is a strong influence of the German market of popular science on Austrian productions.

- Regular reporting on science and technology in Austrian media has only become stable and established during the last decade. This is extremely late compared to other European countries and hints at the difficult situation of science and technology in Austrian Society.
- During the past years actors in this domain have clearly diversified the channels of simultaneous communication on science and technology trying to create through this higher visibility and synergy effects been the different actions taken. (e.g. radio makes an internet portal; TV series are made in parallel to a popular science journal; newspapers have web-pages and organize discussion events)
- Although there are professional organizations for science journalists, there is still no clear professional identity – it was only during 2002/03 that the first academic training course for science journalists was offered, this being only in a pilot phase.
- There is very little critical science reporting dealing also with the societal impact of science and technology. This happens only in cases of conflict where often the degree of polarization does not allow a productive critical debate.
- There is still in many cases public sponsoring necessary to allow for activities in this domain (e.g. the journal *Heureka*, the academic training course for science journalists, science pages in magazines and newspapers).
- From the point of view of themes treated in these media health issues, biomedicine and genetic engineering, more high-tech as well as environmental topics have definitely become the central subjects of science communication.

Science and the media in Belgium: uphill from the hollow of the wave

Gerard Valenduc, Patricia Vendramin

1. Background

In the mid 90s, the presence of science in the media was in the hollow of the wave: there was more TV broadcasts, and there was minimal representation in the press. The general context of re-investment of the regional authorities in science communication, already described when dealing with science centres and universities, had a positive impact on the position of science in the media. Recent events such as the GMO controversy, the dioxin crisis in spring 1999, the ESB crisis, etc., also contributed to an increase in the supply and demand of scientific information for the general public.

In view of the media, the linguistic division of the country is obvious and any item has a twofold aspect. Some general features of the Belgian media, which must be taken into consideration, are:

- The small size of respective Flemish and Walloon audiences and market shares (about 6 million / 4 million inhabitants) makes "national" publishing activities slightly profitable in specialised areas such as PUST. Dutch and French publications and TV-programmes are widespread in Belgium not only for cultural reasons, but for market reasons as well.
- The Belgian press especially the daily newspapers were subjected to a profound restructuring process at the end of the 90s: concentration of press groups, disappearance of newspapers, re-looking of newspapers and decreasing readership (mainly on the French-speaking side). At present, there is a crisis of readership and financial survival. In this context, journalism is also threatened. There is an increasing proportion of free-lance journalists, in other words, majority of the Journalists involved in science communication are free-lance.

2. Science at the TV

French-speaking side

The French-speaking public service television channel RTBF, decided in 1998 to resume a 52-minute monthly science programme, entitled "Matière grise" (Grey matter), broadcasted on Thursday evening (around 21:30) on RTBF1. This initiative

was positively acknowledged, since RTBF was often criticised for having left off scientific culture. The first season's audience ratings were considered a success by the management of RTBF. The budget allocated by RTBF is € 600 000 per year; since 1999, there has been complementary sponsoring from the Walloon Ministry for Research (DGTRE) and from industry (Siemens and the federation of chemical industries). The influence of sponsors is quite visible in the "brief news" section at the end of the programme, which always contains news from the chemical and electronic industries, and about the activities supported by DGTRE. "Matière grise" is carried out by a team of two full-time journalists whose main objective is to produce "a magazine that lets you reflect without thinking about it", and aims at "giving a dynamic and young image of research and the researchers, with an emphasis on Belgian researchers"[202].
The monthly health magazine "Pulsations" is somewhat older (1994) and has got a more established audience. It is realised by one full-time and two-part -time journalist, (and a specific technical team. It is broadcasted in the same time slot as "Matière grise". Both magazines broadcast again on RTBF2, on Tuesday at evening prime time. The appeal of both programmes allows for the enhancing of the team of scientific journalists and correspondents and the production of frequent notices to be included in radio and TV news.
On RTBF's web site, there is an extended section on "science and technology", coordinated by an "electronic science journalist"[203]. This web page contains all the texts of the notices written by science journalists for any radio or TV news; most of the notices are linked with a longer on-line article, containing references and links with other web sites. The coordinator of these web pages intends to develop a real "on-line science journal", as an aspect of the RTBF policy to implement on-line information services.
RTBF also broadcasts the French series "C'est pas sorcier", which has been produced by France 3 since the autumn of 2000. Sequences of "C'est pas sorcier" are integrated once a week in the children's programmes "Ici Blabla", during the evening prime time for children.
Apart from these programmes, which are explicitly considered as science communication by RTBF itself, there are other programmes that can be partially related to science and technology:

- The weekly TV-broadcast "Cyber-café", which is simultaneously broadcasted on Saturday night on RTBF2 and on the Internet (together with an on-line forum), and the daily radio notice "Multimedia" at 8:40 a.m. on the first radio channel.

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[202] Lits M., Rony G., Verhaegen P., *Programmes à caractère scientifique à la télévision : diffusion et perception*, Rapport SSTC/DWTC, Brussels, March 2001.
[203] http://www.rfbf.be. Select "science and technology" from the home page.
http://www.rtbf.be/matieregrise. Contains summaries, bibliographical references and archives of the programmes.

- The bi-monthly magazine “Autant savoir”, produced by the service of general and political information, often deals with topical subjects related to scientific or technological issues: environmental protection, technological risks, problems of public health and food security, etc.
- The weekly magazine “Le jardin extraordinaire” (Wonderful garden) is one of the most famous and ancient TV-magazines, broadcasted by RTBF1 on Sunday evening, after the news. It is not only a programme on animals, but also one that pursues explicit educative purposes and supports campaigns for environmental protection and sustainable development. Scientists are often invited to comment on the images (coming from RTBF’s own productions and from programmes bought abroad). The audience on Sunday at prime time is very high.

The concurrent private TV-chain RTL-TVi also introduced a new weekly science programme, entitled “Tout s’explique” (All can be explained), co-produced with the French channel M6 in 1999. It is a short programme (20 minutes), broadcasted each Thursday at evening prime time (19:35). Unlike RTBF programmes, it is made of short notices (eight themes of between 1 to 2 minutes each), based on images bought externally with an in-house commentary. There is no own production. The team is comprised of two full-time and one free-lance journalist. Live interviews featuring scientists are rare and very brief. The programme uses “spectacular or fascinating images and news, aiming at create astonishing effects for the viewers”[204].
As 95 % of Belgian households are connected to cable-TV and French channel audience is very high in Belgium, the French-speaking TV-viewers now have access to a wide range of scientific programmes of RTBF, RTL-TVi, FR2, FR3, TF1 and TV5 (the French-speaking satellite channel). There is however no consolidated data about the audience of scientific broadcasts among the Belgian population for any of the programmes.

Dutch-speaking side

Within the framework of the Action plan for science information[205], the production and diffusion of three series of TV-broadcasts is supported by the Flemish government:

- Enter 21 is a series of short programmes (7 minutes) prepared for the network of local cable-TV in Flanders. It relates to the impacts of technological innovation on everyday life: telecommunication, transport, energy, materials, production processes, biotechnology and medical technology. An evaluation survey was ordered by the Action plan after the first round of broadcasting, in

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[204] Lits M. & al., op.cit.
[205] http://www.innovatie.vlaanderen.be/knap

order to assess the impact on the attitude of the Flemish population towards technology and innovation[206].

- Curieuzeneuze (Curious nose) is a popular science programme for children, devised and broadcasted by VRT2 on Saturday mornings, from September to December and from March to May. Each programme is co- presented by the journalist and a school pupil aged between 10 and 12, with the rest of the class participating.
- Overleven is a series of 33 documentary films, of which 26 are produced by VRT2 and the rest bought externally. Broadcast started in October 2000, on Sunday evening at 21:00. They are in form of a story of what transpires when a player is confronted with scientific or technological accomplishments in everyday life.

As in Wallonia, 95% of the households are connected to cable-TV and receive Dutch, German, French and English channels, but there is no consolidated evaluation of the audience.

3. Science in the press

Besides obvious “cyber” or “multimedia” pages in all newspapers, several newspapers have recently enhanced their coverage of science and technology issues, notably the Flemish daily newspapers De Standaard and De Morgen, and the weekly magazine Knack, where there is an appointed science journalist, responsible for a regular science column. The weekly magazine “Le Vif / L’Express” commenced an editorial partnership with the French science journal “La Recherche” in January 2001.
Except for the specific cases of Athena and Mens, supported by regional authorities (see below), there is no science periodical published in Belgium, as the editorial market is probably too slight. All the French’ Dutch and some English science magazines are however available in bookstores and kiosks

The case of “Bulletin Athena”

Athena is a 48-page monthly magazine (ten issues a year), currently edited by the Walloon Ministry for research and technology. The bulletin was created in 1984 by the first regional government, as a quarterly information support for a promotional campaign of technological innovation in the region. The free-lance journalist who started the first issue in 1984 is now the editor of the bulletin working within the regional

[206] Sofres-Dimarso, *Enter 21 : bekendheid, bereik, evaluatie en impact*, Actieplan Wetenschapsinformatie, 2002.

administration, and the regularity of publication became monthly at the beginning of the eighties. The aspect of “promotion of regional technology” is still present in the bulletin, but the purposes have evolved. The bulletin also deals with general scientific subjects and regularly includes articles on science & society issues. It also includes bibliographical notes, accounts of scientific events, etc. Nowadays, the development of scientific culture is presented as one of the key purposes of the bulletin.

Subscription to the Bulletin Athena is free and there are currently about 33 000 subscribers. At regional scale, it is a very extensive distribution, as high as that of many newspapers. As there are many institutional subscribers (libraries, schools, documentation centres, etc.), the estimated cumulated readership is about 50 000 readers.

In 1997, the editorial board of Athena carried out a survey among the subscribers, in order to characterise the journal’s readers. The average age of the readers is 43.5 years; 25% are less than 30 years old, 20% between 31 and 40, 25 % between 41 and 50. The readership is composed of employees (19%), professionals and executives (18% upper level, 14% middle management), and teachers (14%). 68% of them have high school degrees. The main motivations of the readers are the improvement of their scientific culture (70%), the need for information on new technology (65%), the enrichment of their professional documentation (26%, mainly teachers and students). The reading ratio is relatively high: 38% of the readers read more than a half of the pages. The average satisfaction of the readers is rated 8/10.

The Bulletin Athena is a long-standing initiative of the Walloon public authorities, combining the promotion of scientific culture and a shop-window for regional scientific and technological activities. The financial investment of the Region is relatively low and the results are fruitful.

The case of Mens

In the Flemish Region, the quarterly magazine Mens (Milieu, Educatie, Natuur en Samenleving – Environment, education, nature and society) is an initiative of the Flemish association of biologists, which started in 1992 and acquired a broader scope. Mens is now dealing with all issues related to sustainable development, biotechnology, food security, mobility and transport, environmental management and the human dimension of ecosystems. It is defined as “interdisciplinary, inter-university, independent and in language understood by the people”. The University of Antwerp, the Flemish regional administration for research and two Belgian chemical enterprises, sponsor Mens. The editorial board however are at pains to ensure independence from sponsors and has an “ombudsman” services for readers who complain of lack of objectivity or balance in controversies. Mens mainly publishes thematic issues, of which summaries can be downloaded from the Internet[207].

4. Internet

The role of the Internet as a public space, open to scientific culture and science communication, seems rather obvious, but there are not yet any available studies on the various uses of the Internet to this purpose. All science centres, universities, administrations and associations concerned with public awareness on S&T are now running their own web sites. Relevant web sites are systematically quoted as footnotes in the other "spaces" papers.

The purpose of this paper however is not to make an exhaustive directory of PUST Belgian web sites. The first section of the paper draws a typology of the uses of Internet in the PUST area. The second section summarises basic data on public access to Internet, in order to give a picture of the potential audience of this new information and communication means.

4.1. Various uses of the Internet in the area of PUST

a) Internet as a new media

The uses of the Internet as a new electronic media consist mainly of the diffusion of information and publications available to the general public:

- Information: programmes of activities and practical information on science centres, university events, and associations for the popularisation of science are currently on the web.
- Publications: electronic versions and/or printable versions of booklets, articles, journals, didactical tools, teaching kits, etc. The teaching tools produced in the framework of the Flemish action plan "Wetenschap maakt knap" or by the Walloon PASS are available to download on-line. An electronic version of the issues of the monthly journal Athéna since 1998 is also available on-line, from the URL (http://athena.wallonie.be).
- Portals: many sites include a section on selected links, allowing for browsing to other sites in Belgium or at the international level. Both regional administrations AWI and DGTRE have extended portals (http://www.innovatie.vlaanderen.be; http://mrw.wallonie.be/dgtre), as well as the web site of SSTC-DWTC for the youth (http://www.belspo.be/young). The web site of DGTRE provides easy

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[207] http://www.2mens.com

access to the French and Canadian web magazines Infoscience and Cyberssciences.

The Internet may be a complementary tool to other media such as science journals or TV-programmes. For instance, the web site of the public French-speaking television RTBF not only contains web information related to the programme “Matière grise”, but also a specific section on science and technology, directly accessible from the home page, which gathers and comments on S&T items from the news and other programmes (http://www.rtbf.be).

In the Flemish part of the country, there is an on-line science journal titled “InterAxis” which was created in 1997 by a non-profit association of professors, researchers and teachers (http://www.interaxis.org). InterAxis is designed as an interdisciplinary and popular science journal with the aim of “bringing science to human scale”. This electronic journal publishes thematic issues, of which the themes are planned and announced on the web by the editorial board. It operates like other science journals, with reviewers, editorial guidelines, etc. Recent themes include natural sciences, technology, social sciences and humanities.

b) Internet as an interactive experimental space

Some web sites propose interactive experimental spaces, with simulated science experiments or science games, for instance on the web sites of the science centres PASS (http://www.pass.be) and Technopolis (http://www.technopolis.be), where on-line experiments are mainly designed to attract visitors. Interactive visits are also proposed by most of the science centres.

c) Internet as a forum

There are however very few well-known initiatives using the Internet as a forum for the organisation of public debates on science and technology, although many socio-political NGOs have a forum section on their web site (e.g. Greenpeace Belgium). The only significant experiment was carried out by SSTC and the Museum of Natural Sciences in 2001, using the opportunity of an exhibition on GMOs in the food chain (“Gènes au menu”) to organise an Internet debate on this topic during the exhibition.

4.2. Public access to the Internet in Belgium

The potential audience of the use of the Internet as a means of the diffusing of scientific culture depends on the level of adoption of Internet in society. Most recent survey data (end 2001) involve the Walloon region and are published by the Walloon agency for telecommunications. About 38% of Walloon households have a home computer and 36% of the population above 15 years regularly or occasionally use the Internet, at home, at work or at school. Gender imbalances remain important: about 42% of men are regular or occasional users, as opposed to 29% of women. Correlation with age is obvious: 50% of the 15-29 years are regular Internet users (at least four times a week), against 25% of the 30-44 years and 15% of the 45-59 years ([208]).

The survey also asks what kind of on-line information people are looking for. S&T is of course not specifically addressed, but “cultural information”, which is a much wider topic is. This item ranks second in the private sphere (31% of regular Internet users) and third in the professional sphere (28%). There is no significant difference in gender or age.

In comparison to other countries, the use of the Internet in Belgium is somewhat lower than in Nordic countries, the Netherlands and the UK, but higher than in larger countries like France, Germany, Italy and Spain.

As a conclusion: the use of the Internet as a media is no longer limited to the intellectual elite, but the cost of equipment is still much lower than that of television.

5. Concluding remarks

The description of initiatives undertaken in Belgium gives a rather incomplete picture of the presence of science in the media that are available for the Belgian population. The market of science-related media (TV-programmes, magazines and journals) is quite international and highly segmented by the languages. For instance: in a survey conducted by FTU in 1995 among the Walloon population, one third of the respondents said that their information on science and technology came from newspapers and magazines published in France.

The lack of studies of the impact of science-related press is still not as good as that of science-related TV-programmes. Yet in 2001, the report realised for the Federal science policy office (SSTC/DWTC) concluded “Data on the socio-economic environment of science-related media is significantly lacking. (…) Extended data collection and processing, and discussion of the results with scientists and journalists, should allow for a better understanding of the issues of science popularisation, its limits and weaknesses, in order to implement a coherent project, based on exhaustive knowledge”[209].

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[208] Delacharlerie A., Usages des TIC par les citoyens wallons : analyse détaillée des résultats de l’enquête 2001, AWT, Namur, avril 2002 (http://www.awt.be)

[209] Lits M. & al., op.cit., part III, p. 25.

French media: Introducing science to everyday-life

Philippe Chavot, Anne Masseran
the part on the internet was written by **Cathrine Roth**

A – Introduction

In 1995, the *Comité National d'Ethique* issued an opinion on ethical issues raised by the transmission of scientific information related to biological and medical research (*Avis sur les questions éthiques posées par la transmission de l'information scientifique relative à la recherche biologique et médicale*)[210]. This opinion accounted for significant transformations in scientific journalism from the mid-1980s. First of all, the number of scientific columns in press and TV news significantly increased. Secondly, scientific journalists act more and more as experts with regard to scientific development. Science - like politics or economics - has become a field of investigation for journalists. Faced with this mutation, the ethics committee aimed at a new regulation of journalists' practices. Hence, they call for journalistic ethics when issues such as public health are raised and for a better management of press relations by institutions.

In some ways, this opinion aimed also at protecting science against investigative journalism as, since the 1980s, it has deeply affected the public perception of science and technology. Indeed, scientific and technological developments are increasingly debated in public – particularly issues related to health or the environment. In this context, popularisation programmes have multiplied on TV and radio; the press also integrates this move with the creation of new popularisation magazines and the multiplication of pages devoted to science in the general press.

It is true that the media brought into the public arena problems that are related to scientific and technological developments (contaminated blood, organs trafficking, asbestos, GMOs...). In addition, activists have fought to make themes related to health or daily life appear in the media: this has led to the multiplication of programmes such as *Téléthon*, *Sidaction*, *La minute du consommateur*. But important changes have also taken place in practices related to scientific information. Many scientific institutions have now set up their own press relation services, which control information broadcasting. In addition, many years ago, the *Association des journalistes scientifiques de la presse d'information* (AJSPI, Society of scientific press journalists)

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[210] CNE, "Avis sur les questions éthiques posées par la transmission de l'information scientifique relative à la recherche biologique et médicale", report n°45, 31 mai 1995
(see http://www.ccne-ethique.org/francais/avis/a_045.htm).

established a "club" that brings together the main actors in charge of relations with major research institutions and industries. This club organises meetings every year to encourage contacts between institutions and journalists.

Let us emphasise the fact that this journalists' society is deeply involved in the optimisation of scientific information broadcasting. The AJSPI was established in 1955, following the initiative of scientific journalists who had already started their career in daily newspapers or weekly magazines. Its main objective was - and still is - to support active collaboration between journalists and researchers from all scientific fields in order to guaranty the objectiveness and reliability of information broadcast. Moreover, in 1984, they signed an agreement with the administrators of the future *Cité des sciences et de l'industrie de la Villette*, which would make them active in the organisation and operation of the newsroom of *Science-Actualité*, considered the window of "science and technology in the making."

In addition, the AJSPI took part in the European negotiation that led to the "charter of Laxenburg", which defines the rights and duties of persons in charge of informing the public. It has also been involved in a reflection on practices and ethics of scientific journalism with the organisation of debates. The debates that have been organised so far focused on military nuclear tests, mad-cow disease, and GMOs.[211] The most recent actions undertaken by this association have been focussing on visiting scientific sites in France and abroad, as well as organising meetings and debates including journalists, scientists and politicians.

B – The Press

1 – The popularisation journals

A relatively small number of daily newspapers exist in France. However, there is a wide range of magazines. In the category of specialised magazines, the general popularisation magazines (most of them monthly) have a significant place. They can be classified into three categories according to their presentation of science and technology: the "high level" popularisation journals; the general public popularisation journals; and the specialised popularisation journals, with magazines devoted to particular issues such as health or astronomy.

It is primarily persons with scientific training (whether or not they have a scientific occupation) who read the first category of "high scientific level" magazines. Two monthly magazines share this market: *La Recherche*, and *Pour la science* (the French translation of the *Scientific American*). These two journals, which until recently were

[211] Source, the AJSPI web site: http://www.multimania.com/ajspi. This web site presents information on the life of the AJSPI and advises for those who are going to enter this profession.

known for presenting science in a rather austere fashion – just as the scientific journals – have recently changed their format. They seem to have integrated the idea that science contents are always negotiated and that science and technology do not develop independently from society. *La Recherche*, in particular, has created new columns in which scientists, philosophers and sociologists may express their views on particular issues. In addition, these journals intend to enhance interactivity with pages devoted to the reactions of readers and with the creation of electronic forums. Apart from these two journals we may add a journal specialised in medicine, *Medecine-Science*, which devotes an important space to debates among scientists.

The second category of magazines includes popularisation journals for the general public. Here, the market is dominated by three major magazines offering a rather traditional format (*Science et Vie*, *Science et Avenir*, *Ça m'intéresse*). The logic presented here consists in educating the public about science, to explain science, by translating its most technical aspects into understandable words and notions while insisting on their social utility. In this group of journals, we find two older publications: *Science et Avenir*, established in 1947, which has a print run of 230 000 issues, and *Science et Vie*, established in 1913, which has a print run of 350 000 issues. The latter has been demonstrating much energy over the last 10 years with the creation of three specialised formats, two of them being aimed at the young public: *Science et Vie Découverte*, and *Science et Vie Junior*. Since 1991, it publishes *Les Cahiers Science et Vie*, with an aim to cover specific discoveries or particular scientific or technological developments, placing them into their historical and sociological contexts. It is worth mentioning that the contextualisation of science – that may proceed either by focusing on science in the making or on the relationship between science, technology and society - is more important in the two publications intended for young readers.
The third popularisation magazine intended for the general public is more recent. Created in 1981, *Ça m'intéresse*, has a print run of 250 000 issues. It pursues its objective of popularisation with a more radical method: the scientific and the technological contents are over-simplified and journalists tend to systematically link these contents with the supposed daily concerns of the readers. This tendency clearly affects the way editors select their topics as well as the way these are covered: numerous articles focus on daily life technologies with headlines such as "How does my TV work?"

Until 2001, this range was completed by a magazine titled *Eureka*, established in 1995, which was offering a slightly different format. The aim was no longer to educate people but to inform them. Published by Bayard Press (who published the famous *Cosmos* magazine from 1885 to 1940), this magazine focused on young adults (20-45 years), a group who is considered – according to the chief editor, Eric Jouan – to be aware of the importance of science in our society and who wants to understand the stakes and the risks related to scientific and technological developments. Hence, this magazine developed a multidisciplinary approach: science was sometimes covered from the standpoint of its contents and, at other times, through economical, social or political issues related to its development. Many columns were devoted to links between science and society and some focused on social sciences. This new magazine benefited from great success, with a print run of 110 000 issues 18 months after its launch. Despite its success, this magazine ceased publication.

2 –The thematic popularisation magazines

There are a lot of specialised magazines devoted to two particular scientific subjects: medicine and astronomy.

a – Health magazines

Private experience and also an individual internalisation of its "scientification" may help to explain the existence of a large number of popularisation magazines devoted to health. In France, the most significant journals are *Top Santé* (print run of 750 000 issues), *Santé Magazine* and the Franco-Quebecois monthly magazine *Capital Santé*. Other magazines complement the scene: *La tribune de la Santé*, *Réponses à tout Santé*, *Vie et Santé, Génération Santé, Alternatives Santé* plus a publication aimed at the female market, *Psychologies*.[212]

André Giovanni established the monthly magazine *Santé Magazine* in January 1976. Its mission was to concretise, through the education of the general public, the opinion given by the WHO: "the mental, social and physical wellbeing."[213] A team made up of general practitioners, specialised journalists and researchers works on editing this publication. It has a print run of 630 000 issues and its readership is estimated at 5 million readers.[214] The magazine provides suggestions on how to protect one's health and beauty, consultation on dietetics and help in educating and protecting children. A large number of articles are devoted to protecting the environment, an issue which, according to the editors, is clearly connected to human health. Recently, *Santé Magazine* has started to offer medical information on the web.

In 2000, the monthly magazine *Capital Santé* had a print run of 55 000 issues and estimated readership of 228 000 readers (in France and Quebec). Like most magazines of this kind, it targets families. Hence the favoured topics are related to prevention, hygiene, wellbeing, nutrition, beauty, children's health, medical

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[212] With regard to the importance of the press devoted to health, we have chosen to detail only the magazines intended to the general public. Many journals are intended to health workers (especially general practitioners) and constitute a specific form of scientific popularisation.

[213] Source, *Santé Magazine* web site : http://www.sante-mag.com/

[214] *Ibid*.

examinations, alternative approaches... Journalists and scientists write most articles. *Top Santé* follows the same line: it targets families and the favours issues related to health, disease and beauty.

b - Astronomy

Historically, scientific enthusiasts have largely contributed – and still contribute – to the making of astronomy. The skies and the stars stimulate the interest of people who are not really scientists – or do not want to be scientists! – but have a wide knowledge of the skies. In this context, the press aimed at enthusiasts of varying levels of knowledge has been flourishing since at least the 19th century. This press is closely connected to the activities of learned societies, like the *Société Française d'Astronomie* (SAF), the *Société d'Astronomie Populaire* (SAP), the *Association Française d'Astronomie* (AFA) as well as local societies or clubs. In this context, journals often serve as informative and practical resources and as relay between the various clubs and societies.

The *Société Française d'Astronomie* (SAF), founded in 1887 by the astronomer and science populariser Camille Flammarion, brings together professional astronomers and enthusiasts. In accordance with the ideals of its founder, the SAF is not only a society devoted to astronomical research but also to disseminate knowledge for all members of the public.[215] As well as the actions aimed at promoting CST[216], this society publishes a monthly magazine: *Astronomie* (formerly *Bulletin de la SAF*), also founded by Flammarion at the end of the 19th century. This magazine, with numerous illustrations, is half scientific journal and half magazine intended to the general public. Most articles - often written by scientists - focus on various and specialised issues.

Since its creation, in 1947, the *Association Française d'Astronomie* (AFA) has multiplied initiatives and popularisation actions as well as advertising campaigns for astronomy and related sciences. Its objective is to make astronomy a shared leisure, open to all, and to develop access to the scientific culture. This society wants to be a link bringing closer the general public, professional astronomers, enthusiasts and the media. The monthly magazine *Ciel et Espace,* published by the AFA, is devoted to the practice of astronomy, with a particular interest in space exploration and sciences of the universe. With a print run of 65 000 issues and a number of readers estimated at 400 000, it can be considered to be the largest astronomy journal of French-speaking Europe (France, Belgium, Switzerland and Luxembourg). Reports and investigative articles are written by science journalists with advice from astrophysicists. Based on a "democratic" idea of astronomy (the observation of the sky is a leisure that anybody can practice), *Ciel et Espace* encourages the development of astronomical leisure.

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[215] The SAF is acknowledged by the Ministry of Youth and Sports as a national society for youth and popular education.

[216] See the chapter devoted to "La nuit des Etoiles" in the present report and the SAF web site: http://www.iap.fr/saf/.

Each month, it informs on the celestial configurations, provides sky charts and practical advice for observation, and gives a list of training courses, conferences, clubs.[217]
We will end this review with *Pulsar,* the publication published by the SAP for more than 90 years. Different from the other two magazines, *Pulsar* is edited by and aimed at enthusiasts. Its various columns are resolutely directed towards the practical aspects of astronomy. To maintain a high level of quality and not to become dependent on commercial constraints, *Pulsar* is distributed by subscription only. Every two months, this journal is supplemented by a diskette containing software, images or files related to amateur astronomy. Finally, other journals exist, such as *Eclipse* or *Astronomie magazine* that act as mediator between the various clubs of enthusiasts.

3 – Science in the general press

Science is hardly present in the major magazines intended to the general public. Even if scientific columns are sometimes published by these journals when a scientific event takes place, science does not benefit from a regular coverage. The situation is different in daily newspapers. Every day, the *Figaro* gives a full page to scientific and technological issues (with a particular interest in medicine, as it is believed to meet the demands of its readership, mostly people over the age of 50).[218] *Le Monde* and *La Croix* offer a good coverage of scientific issues. Five years ago, *Le Monde* attempted to propose a specific treatment of scientific information through a collaboration with the British science magazine *Nature*. This collaboration started with the announcement, in January 1995, of a new description of the primary infection by HIV, which opened possibilities for new therapies (known as the bi- and the tri-therapies). On this occasion, English and French science journalists (Henry Gee and Jean-Yves Nau) as well as the chief editors of the two journals (Jean-Marie Colombani and John Maddox) contributed to the journal by giving their opinion on the issue. This collaboration with a scientific journal illustrates well the way the general press – of the moderate left wing – consider citizens' education to sciences. According to *Le Monde* chief editor, this alliance allowed him to "popularise in French the results, the progress, and the multiple challenges related to this fantastic quest for knowledge, which at the end of the century excites as never before communities of physicians and scientists".[219] The last newspaper, *Libération*, had developed, in the 1990s, a weekly booklet devoted to sciences, *Eureka*.

[217] See *Ciel et Espace* web site: http://www.cieletespace.fr/home.htm.
[218] According to a *Figaro* journalist.
[219] Jean-Marie Colombani, " "Le Monde" et "Nature"", *Le Monde*, January 13, 1995. On that point see MASSERAN A., "Rupture dans l'image médiatique du VIH", GIORDAN A., MARTINAND J.L., RAICHVARG D. (dir.), *Les sciences, les techniques et leurs publics* (Actes des XVIIIe journées internationales sur la communication, l'éducation et la culture scientifiques et industrielles), 1996, pp. 63/70.

Obviously, the contextualisation of science is very different according to the newspapers considered: *Le Figaro* exposes mainly the bare facts; *Le Monde* insists on the institutional aspects of science; finally, *Libération* focuses on actors and on the life of the scientific community.[220]

C – Science in the audio-visual medias

1 – Science on TV

For more than 10 years, television has also radically changed its way of dealing with scientific issues. Each editorial team who works on the creation of a TV programme, has integrated experts for scientific and technological issues. Changes have also occurred in other TV programmes. Traditional and austere popularisation has disappeared from the TV screens since the 1980s. This was not done without the influence of politicians: in 1988, Hubert Curien and Catherine Tasca (Minister of research and Minister of communication, respectively) proclaimed that as regards sciences, TV is "a cultural desert". Did the situation change in the course of the Nineties?

In November 2001, a special day (*Aux sciences, citoyens !*) was organised following the initiative of *Association Science et Télévision* in the scope of the *Assises de la Culture scientifique et technique* (General meetings on scientific and technical culture) launched by the Ministry of research. This day was an opportunity to bring together representatives of each generic French television channels (except TF1), researchers and producers of scientific TV programmes or films. The objective was to determine the means to fill in an existing information gap in matters of science (this determination was a consequence of a survey carried out in 2000, showing that 63% of people felt they were insufficiently informed on scientific discoveries). There is no element to give a measure of the impact of the day. However, actions undertaken by producers and heads of scientific programmes were clearly stating that television should be answering the citizens' "needs" for scientific information. Accordingly, a manner of consensus between broadcasters/producers and researchers emerged as to the philosophy of televised scientific programmes: beside traditional popularisation programmes, the coverage of current themes linking science and society (cloning, etc) should be reinforced.[221]

Science and technologies are increasingly subjected to media attention. However, it should be mentioned that significant differences may be observed as to the position given to science by the various TV channels. Sciences and technologies are mainly

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[220] DE CHEVEIGNÉ S., VERON E., "Nobel on the front page: the Nobel physics prizes in French Newspapers", *Public Understanding of Science*, 3 (1994), pp. 135-154.

[221] On the matter, see: http://www.science-television.com

covered by France 5 and Arte (public service channels with, respectively, a pedagogical and cultural vocation). Non-specialised channels do not dedicate much airtime to science.[222] The two programmes that are considered references of journalistic reliability – *Envoyé Spécial* and *La Marche du Siècle* (which was interrupted in June 2000) – sometimes propose in-depth investigations on scientific and technological issues and can even voice accusations. Similarly, science has taken a place in TV debates such as the weekly programme shown during prime time *Ça se discute*. Finally, several weekly programmes devoted to science and technology were created in the 1990s and 2000s. Among them we can mention:

- programs devoted to health such as Savoir plus Santé (on France 2 since 1992) and the Journal and the Magazine de la Santé (on France 5 – formerly known as La Cinquième – since 1994);
- popularisation programmes for the general public such as On vous dit pourquoi? (on France 2 since 2002), Archimede (on Arte) and E=m6 (on M6)
- programmes intended to children and young adults such as C'est pas Sorcier (on France 3);

However, some of these programmes have ceased to be broadcast: *Nimbus* (shown on *France 3*) and *E=m6 junior*, for instance.

Let us mention that none of these programmes, apart from *E=m6 spécial*, are broadcast during prime time during the week. Most of them are shown at week-ends (*E=m6*, on Sunday at 20h, *Savoir plus Santé*, on Saturday at 13h, *C'est pas Sorcier*, on Saturday and Sunday morning…). In fact, everything continues as if science on TV was to be considered a family subject, useful for the education of the youngest and for helping the oldest on issues related to health. These programs are often presented by two journalists, with a specific division of labour: the first one – the expert – is in charge of presenting the technical issues; the second one, the candid one, addresses related issues such as the social or the psychological aspects. This specific scene provide dynamics that allow for the establishment of both a relation with the public and links between science and society. Moreover, this setting can take a particular form, which preserve or even consolidates the authority of science. For instance, *Savoir plus santé* works on the physician-patient relationship, *C'est pas sorcier*, on the expert-learner relationship: in both cases a power-relation is at work.[223] These remarks are still hypothetical, but it is obvious that this setting of science and of its relation to society constitute a current trend that needs further examination.

[222] In 2000, percentages expressed in number of hours dedicated to scientific magazines and documentaries were, respectively: France 5: 34,2% ; Arte: 18,6% ; M6: 1,2% ; Canal +: 2,5% ; France 3: 3,4% ; France 2: 3% ; TF1: 1,5%.

[223] In the second program, the role of women is limited to tell funny stories, to have a naive look at the experiments and to stand as a decorative piece.

Another trend has appeared, particularly on France 5 and series including about 20 episodes dedicated to scientific themes are increasingly broadcast (Gaïa, Chasseurs de gènes, Psyché…). In order to widen its scope as a pedagogical channel, complements to the television programmes are available both on the channel's website and in teachers' folders designed for secondary schools.

Finally, let us mention one last type of scene in TV channels devoted to health: *Santé Vie*. This channel, which is part of the company Canalsatellite, legitimates its existence by stating that "health is the most important subject of concern for the average man."[224] So, a specialised TV channel is – according to the editor – the best means to meet this demand. But what will a TV channel propose that would not be already offered by the many written publications? First of all (we summarise here the argumentation presented on the web site of this channel), a 4.5-hour program every day during which, both health specialists and journalists interact to produce magazines, talk shows, debates, reports, documentaries and fiction works. During the first years of its existence, the channel was allocating special time slots to the medical profession and only health professionals subscribing to the channel could avail of these programmes (i.e. the general public did not have access to them). The latter, amounting to 200,000 individuals in France – may subscribe to view specific programmes (before 9 am and after 11pm). These programmes are crypted and available on subscription (only doctors may subscribe), far from being intended to the general public, it is supposed to guaranty a level of quality, like in the case of expert committees working away from society. This division was supposed to represent a guaranty of scientific quality for *Santé Vie*. Nowadays, programmes are increasingly turned towards entertaining popularisation, with programmes such as *Bistouri & Cie*, hosted by star-presenter Claude Sérillon and focussed on surgery. Other programmes are dedicated to daily health concerns (*C'est mon poids* is a daily programme dedicated to weight issues, *Femmes-enfants* deals with mother-child relationships, etc). Finally, dialogues between medical doctors, journalists and television viewers are granted a large share of airtime.

2 – Science on radio

Although in France there is a large number of radio stations, only a few programmes are devoted to science. None of the "peripheral stations" (i.e. radio stations which, for historical reasons, had to broadcast from abroad, for instance Europe 1, Radio Monte-Carlo…) devote programmes to science and technologies. Science is only present in the programmes that can address scientific issues following current events and news. It is also present in interactive programmes that can allow members of the public to

[224] Source: the Santé Vie web site: http://www.sante-vie.com/.

participate – such as *En direct avec les auditeurs* (Europe 1). That sort of programmes also exists in public radio stations such as France Inter: for instance, *Alter Ego* and *Radiocom c'est vous* often invite guest scientists who comment or answer questions from the public. Recently a weekly programme was launched on France Inter: *CO2 mon amour*. This programme followed an initiative carried out by journalists in 2003. It offers debates focussed on environmental and ecological issues and includes scientists, associations and listeners[225].

As far as thematic stations from the public service are concerned, there is no radio airtime devoted to sciences and technology. The channel that devotes the largest number of programmes to science and technology is *France Culture*, a branch of Radio-France created in 1970. Offering three weekly programmes, France Culture offers a wide variety and adopts the traditional approach of scientific culture[226]. *L'éloge du savoir* is close to the format adopted by popular universities since it offers lectures from the *Collège de France* and conferences organised by the *Université de tous les savoirs*[227]. *Continent Science* is a popularisation programme focussing on science in the making, inviting scientists from a variety of horizons to explain the nature of their work. Finally, *Science friction*, co-produced with daily newspaper *Le Monde,* is a programme aiming at placing science in the centre of a debate relating to current affairs. The three main targets of CST are thus represented: general public education, understanding world activity, science and the science-society debate.

D – A glance at a profession

In general, media processing is very different whether science is approached in news magazines or in specific programmes. Whereas, in the first case, science is primarily approached in the light of certain contingencies (scandals, medical world first, social demands...). In the second case, the aim is to educate the public on sciences. These two approaches rarely cross. Thus one may observe, in the setting of science in the media, the coexistence of two discourses which represent two sides of the same coin. On one side, journalistic investigations often restrict their treatment to calling into question the actions of scientists (their relations to the economy, their disciplinary rigidity, their race for prestige...). Their investigations rarely grasp the scientific contents, except to verify it. The image of science remains unaltered. In short, one

[225] http://www.radiofrance.fr/chaines/france-inter01/emissions
[226] http://www.radiofrance.fr/chaines/france-culture2/emissions
[227] *Université de tous les savoirs* was an operation undertaken in the scope of the Year 2000 events. The idea was to offer, all along the year 2000, a daily conference with a prominent scientist involved in nature or human sciences. The success of the operation and the size of its audience allowed for a partial renewal of the initiative.

could say that criticising prominent scientific figures - depicted as individual who are all too ordinary – consolidates the concept of purity surrounding scientific constructions. On the other side, the standard science popularisation does not put science into its political, sociological or economic context except to demonstrate the usefulness of science: indeed, science is expected to be admired rather than discussed. The only exception is the magazine *Eureka* which favours a multidisciplinary approach.

In conclusion, it seems important to take a look at the sociological aspects of this profession. The persistence of the standard science popularisation[228] may be explained by the fact that a large majority of science journalists had scientific training, but are self-trained in journalistic techniques: only one third have received journalist training while 60% have been trained in science (with 47% having completed a postgraduate diploma).[229] However, it is clear that even if a majority of the science journalists have a good scientific training, they probably never stayed in that field long enough to practice science and work in a laboratory. Hence, they transpose in the media arena their education to science and not their practice of science. In addition, their familiarity with science may also push them to act as guards of the temple and to conceive popularisation as a means to separate in the public arena true science from its avatars, and then to convince "the man in the street" of their own perception of science. On the other hand, these journalists must also face the competition with the investigative journalists and the "expert journalists" who, without scientific training for most of them, put science back into its social context, a process that obviously can undermine the institution. Finally, the scientific training of science journalists may confer them a legitimacy which, when critics threaten science (either investigative journalists or groups of activists), needs to be reaffirmed. Hence speaking about science becomes similar to defending science. The implications are twofold: first, the public is seen as an undifferentiated mass waiting for science to be delivered ; second, attempts made by scientific journalists to speak about true science go against attempts made to place science in a debate.

Finally, let us underline that this profession largely suffers from a division of work based on gender. If the proportion male / female is somewhat similar to that found in journalism in general (with a ratio of two males for one female), positions of power and the most technical subjects remain the province of men. In the world of televised

[228] This standard popularisation refers to a particular conception of the public: they need science, they want science, but they do not understand science. Hence, this type of popularisation considers that the scientific authority must be consolidated by the transmission of a positive image of science to a receptive public who is asking for more. This explains why the legitimacy of science and technology is rarely questioned: science and technology are the legitimate authorities that tell us what the world is and how to improve matters.

[229] François Tristani-Potteaux, *Les Journalistes Scientifiques, médiateurs des savoirs*, Paris, Economica, 1997.

scientific information these differences appear most clearly. The programme *Savoir plus Santé*, presented by two journalists, a male and a female, constitutes a good illustration. Whatever the issue dealt with, the technical, economic, and institutional aspects are systematically explained by the male journalist who, generally, also acts as programme director. The female journalist tackles related issues which highlight the human aspect of science and medicine, interviews patients, speaks about suffering.

E – Internet: Belated and uneven development of the Internet in France (by Catherine Roth)

The Internet developed somewhat belatedly in France compared to other European countries (particularly Britain, Germany or Scandinavia), both in terms of users – in 1999, 10% of European Internet users were French – and in terms of online contents – in 1999, 6% of European domain names originated from France[230].

In January 1998, a decisive impetus was provided by a programme of governmental action for the society of information (PAGSI – *Programme d'action gouvernemental pour la Société de l'Information*). This project was taking on an economic challenge – i.e. promoting the multimedia industry – whilst also including a political aspect, aiming to create a "more united, open and democratical society"[231]. Six priority areas were defined: education, administration, business, research and legislation.

Between January 1998 and January 2000, the number of Internet users increased more than eleven-fold. The policy relating to public and school-based Internet facilities (hundreds of cybercentres) had a marked influence (in 2000, the figures showed that 10 out of 13 million school children connected to the net). The Internet access rate continues to increase.

Today, there are 18.7 million Internet users[232], i.e. 36.8% of the French population and 6.2 million households have Internet access, i.e. 25.2% of French households (Médiamétrie, December 2002). 40% of Internet users connect every day or almost daily (Médiamétrie, May 2001) and meantime spent monthly on the web amounts to 6 hours and 13 minutes (Netvalue, September 2001).

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[230] Abramatic Jean-François, *Développement technique de l'Internet*, report to the government, 1999.
[231] *Programme d'action gouvernemental. Préparer l'entrée de la France dans la société de l'Information*, La Documentation Française, Paris, 1998.
[232] Individuals aged 11 and over, declaring having connected to the Internet in the course of the last month, whatever the location from which the connection was established.

The use of the Internet tends to become more accessible to all. However, it is still of particular interest to the upper social categories (representing 63% of Internet users – Jupiter MMXI 2001), and to males (representing 65% of Internet users – Jupiter MMXI 2001). Large cities and the Paris region show a penetration rate twice as large as rural areas and small towns (Netvalue, December 2000). After having mainly touched the younger generations, the Internet begins to show an age pyramid closer to that of the population.

At the same time, contents of French origin have developed on the web. Administrative institutions, businesses, scientific institutes, cultural centres, associations, etc, have an increasing presence on the Internet, even if this is still far from being common practice. Since 2000, the breakthrough of pedagogical sites is particularly significant.

However, studies undertaken with the parties involved, on topics such as website traffic, show that the new opportunities offered by the Internet – reciprocity of exchanges, flow of information, establishment of spaces for cooperation, hybridisation of contents, etc – are by far under-exploited by groups and institutions. On the other hand, individuals are taking advantage of them - debating issues in forums and making use of lists of recipients as well as creating "personal web pages" with numbers constantly on the increase.

Numerous debates took place during the development phase of the Internet. They involved "techno-optimists", who were enthusiastic about this reinforcement of democracy and better distribution of knowledge, "techno-sceptics", concerned about cyber-crime and numeric fractures and "techno-cautious", bemoaning the fact that "new technologies" were causing such turbulence. Now, it seems that these debates have lost their intensity and the Internet is on its way to becoming more commonplace in French society.

Proposals of various origins

Majority of the cultural bodies involved in science and technology have, opted to make limited use of the Internet. Admittedly, many operations have been organised under the heading of "new technologies" by science centers: exhibitions, organised activities or publications aiming at presenting to the general public the way these tools work. Obviously, over time multimedia and Internet access points have multiplied to complement exhibition areas. However, museums or cultural centres websites are generally extremely poor.

Most of these centres limit their scope to a presentation of the activities undertaken by the institution, sometimes including quizzes or games or some hypertext documents. The Internet is considered as a means to attract people towards traditional productions, exhibitions, publications or audio-visual works. The value of the website is its ability to act as a bait: "do it online and, if you enjoyed it, come to the *Cité* to learn more about it and try other experiments" this, for instance, is declared by the *Cité des Sciences et de l'Industrie de la Villette* in the introduction to its online contents.

The function of locating and analysing other existing websites is mostly neglected. If, again, we take the *Cité des Sciences et de l'Industrie* as an example, its "web guide to learning" only includes about 40 projects, completed by about 60 additional links. Sections presenting the exhibition and information areas of the *Cité* do mention a variety of Internet sites – see for instance the area dedicated to health – but these may not be accessed online.

These institutions claim economic, technical or legal difficulties to justify the fact that they have not made better use of the Internet, which they consider to be an extremely useful tool for the purpose of fulfilling their mission. In particular, the fear of seeing the number of "real" visitors dropping with the increase of "virtual" ones is a very common feeling. Beyond these explicit obstacles, a deeper reluctance may be perceived. The reinforcement of network collaborations, the reconfiguration of the relationship with customers, the loss of control over contents are so many transformations cultural bodies back away from.

Others institutions have shown themselves to be equally timid. Few scientific establishments have used the Internet to enter into communication with the public. Administrations, businesses, media or associations having developed a genuine online content on sciences or techniques constitute a minority. For the most part, web pages aimed at the general public offer a manner of corporate presentation, an electronic version of their existing brochure printed on glossy paper.

As it turns out, individual initiatives provide the most prominent presence on the French web. Enthusiasts, students, teachers, researchers, medical doctors etc. make up a large group of voluntary workers posting thousands of web pages on scientific, technical or health issues. These sites are hosted by access providers offering free space to their subscribers, on the sites of "virtual communities" such as Multimania, or on sites of schools, universities or scientific bodies. It may happen that sometimes a personal initiative leads to the constitution of a group, more or less formal in its organisation, which pursues the work undertaken; sponsorships of a more official nature may then be required. The range of these websites is extremely wide, from a dozen pages to highly developed portals. The driving power behind these individual initiatives is fuelled by the passion for a topic, the desire to share one's knowledge, a taste for joint actions, and an interest in active leisure.

All types of scientific and technical domains seem to be represented on the French web, earth sciences, life sciences, physics, chemistry, telecommunications, space, mathematics, etc. Some are covered by a higher number of initiatives than others. This is the case of health, on which general[233] or thematic[234] portals are forever multiplying, alongside a myriad of more modest sites designed by doctors, patients, patients associations, museums, administrations, etc. Whatever the nature of the topic developed, the authors of web pages show extreme diversity.

Low-level accessibility

As a result, the PUS scene is extremely fragmented on the web. The guide of French-speaking Internet sites on astronomy and space science, established by the association *Ciel et Espace*[235] provides a typical example of this situation. This non-exhaustive guide - with about 140 references – includes web pages built by individual enthusiasts, universities, research centres, associations of non-professional astronomers, aerospace companies, pupils, teachers, students, multimedia publishers, scientific publications, ministries, learned societies.

The sheer diversity of contents producers allows for ensuring a certain multiplicity and horizontality of points of view, especially as the web also gives access to sources aimed at specialists in addition to those destined to the general public. However, this diversity constitutes a considerable hurdle when Internet users try to access information.

A person looking for information on a scientific or technical topic is faced with nothing short of an obstacle race. He will find countless contents but the chances are that he will lose his way in an information and communication jungle. A few figures suffice to give the measure of this maze - here are the results of a search undertaken with the search engine Google.fr, therefore on the French-speaking web: 58,100 items came up with the word “GMO”; 99,200 for “astronomy”; 253,000 for “biology”; 631,000 for health; 823,000 for sciences.

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233 www.santeweb.com, www.e-sante.fr, www.sante-mag.com, www.taSante.com, www.medecine-et-sante.com, www.cvotresante.com, www.votre-sante.net, www.web-sante.net, www.topsante.fr , www.doctissimo.com, etc....

234 www.diabsurf.com, www.obesite.com, www.nutrition-sante.com, www.santetropicale.com, www.energie-sante.com, www.affection.org, etc...

235 www.cieletespace.fr

There is no centralising point. Inventories of web links are present on almost every site but most of them are rather fragmented and this makes the search all the more difficult for the Internet user. Quite often, these inventories are limited to a small institutional circle, ignoring associations or individual sites while it is indeed on the side of individual initiatives that they are most open. The only project of considerable stature is the portal realised by the Ministry of Education intended for teachers and realised with their contribution, www.educasource.education.fr.

Sites whose authors are not identified cause an additional difficulty. Quite often sections such as “who we are” or “credits” are either non-existent or muddled. Sites developing identification procedures so far as to actually give the name and function of the author of each web page are rather exceptional. The range of non-identified resources is affected and people are being more and more aware of the issue.

Finally, let us mention sites that charge visitors; this is apparently still rare but is being increasingly developed in the field of e-learning.

Restricted interactivity

The contents of sites vary tremendously, and all forms of information and communication developed on the Internet are used to explain and/or discuss sciences and technologies. Two main types of proposition can be identified, although they can co-exist on one same website, they both require a different mode of participation from the Internet user.

The first type tends to keep the user within the narrow limits of the status of information receiver. These are:

- Hypertext documents – they represent, by far, the most widespread type of projects – structured as magazines, files, virtual exhibitions, chronologies, glossaries, dictionaries, encyclopaedia, pedagogical fact sheets, etc, or newsletters sent electronically to Internet users who opt to subscribe;
- games making use of multimedia means to some extent, such as animation, quizzes and tests;
- databases, more or less well-stocked, offering texts, photographs, video clips, cards, etc;
- viewing procedures, using web cams or panoramic systems.

In this case, interactivity is limited to the person-machine interaction or to choices of progression to be made within the enclosed and signposted space controlled by the site designers. The Internet user will be able to make use of this informational and communicational matter on his computer, cutting, pasting, adding and publishing his hybrid creation via the electronic mail, forums or personal web pages – he will, however, remain unable to act on the contents of the site or enter into an exchange with authors.

A second type of proposition restores a form of equity between transmitters and receivers and calls for a more active participation of Internet users. These include:

- surveys, structured in the form of a questionnaire, sometimes arranged on a dynamic page allowing for instant integration of the Internet user's answers;
- "frequently asked questions" providing the Internet user with a possibility to ask questions and displaying the answer given to the most frequent questions or to all queries;
- "chats", allowing for live exchanges;
- discussion forums and lists of recipients accessible from websites or grouped in areas dedicated to this mode of exchange (francolistes, e-groups, etc.), to facilitate off-line exchanges;
- open areas dedicated to posting web pages designed by Internet users, usually limited to projects undertaken by school-aged public.

In this case, interactivity is reinforced. The Internet user may enter into a relationship with the authors of the site, or even with other users, and may contribute to the contents. The bi-directionality of exchanges gives limited access to a space where the role of producer and receptor of information may be swapped and where the various approaches to science and technique may be mixed.

The first proposition largely dominates the French web. As for the second, not only are they numerically in a minority – particularly those of the most participative type – but they are often used to give the Internet user the illusion of having the possibility to express his/her views. The archetype of these "communication illusions"[236] is the online survey. "Should scientists be allowed to change the universal genetic code to create new living beings" asks, for instance, the *Cité des Sciences et de l'Industrie* to its Internet visitors in the section dedicated to surveys which comes with its e-magazine *Sciences et Actualités*. Neither the professionals of the *Cité* nor scientists or site visitors can believe in the impact of a survey to which about a hundred Internet users took part. The low level of participation to this type of survey shows that Internet users are not fooled by such procedures.

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[236] Vidal Geneviève, L'interactivité et les sites web de musée , *Publics et musées*, n°13, janvier-juin 1998, p.89-105.

A reiterated presentation of sciences and techniques

The majority of projects is dedicated to delivering knowledge. They are based on an encyclopaedic and cumulative model of learning. They assume that Internet users should absorb part of the knowledge elaborated by science and technology specialists. They favour pupils and students and give priority to pedagogical approach and recreational modes of learning (edutainment). Sometimes, a window may be open with limited access to methods of research, for experiences to be performed or to present laboratories or production sites – all remaining, however, within the logic of popularisation or entertainment.

Web pages only rarely come in line with the STS approach and set out to place sciences in their social, economic or political context. The history of sciences is underdeveloped and it is usually limited to a portrait gallery of prominent scientists, prestigious discoveries or famous instruments. Unless the user visits sites dedicated to social sciences, sociology is conspicuously absent and, at best, the Internet user may find fragmented information on the "professions" present in one or another field of activity or a few stories told by famous researchers giving an account of their scientific life.

Even the all too rare initiatives with the set objective of creating discussion forums dedicated to science and society have difficulties in getting away from offering joint presentations. The site *Sciences et citoyen*[237] (Science and the citizen) created by the Scientific Culture Mission of the *Université Pasteur* provides a typical example of the difficulty of getting away from traditional models. Explanatory documents, questions to ask scientists and their answers, selection of publications and websites are proposed around a topical theme (GMOs, prion diseases, greenhouse effect, bioethics, etc), "creating links between science and society", as expressed on the homepage. Despite its claims, this system still maintains the citizen in the role of learner, comforting the researcher in his position of expert and continuing to exhibit science as an independent domain.

Individual projects also fit in the overall picture. When an enthusiast or a science or technology professional creates personal web pages, it is generally with the underlying aim of disseminating knowledge and making it more accessible to the layman.

Initial steps towards setting up hybrid forums

The Internet is particularly suited to the creation of negotiation spaces close to the "hybrid forums" described by Michel Callon: areas where specialists and laymen

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[237] http://science-citoyen.u-strasbg.fr

attempt to "reconcile knowledge production and collective experimentation" and "collectively develop a new regime acknowledging the unique status of science whilst also accepting the logic of a political debate"[238]. These initiatives may still be in their infancy but are developing along those lines.

The objective of the website and list of recipients entitled *Veille citoyenne sur les OGM*[239] (citizens watch on GMOs) is to set up "a French-speaking information centre, broadcasting regular, validated, concise and referenced information on all the challenges raised by GMOs, in a language that may be understood by all". The idea is not to replace what already exists but to work in favour of "the identification of good sources of information, a structuring of data, formatting work and dissemination", "questioning official sources of information and analysing the way they present and broadcast information on GMOs". Files, discussion forums, proposals for militant action are offered online. The association Inf'OGM, which started off this initiative, is partly constituted on the basis of a "citizens sphere of influence, united and organised around a discussion group, namely ogm@egroupes.com".

Associations provide a particularly fertile ground for the emergence of such initiatives, institutions may prove themselves to be innovating. EDF (the French electricity board) who took the opportunity offered by the Internet to develop its communication policy already shows remarkable activity (exhibitions, publications, visits of facilities) and has posted online a site specifically dedicated to nuclear energy, *Edf Infos nucléaires*[240]. Its structure and pitch are in contrast with other projects present on the web: "virtual museum", "Internet guide to energy through edutainment", "the school of energy", "a voyage through electricity", etc). The site offers a detailed presentation with key figures, a list of incidents-accidents including dates and locations, files on health, safety, the environment and the future of nuclear energy, a forum (moderated but open to anti-nuclear contributions), a section including frequently asked questions, web links, webcam set up on production sites. Obviously, the will to appear transparent and open to debate is more of a façade than a reality. "We are not the only ones to express our views on nuclear energy. In this section you will find links leading you to what others are saying", may be read in the introduction of a list of links which mentions only two anti-nuclear associations.

The Ministry of Health also opted to throw itself in the venture and created a website named *Etats généraux de la santé*[241]. Set up to facilitate a "genuinely free and constructive debate", following "an approach still unedited" and "constituting an

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[238] Callon Michel, Défense et illustration des recherches sur les sciences , *Revue Alliage*, n°35-36, 1998.
[239] http://www.infogm.org
[240] http://nucleaire.edf.fr
[241] http://www.sante.gouv.fr/egs/index.htm

important milestone in health democracy", this site is designed as a complement to public meetings and conventions organised on the entire French territory. The site offers information on various events, their dates, the issues raised, it gives access to documents and provides an opportunity for Internet users to give their opinion on the various topics: health and media, medical confidentiality, family doctors, etc. Documents are simply presented as elements shedding a light on issues: they reflect neither "the position of the government, not the exhaustive point of view of experts on the matter". Their objective is to "help individuals to develop their own opinion" and to "facilitate a debate". However, the debates taking place on this site remain compartmentalised – as may be seen on the site dedicated to asbestos[242] – designed to be "the progressive working tool of a mission on asbestos", highly dense and less orientated towards the general public. In particular, the administration doesn't really leave much space to health associations.

The emerging uses of the Internet are so much of a nature to disturb old habits in matters of scientific and technical communication that they don't give rise to much resistance and this tends to shape these participative systems on traditional models. The establishment of networks is still very fragmented and the participation of the public is still a relative concept, the concept of horizontality of exchanges is still in infancy, the visibility of relationships between sciences and societies is barely established. Furthermore, the sociology of Internet users limits the access of the population to these new areas. Finally, this approach is not at all widespread. However, the development of Internet access rates and the growing demand for a more participative democracy could act in favour of the continuation and consolidation of these experiments.

Five years have passed since what has been labelled the "beginnings of the Internet" in France. Propositions are far from being stabilised, opening a shifting space and uncertain future. According to Pierre Levy[243], three trends are confronting each other as to the use to be made of information and communication technologies in the world: the state-controlled, the liberal and the libertarian model. This statement can be usefully brought up to provide an explanation as to how the PUS is developing via the Internet in France, not having yet chosen between popularisation, market logic and social trend.

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242 http://www.Sante.gouv.fr/amiante/index.htm

243 Pierre Levy, *Cyberculture. Rapport au conseil de l'Europe*, Paris, Editions Odile Jacob, 1997.

Media and PUS in Portugal

Maria Eduarda Gonçalves, Paula Castro

1. Background

In a country with low levels of public and private R&D funding, a weak scientific community, and a low degree of scientific and technological culture, science has been relatively invisible both in the public sphere and in the schools until recent decades. These conditions did not encourage the mass media to engage in the popularisation of science in an active manner.

Political democratisation following the 1974 revolution, and most of all, accession to the European Community in 1986 paved the way for a progressive, though slow, opening of the mass media to scientific issues and information. During the 1970s and 1980s, the volume of articles in newspapers and TV programmes, while pointing to an increasing trend, was still quite low.[244]

Again, the last two decades also saw some changes in this area. From the mid-eighties onwards science and technology were included in the political agenda in Portugal; and from the mid-nineties a specific line of policy for scientific culture was launched. These factors eventually had its impact upon the treatment science and technology received in the various media (the press, TV, radio and popular magazines).

2. The press

2.1 Recent trends

The growing interest shown by the written press on matters of science and technology has had the following manifestations:

The emergence of a new generation of “scientific journalists”. The CENJOR (Centro Protocolar de Formação Profissional para Jornalistas), has organized courses on "science journalism", funded by the Science Ministry, and on "science in the media", funded by the Calouste Gulbenkian Foundation (2002). Both courses were attended by scientists and journalists, and some of the journalists who attended the first course are now working in specialized science sections of daily newspapers.

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[244] Machado, F.L. and I. Conde (1989), “Públicos da divulgação científica”, Sociologia - Problemas e Práticas, 6, pp. 81-100.

The inclusion of specialised sections on science and technology in a number of newspapers, particularly the daily newspapers Público e Diário de Notícias. These two newspapers now have a daily section on "science and the environment".

The emergence of separate pages ("suplementos") dealing with science, in daily and weekly newspapers (namely in the weekly Expresso, and, for a short period, the daily Público), that contributed to an impressive increase in the number of news printed during the same period. As an unintended outcome, however, this trend resulted in an "escape" of the articles where science was more "visible" (those focusing on basic science and science policy) from the main body of the newspapers to the "suplementos", with the consequence of limiting their potential publics.[245]

2.2.Matters treated by the press

Strikingly, one of the subject-matters given regular attention by the press is *governmental science policy*, including, in particular, the development and evaluation of scientific and academic institutions (state laboratories, research units, etc.), the training of human resources, international co-operation, besides the promotion and evaluation of scientific and technological culture. Events involving the Ministry of Science, and the action by the Minister, have been regularly reported. Yet, science policy is far from being the only subject-matter demanding the media's attention of - the same happens with news relating to basic scientific research. Studies have shown that environmental issues and technological applications caught a high proportion of press news throughout the nineties. Recently, the *Diário de Notícias* has also regularly published reports about research projects carried out in Portuguese institutions, including in the social and human sciences.

It should also be noted that, though very sensitive to governmental policies - with political actors working as important sources of information for scientific journalists - the press also developed their own strategies in selecting themes, thus moving away from the issues and concerns of the political institutions' official discourse.

The divergence between the official discourse and the media coverage has been most clearly illustrated in the regular coverage of science-based controversies in recent years.

Among the controversial issues dealt with by the press, those related to public health have been the most extensively covered. The struggles against cancer and AIDS, food

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[245] H. Mendes, "Visibilidade da Ciência *na Imprensa.* A Tematização da Ciência nos Jornais *Público*, *Correio da Manhã* e *Expresso* (1990 e 1997)", in M. E. Gonçalves (ed.), *Os Portugueses e a Ciência*, Lisboa: Publicações Dom Quixote, 20023.

In 2000, the daily newspaper "Público" promoted a survey where it asked the subjects their audience would like to see more developed. The two subjects most selected were tourism and science, technology and environment. Some months later, two supplement sections appeared about these subjects (the one dedicated to science, technology and environment is called "Terra" ("Earth")). In the TV arena, this trend was followed and reinforced by the emergence of a programme called "Saúde Pública" ("Public Health") in SIC Notícias (the first Portuguese channel dedicated fully to information and news).

issues including BSE, co-incineration, genetics, depleted uranium and cloning have been recurrent topics in the pages of Portuguese newspapers in recent times (Duarte, 2001: 71).[246]

The emphasis on controversies has been viewed as triply damaging: for scientists and scientific institutions, for the political institutions responsible for scientific and environmental issues, and for scientific and technological culture itself. These concerns could well be justified: it is likely that highly media-driven events - which reach TV prime time and radio news, and not only newspapers - are prone to shape the public's image of science and scientists in a stronger way than the daily news appearing mainly in the newspapers, read by a relatively small number of people.

3. TV and radio

According to results of the most recent survey of scientific culture undertaken by the Science and Technology Observatory (STO), only 8.3% and 19% of the respondents declared that they read news articles on science and technology "regularly" and "once in a while", respectively, in the press. The TV, not surprisingly, enjoys a larger slice of the market: 13.4% and 32.6% of the respondents declared that they have watched TV programmes on science and technology "regularly" and "once in a while", respectively.

However TV programmes with science and technology focus are not very many.

There are four Portuguese, regular TV, channels (two public and the other two private). Only public Channel 2 presents a weekly programme ("2001") on science and technology, with a special focus on information technology. There have also been in the past (last five years) some series of short duration, two of which are coordinated and presented by a well-known physicist, who also regularly publishes books in the area of history of science.

Apart from this, there is cable TV, which offers Odyssey, and Discovery, for instance.

As for radio programs, there is a daily, short science commentary which lasts just a few minutes called Twenty-first Century on TSF, sponsored by the Science Ministry.

4. Magazines

4.1 Introduction

Scientific periodicals have no consolidated and broad presence of in Portugal. Their number is exiguous, their distribution limited, and their life span has often been short. It is, therefore, not surprising that, in a recent survey on reading practices of science

[246] Joana Duarte, Análise de Imprensa: Artigos de ciência e tecnologia. In A. Firmino da Costa, Patrícia Ávila e Sandra Mateus, *Publicações e Públicos de Ciência*. Relatório Preliminar. Lisboa: CIES/ISCTE, 2001, pp. 71-99.

magazines, 73% of those inquired declared that they never read such magazines, while 8.8% declared to read them regularly (on a weekly or monthly basis) (Costa, Ávila and Mateus, 2001: 13).

This may seem paradoxical at a time when, as we have pointed out, science is more and more present in political discourse and the media, and the scientific community is increasingly involved in popularisation activities, namely under the Ciência Viva program. Some indicators indeed point to an expansion of the public for such publications (ibid: 6).

4.2 Main magazines published in the 80s and the 90s

In the second half of the 1980s, coinciding with a period of reorganisation and mobilisation of the Portuguese scientific community (see below "Non-governmental initiatives"), a number of magazines featuring articles and news about science and technology for the general public were launched. Examples were the "Revista de Ciência, Tecnologia e Sociedade" (CTS), "Futuro" and "Omnia". The CTS, published by the ACTD, an organisation of scientists, worked as a vehicle for the diffusion of research and information about the social dimensions of science. "Futuro" and "Omnia" were edited by journalists or people linked to the mass media with the collaboration of scientists from various disciplines. These magazines included short articles and news about scientific developments and science policy, interviews and reports.

All these publications survived only for a few years.

"Colóquio-Ciências", another scientific magazine, launched in 1988, lasted longer. Published by the Science Service of the Calouste Gulbenkian Foundation, its central purpose has been the popularisation of science based on articles on various themes and topics authored by Portuguese researchers. "Colóquio-Ciências" suspended its publication in 2000.

At present, in the absence of genuinely Portuguese magazines for the general public, the readership is mainly oriented towards foreign ones, widely diffused in the country, above all Science et Vie and Scientific American.

Reference should also be made to the role played by the books publisher Gradiva. Since the mid-1980s Gradiva has published around 278 books devoted to scientific subject matters which have been very well accepted by the Portuguese market.

5. Internet

The use of the Internet in Portugal has grown at a rapid pace. According to data from Marktest surveys (Bareme-internet, http://www.marktest.pt), in the first trimester of

2001, 36.5% of the respondents had access to the internet, although only 20.4% had home access (Lima, Pinto, Baptista & Castro, 2001).
The Ministry of Science and Technology, established by the Socialist Government (1995-2002), had a central role in the promotion of the use of information technologies, through a number of programmes for the building of an information society in Portugal. These followed the approval by the government of the policy orientations contained in the Green Book on the Information Society, in 1997, and the Operational Programme for the Information Society, in 2000. [247]

Among the governmental policy actions in this field, reference should be made to the Science, Technology and Society network (http://www.rcts.pt/), which links the universities, polytechnic institutes, and research and development institutions. The access band for the access by these institutions to the RCTS was considerably expanded. International connections were considerably improved as well. The RCTS was also instrumental in assisting secondary schools to have access to the Internet, and in facilitating their communication with the academic and scientific milieu. This network has enabled a growing development of communication among the scientific, technological and socio-cultural communities: teachers and students at various schools, as well as the users of municipal libraries nowadays have access to the Internet, thus reducing the corresponding inequalities.
Institutions that play a role in the diffusion of science, such as the universities, the research laboratories, and the science museums, now have their sites on the Internet. The information contained in these sites is generally of a descriptive and institutional nature. Only on rare occasions has it been used to disseminate science to the public.
In the specific field of scientific and technological culture, reference should, however, be made to the initiative by the Observatory of the Sciences and Technologies, an agency of MCT, to establish a web site specifically devoted to "Scientific culture and the knowledge society" (http://www.ccsc.iscte.pt). To build up the contents, and to run this site, the OST has relied on support by the Centre for Research and Studies in Sociology of ISCTE. The site includes a forum for the presentation, diffusion and debate of research results and reflects on scientific culture, as well as a data base containing information about research projects, publications, researchers, and institutions involved in research in the broad field of the scientific culture and the knowledge society.
Also in the MCT page, there is a Permanent Forum on Science and Technology policy (www.mct.pt/forumCT/wellcome2.htm).

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[247] Http://www.mces.pt/.

Media, internet and PUS in the Swedish context

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

The first part of this chapter examines how initiatives of PUS are manifest in Swedish media. Inevitably, such a discussion will also discuss the broader issues concerning the relation between science and media in Sweden.

Science and Media: repercussions of policy

We can connect developments in Swedish policy to the how PUS initiatives are perceived specifically in and by the Swedish media. For example, the reforms characterising Swedish universities and colleges during the 1960s and 70s, such as the 'sectorial principle'[248] and the legislation of the "Third Assignment"[249], demanded information strategies on behalf of the universities, particularly stressing the internal information directed at employees while outward ambitions were restricted to information on new courses.[250]
All Swedish universities and colleges have now established information units or Contact Secretariats (*Kontaktsekretariat*). Following the introduction of the "Third Assignment", new requirements are often integrated into the usual activities being undertaken by these units. Research information was previously often communicated in connection with motives coming from The Vice Chancellors office. Primarily, the work of these units focused on executing information strategies, and the "The Third Assignment" was an added on task to these.[251] Some information units started to

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248 In accordance with this idea, the university is the main public repository for science that may solve problems within various societal sectors, be it housing, supply of energy, national transportation and local systems, environmental protection, health and welfare, etc. The argument for this system of engaging academics in applied research is, firstly, that the universities are all national civil service facilities, belonging to the national unitary system of science and higher education. In the Swedish context it therefore became important to view research in the academic domain as open to public scrutiny and transparency. This means that efforts must be made to inform a wider audience about the existence of this kind of research, making it accessible particularly to various *user* categories

249 In the new University Act of 1977, a new task supplemented the earlier two officially proscribed responsibilities assigned to the universities, teaching and research, and it was thus called "the Third Assignment" (*tredje uppgiften*). Such disseminated research information (*forskningsinformation*) should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have come to modify the text, somewhat changing its intent. Some core ideas are, however, still present, which goes back to the fact that the universities are part of a unitary national system and publicly funded. An important element of the "Third Assignment" is the emphasis on the democratic significance of research-based knowledge.

250 Hjort, C, et al, 1981, *Ut med forskningen.* UHÄ & Liber, Södertälje, p 149.

251 Jan Nolin (1993) "Democracy and the program of Science information in Sweden" in John Durrant & Jane Gregory (eds.) *Science and Culture in Europe*. London: Science Museum 1993, pp. 187-193.

produce newsletters for both internal information and external promotion of the image and profile of their university or college. The quality of these newsletters and university tabloids is somewhat sketchy. They serve primarily as an information source for university employees but do have a wider circulation, most notably to students and major news media.

The Swedish Association for Science Journalism was established in 1972, at the same time as the introduction of the 'sectorial principle'.[252] The Association's purpose today is to facilitate open but critical science journalism regarding the impact of science on society. Furthermore, it facilitates collaboration between members and pursues discussions relating to professional ethics. Also of importance is the promotion of international co-operation. To this end the Association is a member of the European Union of Science Journalists' Associations (EUSJA). The Swedish Association, which had 135 members by 2000, organises science journalists from the media, as well as informateurs at the universities, colleges and public agencies. Since the mid-1990s, together with the Institute for Future Studies and the Science Radio station (public service), the Association has organised recurrent annual meetings. These meetings constitute one of the very few fora in Sweden at present where representatives from research on popular science (often international guest speakers), journalists and natural scientists can meet and exchange ideas, experiences and opinions. The meetings are normally held in a large auditorium. They draw a huge crowd, consisting mostly of mainstream journalists, although many of those attending only have a slight interest in the research angle. The meetings have, of course, served the purpose of promoting the research angle among other journalists. The association also produces a newsletter called Ugglan (The Owl).

Another important Swedish policy episode affecting the representation of science in the media was the referendum on nuclear power held in 1980. Due to this debate, several of Sweden's larger daily newspapers established editorial teams and feature pages on science in the late 1970s and early 1980s. However, due to falling advertisement revenues and circulation in the 1990s, some of these initiatives have now disappeared, whilst some publications cover science as they would any other possible newsworthy subject.

Sweden's three largest morning dailies (Dagens Nyheter, Svenska Dagbladet and Göteborgs-Posten) all employ editorial staffs concentrating on science as both a news and feature domain. Almost all of Sweden's morning papers have cultural pages covering literature, art and they act as a forum for cultural criticism. They also

[252] The sectorial principle meant that efforts must be pursued to inform a wider audience about the existence of different kind of research and making it accessible particularly to various user categories. See Elzinga, A, 1980, "Science Policy in Sweden: Sectorisation and Adjustment to Crisis", *Research Policy,* vol 9, no 7, April, p 116-146; 1990. The sectoral councils combine criteria of societal relevance and scientific excellence in their review procedures. In some cases the former dominate over the latter, in other cases the two-tier approach starts with scientific merit. Of course there has been a lot of debate around these procedures, they may be compared to the notion of "extended peer review".

frequently include research in the humanities. The highest proportion of PhD holders in the Swedish press is probably to be found in the editorial staff and freelance writers from cultural sections.

As such, Swedish tabloids often include cultural pages but lack special sections focusing on science. However, most tabloids include special magazines, most notably on Sundays, featuring research results on popular topics such as health, nutrition, beauty, lifestyles and psychology. These articles are written and graphically packaged in a very popular form. Scientific results are redressed by journalists who often know very little by way of research and its background. Nevertheless, these articles have a very large readership. Two additional aspects of these kinds of articles are worthy of note. Firstly, while some research material is featured in two-three pages, it is just as common to see results condensed to a few lines and displayed almost as an object of curiosity. Secondly, scientific knowledge is often placed adjacent to knowledge from other professions and even beside articles from the 'New Age' sphere.

Recently a new publication devoted to science has been created. It is called Dagens forskning (Science Today) and is published on a fortnightly basis. Its editorial staff was recruited from other newspapers and magazines focusing on science; in addition, several scientists are involved as resource personnel. The economic base for Dagens forskning is surprisingly sound: two main financiers (Riksbankens Jubileumsfond [The Bank of Sweden's Tercentenary Foundation] and the publishing house/foundation Natur & Kultur [Nature & Culture]) have injected a combined 20 million SEK into the project. With some other financiers, the overall start capital is well above 30 million. As such, a beneficial consequence of this is that the paper does not actually need to generate an economic profit during its first five years after establishment. It is worth mentioning here that it is common in Sweden to subsidise cultural products of high quality, in order for them to compete favourably with sheer commercial publications.[253]

Another example of this system is the creation of the high quality popular science magazine *Forskning och framsteg* (Research and Progress, 1966-) in the mid-60s. Several sectorial councils supported the establishment of a foundation, which has financed the journal ever since.[254] However, it is very much independent and has a readership of about 50,000 for each of its 8 yearly issues. This would enable it to be solvent even without the money from the Foundation. Still, this extra money enables the journal to put together a product without advertisements, which further ensures independence and integrity. Many of Sweden's most noted science journalists are on the staff of this journal and articles are either written solely by these or in collaboration

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253 See Johan Berggren (2002) "Tung lärdom på modet", *Dagens Nyheter* (9th of February 2002), p. B04. See also Resumé, 17th of January 2002, p. 8. *Dagens forskning* can be found at www.dagensforskning.se.

254 The Foundation is supported by several sectoral councils, but also among other the Humanities and Social Sciences Research Council (HSFR), the Medical Research Council (MFR), the Social Science Research Council (SFR), the Engineerings Sciences Research Council (TFR), and the Royal Academy of Sciences.

with a researcher. In the latter case a process starts with the researcher producing an article in as populist a form as s/he can muster. This is usually not sufficient and the journalist thereafter rewrites the article and feeds it back to the original author who will then perform a further rewrite. In fact, articles from this journal often carry some weight within academia, despite their popular form. As it is serious and research driven, many researchers read it in order to keep up with research fields other than their own in order to maintain a general scientific literacy.

Apart from this very important initiative, Sweden had its commercial boom of popular science magazines in the beginning of the 1980s. Again in the mid 1990s there was a rise in publications of this kind. Some of the earlier magazines were rather short lived, for instance: Populärvetenskap – Rymd, medicin, teknik, framtid (Popular science – Space, medicine, technology, future, 1982-83), Teknikmagasinet: Populärvetenskap, äventyr, science fiction, rymd, data (The Technology Magazine: Popular science, adventure, science fiction, space, computers, 1983-86) and Vetenskap för alla: Populärvetenskapligt magasin (Science for all: Popular science magazine, 1985-87).

Illustrerad vetenskap (Illustrated science, 1984-) which boasts a circulation of around 140,000 is the most widely read popular science magazine in Sweden at present and indeed seems to proliferate. Illustrerad vetenskap presents science stressing visual representations and sometimes features archaeology and social anthropology. In a slight contrast to this publication stands Teknik och vetenskap (Technology and science, 1985-) issued by Chalmers University of Technology in Göteborg together with a commercial publishing firm. Like Forskning & framsteg this publication is research driven and researchers read it in order to keep up with other research fields. With a circulation of 13,700 it aims to reach technicians, civil engineers and decision-makers in trade and industry.

The journal Tvärsnitt (1979- Crosscuts) is an example of a PUS-initiative from a cultural angle. The journal is funded through the Humanities and Social Sciences Research Council (HSFR) and has a circulation of approximately 5,000. Its successive editors have come from the field of the history of ideas and science, a discipline which has a special Swedish tradition, and enjoys widespread popularity when it comes to cultivating the national heritage of learning. Several scholars in the history of ideas and science are also active in research on the popularisation of science in Sweden, e.g., Kjell Jonsson, former editor of Tvärsnitt, Gunnar Eriksson (former Chair of Department of History of Ideas and Learning, Uppsala University), and others.

Tvärsnitt features articles mostly from the realm of the humanities and social sciences, but recently began to feature science and technology studies in a broader sense. The ambition is explicitly to contribute to a greater cultural and civic public understanding of contemporary scientific theories, research and debate.

A new journal in the same mould, Axess (Access), was established in early 2002. It is financed by the Ax:son Johnsonstiftelsen (The Ax:son Johnson Foundation), and its objective is to disseminate research results in the humanities and social sciences. This, it is claimed, will create opportunities for friendly relations between science, society and industry.[255] The journal features sections devoted to news, reviews, debate and in-depth essays.

Populär arkeologi (Popular archaeology, 1983-) is an example of another research driven publication with both cultural and civic ambitions. Civic ambitions are represented in debates and articles emphasising the societal function of archaeology in connection with issues such as peace, democracy, civilisation critique, etc. Articles are written by professional archaeologists presenting projects and relating them to the research front. As with Forskning & framsteg, the editorial staff rewrites articles and subsequently feeds them back to the original author who will then rewrite. With a circulation of 4,500 the magazine functions as a source of information for professional archaeologists both in and outside academia, but is for the most part intended in style and form for the greater public. The articles featured in Populär arkeologi often stress prehistoric production and technology together with new methods in archaeology, in particular those drawn from the natural sciences.

The beginning of the 1990s saw, to an extent, a resurgence in popular science magazines in Sweden. For instance Fakta: Om natur, geografi, kultur och forskning (Facts: Nature, geography, culture and research) replacing Vetenskap för alla from the earlier period, Populär historia (Popular history), Månadsmagasinet Lexicon (Monthly Lexicon), Populär vetenskap: Månadstidning om teknik, vetenskap och forskning (Popular science: Monthly issues on technology, science and research) and Facts & fenomen (Facts & phenomena). Whilst some of these publications experienced desirable circulation figures at their outset (Facts & fenomen, 49,400 in 1996 and Populär vetenskap 30,000 the same year) only Populär historia survived beyond 1997. Populär historia (Popular history, 1991-) has a circulation of around 22,000 for its bi-monthly issues and is well supplied by texts from eminent historians based at Swedish universities.

The Royal Swedish Academy of Sciences (perhaps best known for awarding the Nobel prizes in physics and chemistry) publishes a newsletter Akademin anser (According to the academy) where prominent members of the academy discuss the scientific aspects of important societal problems. The academy has a long tradition (the oldest in Sweden according to some) in PUS with a focus on the practical side of science. By 1741 the Grundregler (Ground rules) already stated that as soon as a research result 'matured' it should be brought to the attention of the public.[256]

In addition to the above, The Royal Swedish Academy of Engineering Science also publishes a newsletter (*IVA-Aktuellt*). This features a practical public understanding

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[255] See http://www.axess.se. See also Thord Eriksson (2002) "Axess ger access till humaniora" [Axess give Access to the Humanities], Dagens Nyheter (25th of January 2002), p. B01.

[256] Kärnfelt, J, 2000, *Mellan nytta och nöje*. (Between utility and pleasure) Diss: Institutionen för idé- och lärdomshistoria, p 70.

with a focus on engineering and economics. Furthermore, *Ny teknik* (New Technology) is a journal owned by the associations of civil engineers and engineers. It has a very wide circulation (approx. 135,000) which is spread among professionals from many different fields, but with a background in Engineering.

Labour unions have a strong standing in Swedish society. Almost every Swedish union has its own magazine where scientific results often in the form of a (practical) base for the profession are presented. A current example is the professionalization via science of teachers and earlier examples are the similar professionalisation exercises for social workers and journalists.

Popular science books in Sweden appear to be somewhat out of fashion at present. Except for translations of mostly English and North American best sellers, Swedish writers in this tradition are currently few; Peter Nilson (Astronomy), and Georg Klein (Cancer research) are the best known examples. With regard to children's books the situation is somewhat different, whereby publishing houses are more willing to publish 'science for kids' as this is seen as an important commercial area to exploit for Swedish publishers.[257]

Reviews and comments on this kind of literature have not been particularly abundant on the cultural pages in the press. However, Sweden has since the late 1980s experienced a boom in popular history, starting with historian Peter Englund's Poltava – The defeat of an army (Poltava - Berättelsen om en armés undergång) in 1988. Englund has since written a number of books and has also been active in cultural journalism where he is currently connected to the daily Dagens Nyheter. In connection with the boom of popular history, Sweden had its own modest version of a science war. Well-known journalist Herman Lindquist wrote several books and was featured in a series of documentaries (1993-1995) on Swedish public television under the title Hermans historia (Herman's History). Following Lindquists first book a rather hectic discussion on his (outdated) perspective of Swedish history – which his opponents sometimes characterised as reducing history to important personalities and events – engaged professional historians (among them Peter Englund) on the cultural pages of Dagens Nyheter.

One book, which gained short-lived but intense attention in the 1990s, was written by the linguist Sven Öhman who has a background in science. His book entitled Svindlande perspektiv[258] (Dizzying perspectives: 1993) prompted a series of debate articles in the cultural pages of major national newspapers. One of Öhman's most prominent and most discussed theses is that popularisation can be or indeed is dangerous – it seduces the reader into believing that s/he knows something when that is not really the case. Popularisation is dangerous because it erodes ordinary people's

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[257] See for instance the books by astronomer Marie Rådbo, 1998, *Runt i rymden* (Around in space), Opals förlag, Stockholm; 1996, *Rymdens gåtor* (Enigmas of space), Opals förlag, Stockholm.

[258] In Swedish the word *svindlande* also means cheating.

common healthy anchorage in the world of everyday reality around them, a world they have no problem navigating in normal situations. What popularisation of science can do, says Öhman, is to destroy this sense of certainty, forcing people to take seriously the fact that their understanding and life experience actually does not rest on the solid ground that it is often claimed to do, thus removing the seemingly secure basis for taking a position on fundamental questions.[259]

The 1980s saw the advent of commercial TV and radio in Sweden, which subsequently boomed. The Swedish based commercial channels occasionally take up science. Now, an array of channels is available via satellite which offer many popular science programs (Discovery etc). Sweden is a country of nature romantics, as such nature and wildlife programming has a strong tradition in both TV and radio. Almost all of the Swedish based commercial channels have regular programmes on nature and wildlife. Occasionally foreign produced programmes on science are broadcast, with higher production values. Commercial radio in Sweden has so far not included any initiatives concerning PUS. However one commercial radio station is collaborating with the arrangers of The Göteborg International Science Festival for shorter feature reports during the event.

Public service television and particularly radio in Sweden have a long tradition in PUS.[260] Beginning in 1949 and developing during the 1970s and in the late 1990s, Swedish public service radio (SR) now boasts an extensive editorial staff and several programs (news and features) covering the humanities, social and natural sciences and medicine.

Swedish public service TV (SvT) started covering science in 1971, but already by the late fifties, progress in technology was regularly featured on Tekniskt magasin (Technology magazine). The programme Vetenskapens värld (The world of knowledge) on SVT1 has since made feature-length programmes often jointly produced with TV-companies in England and the USA. “Nova” on SVT2, which has a more news oriented perspective on science started in 1994. In 1995 Hjärnkontoret (Upper storey) on SVT1 was launched. This programme presents science for schoolchildren often followed up with discussions and question and answer sessions with scientists online.

Swedish public service network also broadcasts educational programmes both on TV and in the radio, often in collaboration with the universities. Recently some of the universities have started broadcasting lectures on TV, sometimes as part of distance education programmes. With the onset of digital TV, a new commercial knowledge channel (K–World) has been created featuring high-quality programmes specifically

259 Öhman, S, 1993, Svindlande perspektiv, Stockholm: Wahlström & Widstrand, s 160
260 Nordberg, K, 1998, *Folkhemmets röst: Radion som folkbildare 1925–1950.* (The voice of the people) Eslöv: Symposion.

pertaining to science and culture. However, due to severe financial problems, this channel had unfortunately closed down by the beginning of 2002.

Internet and PUS in Sweden

The following section analyses how Internet is used in different Swedish PUS efforts. As most initiatives of PUS use the Internet in one capacity or another, many aspects have been discussed elsewhere. The objective here is to take an overall look at how Internet is employed in both traditional and newer PUS efforts.

Internet: some general remarks

Sweden has one of the highest percentages of Internet users in the world. According to a new study by the Central Bureau of Statistics (*Statistiska centralbyrån*), 76 % of the Swedish population uses Internet either at work or home. Elderly people use it less while younger people form a higher percentage.[261] According to comparative statistics, Swedish Internet usage scores twice the European average.[262] This means that the Internet is a very important forum when trying to reach people with regard to different PUS efforts.

Specific initiatives: funding agencies, the press and museums

On the Internet we find most dailies, tabloids, magazines, newsletters and several of the institutions behind them. The initiatives of different governmental or state institutions can be seen as a consequence of the traditional ideas of democracy, transparency, and scientific knowledge.[263] In addition to offering original information, these kinds of efforts often function as a navigation tool to other information resources for the public, administrators and practitioners. For instance *Forskningsrådsnämnden* (the Council for Planning and Co-ordination of Research (FRN)) was established early on the Internet with an extensive web site and the on-line newsletter *Vetskap* (Knowing). Today the Swedish system of research funding has undergone great changes, but the successor of the old funding agencies – *Vetenskapsrådet* (The Science Council) –also has a comprehensive web page. It features a news service as well as a section for research information and a specific division for contacts with the press.[264]

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[261] See http://www.scb.se/press/press2002/p022.asp. This investigation was executed in September of 2001.
[262] Figures from database ”Ditt land och ditt liv” (Your country and your life) created and controlled by Forskningsgruppen för samhälls- och informationsstudier (The researchgroup for societal and information issues). These figures are not to find in any public report, but made accessible on request.
[263] See the section of the Swedish policy context.
[264] See http://www.vetenskapsradet.se.

In addition, the Swedish government pursues an active IT policy in several areas. At the end of 1996, the Government assigned Högskoleverket (the National Agency for Higher Education) to co-ordinate a national system for disseminating research information on the Internet. The project resulted in SAFARI. This Swedish acronym translates as "the spreading of research information to the general public over the Internet".

The system aims at supporting groups like journalists, upper secondary school students, firms and other organisations, to find information from research throughout the whole of Sweden at a single source. The Agency (Högskoleverket) is responsible for developing and maintaining the system and universities; other research organisations are responsible for the information input.

On the local or regional level, municipal and city authorities have also developed methods to supply the public and practitioners with information on scientific knowledge and findings. A general feature of efforts of this kind is a focus upon specific questions. A good example is *Kunskapskällar'n* (The Cellar of Knowledge) in Göteborg.[265] Its focus is on problems of drugs and alcohol; the objective is to offer practitioners, students, public administration, and volunteer organisations with information resources on these matters. The web page features news, a debate forum, and links to other information resources. In addition to its web engagement, *Kunskapskällar'n* also organizes seminars and produces and supplies information material (such as books, movies and brochures).

Swedish museums, both new and old, are usually represented on the Internet. An objective of this is of course to attract visitors but many of them have very comprehensive presentations of their areas of science. An example of this is the *Naturhistoriska riksmuseet* (The National Museum of Natural History). In addition to a presentation of the collections, they offer in-depth information resources regarding animals, planets and the environment as well as introductions to the areas in which the museum pursues research (e.g. biology, geology and palaeontology).[266] For the new science centre *Universeum* in Göteborg, it is a natural step to also have an Internet page. In addition to giving information about the centre, it presents all of the physical sections of the centre, though not as thoroughly as traditional museums do.[267]

Private actors are also frequently represented on the Internet. Daily newspapers featuring a scientific section more often than not also have these sections published on the Net.[268] This is also the case with popular science magazines, such as *Forskning och Framsteg* (Research and Progress)[269] and *Illustrerad vetenskap* (Illustrated

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[265] See http://www.kunskapskallarn.goteborg.se.
[266] See http://www.nrm.se.
[267] See http://www.universeum.se.
[268] See for example www.SvD.se and www.dn.se.
[269] The Internet edition of *Forskning och Framsteg* has grown rapidly. At the end of 2001, the web page had more than 1000 visitors a day.

Science)[270]. Magazines with a focus on the social science and the humanities, such as *Tvärsnitt* (Crosscuts) and *Glänta* (Glade), are also represented on the Net.[271] In this area we also find a publication that only uses the Internet as forum: *Alba* (www.alba.nu). The magazine was launched in 1997, publishes about seven issues a year, and by the beginning of 2002 had over 3,000 visitors a week.

Because of the growth of the Internet, several other actors also find it an interesting and valuable medium to utilise. Even the highly traditional Nobel Foundation has opened a web page. (www.nobel.se). It features information about the Nobel Prizes and the prize-winners, and publishes various texts authored by laureates. In addition, there are sections containing educational material of the scientific disciplines that have a Nobel Price (such as medicine, chemistry, and physics). The usage statistics of the web page are very impressive: from about 1 million in 1995-96, the total number of hits (number of documents opened) has reached close to 240 million in 2001.[272] This figure not only reflects the efforts put into producing a high quality Internet resource, but also the strengths of the Nobel trademark. Mainly, the visitors come from educational sectors in the United States, Western Europe and Japan.

While there is a great deal of Internet activity of PUS-actors, the general impression of PUS efforts on the Internet is that the quality level is uneven. Some have very ample presentations and a variety of features, while some have just the most basic characteristics. Another conclusion is that there is surprisingly little interactivity in these sites, a frequent observation is that the web pages are quite traditional. In some cases, however, there are fora for debate and personal contact.

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[270] See http://www.illustreradvetenskap.com.
[271] See http://www.ssp.nu/tvarsnitt resp. www.glanta.org.
[272] See http://www.nobel.se/about/visitors/index.html.

Media and New Media in the UK: PUS in print, on the airwaves and on-line

Josephine Anne Stein, Damian White

Introduction

In many respects, the UK could be viewed as a media saturated society. The UK public has access to two state run terrestrial television stations (BBC1 and BBC2), three independent terrestrial channels (ITV, Channel Four, Channel Five) and now up to 120 additional channels available through cable/satellite and digital services. Radio comprises five BBC radio stations and numerous independent stations. Almost all households own a television receiving terrestrial channels (98%) and in 2000-2001, 45% of households had access to non terrestrial television. Between 87% and 89% of adults listen to the radio regularly (Social Trends 2002).

The Internet has become increasingly important as a site of engagement between science and its publics in the UK. Significant opportunities clearly exist to greatly expand public access to scientific information through web sites and web based information systems; significant challenges are also apparent in achieving truly widespread access throughout British society.

Government statistics show that more that two fifths of UK households own a personal computer in 2000-2001 compared to only 13% in 1985 (Social Trends, 2002). According to national statistics 40%-45% of residential homes are connected to the Internet (Oftel, 2002). However, class, gender and age variables significantly influence ownership patterns of computers and access to the Internet.

Access to the Internet may improve. The present UK government is committed to challenging the "digital divide", for example through a £200 million programme launched in 2000 to network public libraries. However, as Thomas and Wyatt (2000) observe, patterns of Internet use reveal that many assumptions about growth in usage and diffusion of access throughout all segments of society are demonstrably incorrect, and that the evolution of the Internet may exacerbate the "digital divide" without sustained and significant public intervention. Similar arguments can be extended to the use of digital television as a future vehicle for PUS and participatory democracy. Nevertheless, the extent to which connectivity has been prioritised by UK government at all levels, and by the British “PUS Industry”, makes this form of science communication one of the more dynamic, innovative and increasingly significant elements of PUS and democratic engagement in the UK.

Science in the print and broadcast media

Market research suggests that national newspapers, TV documentaries and current affairs programmes are the UK public's main sources of information about science (MORI 2000:23). Research carried out in 1997 suggested that 34 million people, (60% of UK population) watch or listen to some science programmes (House of Lords, 2000:90). The media thus is properly seen as a major place of interaction between science and the public. However, the extent to which the UK media constructively contributes to the public understanding of science, or is increasingly guilty of generating hysteria and moral panics, has become controversial.

From 1998 through to March 1999, BBC Science produced a total of 475 hours of science programming. This broke down into 235 hours for television, 97 hours for radio and 143 hours for the BBC World Service. (House of Lords, 2000:90). BBC Science currently employs over 329 staff, of whom over 84% of the researchers and over 70% of the producers and senior broadcast journals are science graduates (House of Lords, 2000:90).

Print media

The UK presently has eleven national daily newspapers which in 2000/1 were read by 53% of the population (down from 60% 1993/1994) (Social Trends, 2002). They are traditionally divided into the tabloids (The Sun, The Mirror, The Star, The Daily Mail, The Daily Express) and the ‘quality’ or broadsheet newspapers (The Times, The Telegraph, The Guardian, The Financial Times, The Independent). 12% of the population read a quality or broadsheet newspaper. Every broadsheet newspaper now has a science page and a science correspondents. In addition, two ‘middle market’ tabloids have science correspondents.

All the major current affairs weekly magazines in the UK (The Economist, The New Statesman, The Spectator) have science correspondents or regular contributions from scientists and science writers. New Scientist is the leading weekly magazine serving the UK science community, selling over 130,000 copies a week. In addition, the UK has a range of magazines which cover science related affairs in a more generalist/populist fashion from ‘The Ecologist’ (which focuses on environmental issues and philosophy) to ‘Focus’ (a futurology/new technology popular magazine).

Radio

From the early days of the BBC, science popularisation was viewed as an integral part of its public information role. From the Second World War onwards, state concerns about health and nutrition were particularly significant in shaping the initial development of BBC Radio science (Gregory and Miller 1998:34). From 1942 onwards, a 'Radio

Doctor' gave advice on diet and health to wartime populations coping with bombing, dislocation and rationing (Gregory and Miller 1998: 34). Radio coverage of scientific topics broaden considerably in the 1950's. The British cosmologist Fred Hoyle gave radio talks on 'The Nature of the Universe' which were extremely popular (Gregory and Miller, 1998:37).

Since the 1960's and up to the present, BBC Radio Four has continued to be an influential medium for science information and for some degree of science-public engagement. Important science popularisation series that have run over recent years include the BBC Radio Four weekly programme on environmental concerns 'Costing the Earth'. The history of science has also been discussed at length on BBC Radio programmes such as 'In these Times', while an acclaimed radio programme 'Standing on the Shoulders of Giants' provided an overview of great inventors and technologies.

At a more discursive level, the highly influential Radio Four ‘Today' programme (an early morning news and current affairs radio programme that frequently sets the news agenda for the day) gives coverage to science stories and has recently added a scientist to improve its coverage of science matters.

The BBC Radio Four weekly roundtable discussion programme 'Start the Week' is also a major bridge for the ‘two cultures’. This programme regularly brings together leading figures in the natural sciences, the social sciences, philosophers, ethicists, historians and assorted other academics to discuss their work and interact with each other.

Television

The first science programme television broadcast occurring in April 1948 (Gregory and Miller:41). 'Science Review', the first full length documentary screened in 1952 was watched by over 10% of the population. Over 20% of the British population watched 'Zoo Quest', the first natural history programme shown on the BBC. The BBC's astronomy programme 'The Sky at Night' began broadcasting in 1957 and is presently the longest running program in the history of television.

All the major terrestrial channels have science reporters for their news shows. Generalist current affairs programmes such as the BBC’s Panorama or Newsnight also cover science from a social or political angle where relevant.

Further contemporary science programming which would deserve mention include 'Horizon' - in many senses the BBC's flagship science programme, broadcasting since 1964 (attracting audiences up to 5 million), 'Tomorrow's World' a programme primarily concern with 'future inventions' but containing some scientific content and the variously titled natural history programmes made by David Attenborough and his colleagues. Recently the BBC has also shown a range of series: ‘The Human Body’, ‘Earth Story’ and ‘The Planets’ at peak time. The BBC has also provided science programming for children in the area of zoology, natural history and mathematics.

Of the independent TV channels in the UK Channel Four probably makes the most substantive contribution to science programming, providing an estimated 100 hours of Science programming a year. (House of Lords, 2000:91). Equinox is Channel Four's flagship science show. In 2000, it included films on germ warfare, the Swedish sterilisation/eugenics programme, risk and risk consciousness, and digital convergence. Channel Four also runs a wide variety of 'one-off' forms of science programming e.g.: 'The Baby Makers' provided a history of *in vitro* fertilisation and 'Body Story,' a six part series on the human body.

With the spread of cable and satellite television, science programming has been greatly extended in the UK. The launch of the 'National Geographic Channel' and the 'Discovery Channel' has been particularly important here in establishing TV channels solely dedicated to showing science and technology-related programming.

Science on-line: self publication, self promotion

There are now so many Websites with science-related information that the Wellcome Trust Information Service operates a service that vets and catalogues relevant Internet Resources. It offers guidance to the public on how to assess the reliability of scientific information posted on the Web, and makes its own catalogue available through a searchable database known as *p*UBLIC **sci**ENCE **com**MUNICATION[273]. PSciCom also includes a calendar of events, online bibliographies, links to associated e-mail discussions, information on science communication courses, a directory of sources of funding for key reports and documents, and information on surveys and opinion polls on the public understanding of science.

ScienceNet[274] describes itself as a "one-stop science site". It provides access to ScienceLine, a free enquiry service for the public which answers scientific questions via a panel of scientists. It also provides access to its own database of science questions; a section on careers in science which includes interviews with famous scientists; and an area giving up-to-date news from the science research world.

OMNI (Organising Medical Networked Information)[275], created by the University of Nottingham Greenfield Medical Library, evaluates Internet resources in health and medicine. It is an electronic gateway aimed at students, researchers, academics and practitioners in the health and medical sciences rather than members of the general public. In contrast, Patient UK[276] is provided by two doctors (General Practitioners) from Newcastle Upon Tyne with the intention to direct non-medical people in the UK to

273 http://omni.ac.uk/psci-com/
274 http://www.sciencenet.org.uk/scienceline/index.html
275 http://omni.ac.uk/
276 http://www.patient.co.uk/

good quality web sites about health related issues. Health and illness-related databases are reviewed and links are added to a searchable database.
Boxminds online educational website[277] is a subscription-based service which provides video e-lectures by leading British academics such as Prof. Richard Dawkins and Prof. Susan Greenfield.

BBC Science Online

The BBC's Science Online website[278] has become an increasingly popular vehicle for science communication. Broadcast of its URL now regularly follows BBC television and radio science programmes. BBC Science Online has facilitated Internet dialogues on science based topics; leading scientific experts that have appeared in television programmes have subsequently made themselves available to answer e-mail questions from the public on this site. The BBC's on-line 'answer back' site also provides a page called 'BBC Listens' where viewers and listeners are encouraged to give their points of view about science coverage. 'BBC Science Shack'[279] provides a forum for children where questions can be submitted in four areas: everyday science, techno files, physical world and the natural world. The web site also contains a multimedia section with answers given via video, interviews, 360 degree picture and web cams. 'What's on ... Science" provides a guide to science seminars, demonstrations and exhibitions occurring in all areas of Britain.

Science Journalism

Journalism differs from self-publication in several important ways. It is either a public service (*e.g.* the BBC), a private sector industry with a profit/loss “bottom line” (*e.g.* newspapers and magazines), or a hybrid (the broadcast industry in the UK is heavily regulated by the public sector). Journalists, being independent from the scientific enterprise, can in theory investigate, analyse and interpret scientific discoveries, events, trends and “people behind the science” human interest matters, reporting their stories to the public, their customer base. As we explain below, they can and often do engage in controversial topics, for a combination of scientific, public service and commercial reasons.
So far, internet-based PUS is overwhelmingly seen as a public service, although regulation of content is in legal terms in its infancy. It is used as a vehicle of the “PUS Movement”, with the purpose of promoting science rather than as a commercial

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277 http://www.boxmind.com/
278 http://www.bbc.co.uk/science/
279 http://www.bbc.co.uk/science/scienceshack/

venture. Science journalism, for now, remains a preserve of the print and broadcast media.

Print media

Bauer et al's (1995) four volume quantitative study of Science and Technology coverage in the British press found that front page science in the UK has declined since its post war peak in 1952. Bauer et al argued that two phases could be discerned, the first of which was between 1950-1965 in which the coverage of science was 'positive and celebratory'. In a second phase, between 1965-1990, the overall tone was 'negative and critical' (Bauer, 2002:8) and a discourse of risk increases sharply. There has also been a shift away from the physical and towards the social and bio-medical sciences. Tendencies were also found by Bauer et al (1995) to celebrate national rather than international achievements.

The House of Lords Select Committee on S&T (2000) found that popular science journalism is currently 'thriving' in the UK, based on observations that over the last decade the number of science correspondents in the general press has risen. However, the House of Lords also cites a report commissioned by the Scottish Science Trust that notes three leading French newspapers employed a total of seventeen science journalists while UK papers such as The Times, The Daily Telegraph and the Independent only had 10 science journalists between them. (House of Lords, 2000: 54). Hargreaves and Ferguson also argue that while the would appear to have been a growth in the number of science journalists (membership of the Association of Science Writers has risen form 50 to 600 between 1950 and the present, there has not been a marked increase in science staff in the last decade.

Broadcast media: science, drama and quality

In the UK, science-related television broadcasting can attract very large audiences. Wildlife programming and a very successful fictionalised wildlife programme, "Walking with Dinosaurs", earn significant amounts of money for the BBC, primarily through exports. Recent BBC series on The Planets, The Human Body and Earth Story achieved very high audiences. Hardcover books that accompanied The Planets and Earth Story both reached number one on the best seller list.

For the most part, the BBC's programming is highly respected, managing to maintain a high degree of serious scientific content, accessibility and excellence. However, these programmes can be as much about entertainment as they are about education, in some cases making little attempt to distinguish between science and drama. One of the BBC's flagship television programmes, Horizon, has as its slogan "Pure Science, Sheer Drama". However, this approach has attracted criticism; the BBC was accused of making excessive use of dramatic licence and speculation in its visual reconstructions in "Walking with Dinosaurs".

Criticisms have also been made against Channel Four’s Science coverage which has been accused of being sensationalist and inaccurate. A Channel Four Series entitled ‘Against Nature’ was widely criticised for its one-sided dismissal of environmental questions. Channel Four followed the showing of the final programme with a ‘Right to Reply’ debate. Environmentalists confronted prominent ecosceptics and debated the merits of the programme.

More generally, it has been argued by some (notably Nobel Prize winning chemist Harry Kroto) that science programming often leaves out much science since it is believed this would be too difficult for the public. Consequently Kroto (1999) argues that much science programming focuses on the uses of science rather than science itself.

Controversies about science programmes have opened up new spaces for dissenting voices. The interaction between science and the public through the traditional media has so far been largely one way. With new media technologies, opportunities are opening up for more interactive engagements between science and the public such as deliberative polling, which are discussed in more detail below. Firstly, though, we examine the relations between science and the media through the traditional media, and how public controversy is manifested and perceived.

Science-media relations in the UK

A concern first raised in the Bodmer report of 1985 has been the limited attention given to training scientists to use the media to communicate with the public. As a result, there has been some response from various bodies.

COPUS has provided:

- media workshops, schooling scientists in the art of media communication.
- fellowship schemes to ensure that scientists can work with the press (Gregory and Miller: 231).
- funds to allow speakers for the Women's Institute

COPUS and the Committee of Vice Chancellors and Principals (now "Universities UK") organised a conference in 1999 entitled "A Better Press For UK Science?" (see Roberts, 1999). Problems diagnosed as limiting more healthily science-society relations include a perceived cultural bias against science in the media, differences of time scales, priorities and objectives between scientists and journalists. Difficulties were also identified to get journalists to talk to the media with many UK scientists being much less willing to travel to give media interviews in comparison to US colleagues. Bad media experiences, a concern that popularisation was looked down upon by colleagues and possibly research councils was also identified as potential limiting problems.

In a more constructive light, it was also suggested that universities should ensure that ISDN lines are installed to enable on-site interviews and that press officers – as the key link between universities and the media could play a central role in developing a more positive outcome. As Roberts argues "Occasions that bring press officers, scientists and journalists together to share best practise and build networks offer one of the most positive ways forward".

Science, media and public controversy

The recent and current relationship between science and the UK media has been marked by 'bitter recriminations' according to Hargreaves and Ferguson (2000). Polling suggests that only one in ten of British scientists believe that recent coverage of BSE and GM food in the British press has clarified the general public's understanding of science (MORI, 2000: 31). This, as MORI notes, reflects ‘scientists low level of trust in the media to portray science accurately’ (MORI, 2000: 31).

A MORI poll conducted in 1999-2000 found that 35% of scientists interviewed identified the UK media as one of the greatest barriers to greater understanding of science amongst the public. Reflecting on the GM debate, Prime Minster Blair in 1999 stated the view that:

‘Parts of the media have conducted such an extraordinary campaign of distortion, its hard to know where to begin. Anyone who has dared to raise even the smallest hand in protest is accused of being either corrupt or Dr Strangelove’ (cited in Hargreaves and Ferguson, 2000).

As a result of this sense of discord, Professor Susan Greenfeld in her Millenium lecture in 1999 proposed ‘clear codes of practise ‘between scientists and journalists and the establishing of day long science updates reported in full to the public by the media’ (cited in Hargreaves and Ferguson, 2000:1). The Royal Society has followed through with a code of conduct for newspaper editors. In a parallel development, the Royal Institution has set up a Science Media Centre which will put approved experts in touch with journalists. The former development has been endorsed by the House of Lords Select Committee on Science and Technology who have recommended that the Press Complaints Commision adopt this measure. However, other critics remain less convinced. Wakeford (2001) has argued that such a code marks ‘the first time since World War II that the rights of free speech of scientists have been threatened’.

More generally, complaints have been raised about the portrayal of science in the media. Chaloner (1999) repeats a longstanding complaint of the scientific community by noting that persistent media images linger of scientists as mad, bad, socially inept, workaholic or otherwise dysfunctional, although some signs of improvement in this caricuture are recognised. Such work mirrors previous work by Jones who found 'the boffin' was the most common sterotype of scientists that could be found in post war British films between 1945-1970 (Jones, 1970).

The House of Lords report identified additional difficulties with science journalism in the UK, notably in a highly competitive market, there is a significant clash between the reporting of science and news values or the desire for 'a story'. Moreover, science stories which do not have significant dimensions of controversy in them are frequently ignored. Research conducted by Hansen (1994) has suggested that UK science reporters see themselves as journalists first and scientist writers second.

GM Food and the British media

While it has been argued that the GM issue has provided one of the best recent examples of the media operating in 'scaremonger' mode, academic research has suggested that more complex issues might be at play.

'The Great GM Food Debate' by John Durant and Nicola Lindsey provided a content analysis of 11 daily or national newspapers and four BBC radio outlets focusing on how the British press covered the GM food issue from February to June 1999. This report suggests that the idea the UK media invented or originated anxiety about GM food does not bear serious attention. The decision of certain UK newspapers (most notably the Daily Express) to adopt a campaigning role against GM food gave the debate 'its characteristically confrontational and even raucous qualities'. However, the conditions for an effective newspaper campaign was produced by the 'steady divergence after 1996 between government and industrial policy on GM food, on the one hand, and public opinion on the other' (Cited in Hargreaves and Ferguson:39).

Hargreaves and Fergusson also suggest that the GM food issue cannot simply be reduced to the UK media generating hysteria. Rather, the GM food issue can only be understood across a complex backdrop of issues which would include declining public trust, within the context of previous food scares and broader science and society questions such as that of nuclear power, changes in the media and changes in the balance of power more generally in the political world.

The Internet as a facilitator for PUS and democratic engagement

For the most part, the traditional (print and broadcast) media offer limited opportunity for public engagement, most commonly through letters from readers and interviews or discussion programmes on radio and television. It is predominantly conveying content to readers/viewers, while engaging in limited market research to hone its coverage to match demand. The internet provides a much greater capacity for two-way communication between science and the public.

The House of Lord's 'Science and Society' report argued that the Internet has numerous advantages for informing the public understanding of science, noting:

- The Internet has a large potential international reach
- Users are likely to be taxpayers
- User access is quick and convenient
- The Internet can be used for large scale polling.

The Lords also recognised though a number of disadvantages of the Internet as a medium for furthering PUS, notably:

- Actual research never actually reaches its potential
- Users are not representative of society
- There are many competing sights
- There is no check on the authenticity of material

That much of the quality of scientific material on the Internet material is highly variable has become a central area for concern. The House of Lords noted that peer review material often has to be purchased which can result in an advantage to material of lower quality. (House of Lords, 2000b: 31).

Electronic Consultation and Internet Dialogue

Some of the most interesting experiments in PUS/Internet engagements in the UK have occurred around 'electronic citizens juries' and cyberconferences. In 1996, an electronic consultation was set up by the UK advisory committee on genetic testing on its draft code of practise on over-the-counter genetic testing. This process was judged by Finney to be ‘partially successful’ in that it brought the draft code of practise to a greater range of individuals. Although the general public was encouraged to make an input, media coverage was disappointing and all responses came from health care professionals.

Other bodies have also experimented with Internet deliberation. The Nuffield Council on Bioethics in 1997 started an electronic consultation process to consider the ethical, social and legal implications of research into the genetics of mental disorders through electronic deliberation.

A consultancy "People Science & Policy" was set up in late 2000, to provide "support for science communication to improve relations between science and the public at local, national and international levels." It is placing an emphasis on its Website as a primary communications medium.

However, it is in the public sector that Internet consultation has become most prominent. The UK government is progressively putting more discussion documents online[280]. Between 1999 and 2000 POST (The Parliamentary Office of Science and Technology) with the Hansard Society organised two internet dialogues, on the Data Protection act and on The Experience of Women in Higher Education. Outside Westminster, the new regional assemblies are also developnig forms of electronic dialogue (see section on Government initiatives).

Under the banner "Have Your Say", the Prime Minister's office launched an Internet-based consultation on "Scientific Advice and Public Confidence" in November 2000. The home page of the Website invited public feedback as input to the development of a new Code of Practice that now applies to all scientific advisory bodies.

The 10 Downing Street Science forum Website provided links to some of the main S&T-related government departments and activities, and identified six specific issues for public feedback. One of these relates directly to PUS itself: "How do you think the risks and benefits in science and technology might best be communicated?"

The main stated objective of the exercise is in itself is a fitting encapsulation of the Government's attitudes towards public consultation and PUS itself:

> *"The Government wants your views on how science is handled. We want to know whether you are concerned about current developments in science and what you think about the ways that the risks are controlled."*

Electronic Citizens Juries

In 1997 the Buckingham Health Authority organised a citizens' jury on options for managing back pain (See Finney, 2000 for details). In association with the science museum, BHA decided to explore the potential for electronic citizens juries to function as complementary deliberative processes.

Work by Finney suggests that the results of this experiment was mixed. Gains of electronic juries in comparison to face to face juries were identified in terms of cheap costs and potentially broader participation. Limitations of this model though emerge from the fact that participants in electronic deliberative processes may incur telecommunications costs that in effect exclude some societal groups. Electronic consultation methods were not viewed as substitute for other type of consultation.

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[280] www.online.gov.uk

Finney has argued that electronic citizens juries can effectively supplement face-to-face citizen consultations. (Finney: 63).

Cyberconferences

The *First Global Cyberconference on Public Understanding of Science*, organised by Steve Fuller of the University of Durham with the support of the ESRC, ran from 25 February to 11 March 1988[281]. Thirty-five selected expert commentators from countries around the world were invited to make opening statements, after which the cyberconference was open for unmoderated electronic discussion. The conference attracted nearly 2000 hits from 35 countries on every continent (Fuller, 1998).

Although this was not so much a British as a global exercise, it does demonstrate an aspect of the leadership position that the UK has achieved in PUS research. The most interesting result to emerge from this exercise was the extent to which PUS is understood differently according to the cultures in which it is embedded. Although some have long regarded science itself as a cultural phenomenon, the cyberconference extended this idea to Public Understanding of Science as well.

The cultural character of PUS was also a feature of a subsequent cyberconference, but this time as an explicit expression of British culture. The British Council, an organisation that promotes British culture, commissioned a consultancy (River Path Associates) to run a six-week cyberconference *Towards a Democratic Science* in September - October 2000. The "e-conference", as the organisers called it, covered a different topic each week:

- Perceptions of science
- Risk and uncertainty
- The need for regulation
- Ethical responsibility
- Public consultation
- Consumer protection

and the results of each week's electronic discussions were summarised and posted to conference participants[282]. While neither the content of the conference nor the conclusions were particularly original or surprising, what is striking is how Public Understanding of Science has come to occupy such a central position in British life that the British Council should choose to organise such a conference.

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[281] www.dur.ac.uk/~dss0www1/

[282] www.mailbase.ac.uk/lists/democraticscience-all/files/volume1.htm; www.mailbase.ac.uk/lists/democraticscience-all/files/volume2.htm

Conclusion

Where traditional media have been relatively better at raising controversial science-related public issues than the on-line media, which are still predominantly used as self-published promotionalism, the traditional and the new media are in practice converging. The internet offers an admittedly imperfect but real possibility for contributing towards resolution or social closure of science-based controversy in the public sphere.

Whether use of the Internet in the UK will expand to the point that it will lead to improved public understanding of science, or new understanding of the public by scientists and government, remains to be seen. Whether it genuinely improves democratic processes for public "ownership" and "management" of science is an even more open question.

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CHAPTER 3.2.

Museums and Science Centres as Spaces for OPUS: Similarities and differences across Europe

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

1. Introduction

As science museums can be up to several centuries old, they are probably one of the most established and most important institutions of public understanding of science. Their long history make them prestigious, both nationally and internationally. Traditionally, museums have been a place where the public meets objects and ideas derived from science and scientific practice. However, museums and their role in society are undergoing changes: several institutional additions have been created in recent decades as well as transformations of already long established museums.

This chapter will review and discuss the role of museums and science centres within the public understanding of science. To be able to pin down and analyse these features, we will work with a number of themes throughout the chapter.

The first theme will discuss the question of effects on museums and science centres by cultural and regional policies. An important difference can be seen in different perspectives on the role and purpose of museums and science centres coming from conservative, liberal and social democratic politics. This also impinges on the subject of decentralisation and on the question of how policy areas are supposed to deal with these issues. The latter will, as we will see, have consequences on the development of museums, science centres and their role respectively.

Some countries have one dominating and prestigious institution on the scene of museums and science centres, some don't. The consequences of these differences will be discussed under a second theme called Dominating institutions.

A last and concluding theme will deal with current trends involving museums and science centres. Here we once again will highlight the question of decentralisation and will see that it is possible to talk of different kinds of decentralisation. This theme will also show how different institutions are adapting to a changing society and trying to cope with economic pressure and competition. Another part of this section will discuss the overall tendency to invest more in science centres than in what could be termed traditional museums.

Before commencing with these themes we will, however, discuss how different conceptualisations of science affect both our analytical work and the social scene of museum and science centres.

2. The Museums, Science Centres and Different Conceptualisations of Science

Science Museums and Science Centres

It is difficult to draw a clear distinction between the two institutions, science museums and science centres. Increasingly as museums have been modernised, the similarities between the two have increased. Some institutions embody characteristics of both. Basically, the science museum has been part of a museum tradition occupied with displaying artefacts as instruments of science or linked to the results of scientific work. Science centres are built on a much younger tradition, starting with Frank Oppenheimers *Exploratorium* in San Francisco established in 1969. Paradoxically, this science centre is now labelled a science museum. This clearly shows some of the problems of drawing a line between these two institutional forms. The focus of science centres is, however, on interaction rather than displaying. There is also a difference in the targeted audience, mainly children and youths. A third difference is that the museum plans a number of exhibitions with different themes, whereas the set-up of the science centres is usually more or less fixed.
The problem is made even more difficult by the conceptual device of “informal learning centres”, launched by James Bradburne as the future for science centres. These types of institutions would distinguish themselves from science centres by being more flexible, much more sophisticated when it comes to interaction and by contextualising scientific knowledge within societal conflicts.[283]

Anglo-Saxon “science” vs. German Wissenschaft

It is important to note that different countries have different conceptualisations of science. In the Anglo-Saxon world, science is traditionally associated with only the natural and physical sciences. Although important for cultural and political reasons, the humanities and the social sciences are not regarded as “real” sciences. Another definition of science can be seen in the German sphere. The concept of *Wissenschaft* incorporates not only the natural sciences, medicine, agriculture and engineering sciences, but also the humanities and social sciences as well as legal science and

[283] James Bradburne (1998) “Dinosaurs and White Elephants: the science centre in the twentieth century”, *Public Understanding of Science* vol. 7, pp. 237-253. Also see Per-Edwin Persson (1998) “Science centres are thriving and going strong”, *Public Understanding of Science* vol. 9, pp. 449-460.

theology. The broader German conceptualisation of science has influenced other countries around Europe; it is for instance present in Scandinavia, while others are more oriented towards the Anglo-Saxon definition.

This will have continuousness effects on how the scene of science museum and centres in different countries will be constituted. Consequences can be seen on two levels: one theoretical and one practical. First of all, what is considered as a "science museum" in the United Kingdom is still a "science museum" in the Swedish context, but what is regarded as a "science museum" in the Swedish context may not be regarded as such in the UK.

For example in the Austrian context folk and historical museums are seen as presenting academic knowledge – at least the scientific nature of the knowledge being presented there is stressed – however these museums are more associated with the sphere of culture than to science. Although, the German notion *Wissenschaft* comprises social sciences and humanities, when talking about science museums one thinks of "science" in the more narrow sense of English word *Science.* The different conceptualisations of science will thus have consequences for the selection of possible museums and science centres in this particular chapter.

Secondly, and presumably more important, these differences do have effects on the actual public understanding of science in the different countries. With a broader notion of science, the area of possible initiatives of PUS grows: not only museums of the hard sciences can be an instrument to reach and interact with the public, but an institution focusing on displaying – for example – ethnographic objects or even pictorial art can be considered an element of policies directed towards the public. A broad conceptualisation of science actually means that issues of PUS are possibly connected to every important societal issue within the public sphere.

As these two levels – the conceptual and the practical - are interdependent, we will try to reflect and make use of this in our analytical work.

Directly and indirectly research-based museums

Science is still regarded as something highly intellectual, something few people can exercise or even understand. This is something museums have contributed to. When analysing how the general public actually do get in touch with science and discussing methods of this interaction, this "high culture" obstacle may of course be a severe problem. The people you would most like to visit museums for educational purposes will probably be the hardest to get there. As a way to overcome this, museums need to carefully consider how they shall present themselves to the public.

Some museums choose to display themselves without an explicit reference to science. An example of this is *Världskulturmuseet* (The National Museum of World Cultures) in Göteborg, Sweden. A result of presenting the museum in this way, so to speak, without the header "Science", may be that people that normally would not go to a *scientific* museum are not excluded. Other examples are the Austrian *Haus der Natur* (House of Nature) and the *Haus des Meeres* (House of the Sea) that also avoid using the word "Science" in their headers in order to attract their dominant target groups, among them predominantly school children.

Other museums, like The Science Museum in London, are explicitly research-based in their presentation of social sciences and history. Although this may frighten some possible visitors, it certainly will lend credibility and prestige to the museum. This is possibly also attracting an audience, although perhaps different and smaller than with an implicit reference to science. As Eckstein and Feist note in relation to the UK museum scene, "museum visiting in the UK remains primarily a white/upper middle class pastime" (1992:77). A part of the explanation for this is probably found in the "high culture" connotation of the notion of Anglo-Saxon "science". Along a similar line for example the Natural History Museum in Vienna, would also underline besides its activity in exhibiting science its research work carried out, especially in the field of history of science and history of musealisation.

These two approaches are thus also connected to the different conceptualisations of science. A narrow definition of science, will lead to more explicit presentations of scientific museums: it is hard to present an exhibition of chemistry, astronomy etc., as something else but scientific. In relation to this definition, the discussion of populism would also be more acute. As a consequence of this, with a more inclusive conceptualisation of science, the possible methods of presenting the museum will be more flexible. However, flexibility is of course no guarantor to eliminate the possible high culture obstacle.

In addition, even with a more Anglo-Saxon conceptualisation of science it has still been possible to have exhibitions that contextualise science with mainstream cultural representations. Examples of this in the Science Museum in London, UK, are the exhibition on science in sport – a theme also taken up recently in the Technical Museum in Vienna – or the theme on James Bond for 2002.

An innovation in the Austrian science museums sector is the *ZOOM Kindermuseum* (Museum for Children) since this exhibition is explicitly desigend for children in order to offer them a location "where they can research, experience and learn in a playful way." [284] Additionally external experts and researchers have the posibility to initiate research projects that are carried out within the museum and thus will contribute their research results to the fields of didactic, pedagogic, media, technology and related topics. The research focuses on children's and adolescents' experience with technology and science in addition to the influences that the interaction with communication technologies have on visiting children. Thus the targeted audience is at the same time

[284] See on http://www.kindermuseum.at/main2.html

an object of research and the museum is not only a place where research products are mediated and presented to a specific public but also a location where research about the very target group is done. The *ZOOM Kindermuseum* is thereby an intermediate location between a knowledge producing space – about children and their education – and a knowledge mediating space – targeting children.
Further, this can highlight so called conflicts of learning. This has to do with different perspectives on what science is as well as whom the public are. One vital issue is the debate discussing if museums can and should disseminate scientific knowledge and if this means a simplification or even a distortion of scientific facts and work. Important here is to which public the museums are directing their attention and if the museum is part of an institution where scientific research is undertaken. Further, this relates to the theoretical discussion in the literature of Public Understanding of Science and notions as "scientific literacy".

3. Cultural and regional policy

As museum and science centres are publicly or sometimes semipublicly financed institutions, the political landscape inevitably will frame and shape where and how these institutions appear. The roles prescribed and presumptions associated with museums and science centres under divergent political ideologies are examples of this. It is possible to see three different policy areas that are active in shaping the scene of museums and science centres: 1) regional, 2) science and technology, and 3) cultural policies. The relations between these spheres of politics are not simple but are often competing. In discussing this, we will focus on three countries: Belgium, Sweden and the UK.
Up to 1995 the only well known science museum in Belgium was the Natural Science Museum in Brussels. It was the only federal institution devoted to scientific culture in the country. Since then several science centres have been created: The Park of Science Adventures (PASS), located nears Mons, is a project supported by DGTRE, the regional Ministry for Research and Technology, and is financed by the European structural funds. It has received 16 million Euro from the European Fund for Regional Development (FEDER) and 5 million Euro from the European Social Fund (FSE). PASS expects as many as 300,000 visitors a year and is primarily targeted at school children, students and teachers. In 1996 another science centre was created, this time in Parentville in a castle and park belonging to the Free University of Brussels (ULB). This centre also received funding from the European structural funds. A permanent section of Communication Space was sponsored by DGTRE, the regional ministry for research and technology. The centre is currently hosting the co-ordination of the European network of science museums ECSITE (European Collaborative of Science,

Industry and Technology Exhibitions). A third institution, the Technopolis in Mechelen, Antwerp, was created already in 1988 but was in 1997 turned into a science centre. The initial investment was made by the regional government of Flanders.

In Belgium, the regionalisation process of science and technology policy on the one hand and of the cultural policy on the other hand, did not develop at the same pace. The first steps of regionalisation of S&T started in 1984 and the process ended in 1993, while culture is regarded as a non-national matter since 1980. This long transition period was not likely to support new initiatives and new investments in areas of public understanding of science. The recent creation of new science centres was undertaken as an element of technology policy, in both Flanders and Wallonia.

The use of European structural funds and regional development funds was the best opportunity for the decentralised science centres. However, due to the bureaucracy of integration in pluri-annual planning, approval by the European Commission, and approval of complementary regional funds, this process is rather slow.[285]

In Sweden, museums have had a long tradition of support from the Ministry of Culture. With a context and history of considering science and popular knowledge as important to democracy and the cultural life of the citizens, the museums became a vital mean to reach the public with scientific knowledge. The inclusion of the museums under the Ministry of Culture implied a steady governmental support. Apart from the direct support, there also exists co-operations between various governmental bodies, different institutions and museums. An example of this was *Forskningsrådsnämnden* (The Swedish Council for Planning and Co-ordination of Research (FRN)), which with the recent structural change in the Swedish funding system was replaced by *Vetenskapsrådet* (The Science Council). In some projects, FRN tried to link different actors in the Swedish PUS landscape; this was the case with the national initiative of *Populärvetenskapens vecka* (The Week of Popular Science). The arrangement is localised at a different university each year working as a hub in an array of activities linking universities, local governments, businesses with museums and science centres.

Sweden has actively worked with museums as a tool of regional policy. As a result of this, all larger cities have a museum of their own.[286] In addition, all counties (*län*) have museums with different focus.[287] These are often mirroring some of the local features, in and around the city or county. Different kinds of Museums of Art and History are common throughout the country. In the university cities, more science-oriented museums are becoming an important element. An example of this is Gustavianium in Uppsala, established in 1677 and located in the oldest building owned by the

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[285] Another aspect of the Belgian example with the late development of science centres cannot be overlook: although Belgium did not have any science centre until 1996, the Belgian public had access to science centres in France, the Netherlands and Germany.

[286] For an example, see the City Museum of Norrköping, featuring exhibitions on the history of textiles and handicraft (http://www.norrkoping.se/stadsmuseet/).

[287] With a focus on cultural history and art, an example of a county museum is the one in Stockholm; see http://www.lansmuseum.a.se/.

university. The museum aims both at informing about the institutional history of the university and of the research performed within the university. Today, the museum features four permanent exhibitions; the first highlights the history of the university from 1477 to the present; the second exhibits anatomical and medical studies in the Anatomical Theatre of Gustavianium; the third is the Augsburg Art Cabinet, showing objects such as the thermometer of Celsius; the fourth is an exhibition of the antiquity and the Middle Ages in Sweden. In addition, the museum also has a space for temporary exhibitions.[288]

On the national level, there are a large number of museums specialising in some specific area. In addition to displaying their huge collections, they execute research in line of the featured area. Examples of this are *Nationalmuseum* (The National Museum), featuring both exhibitions of and research in art and art history; and *Naturhistoriska riksmuseet* (The National Museum of Natural History), displaying large collections of and exhibitions in biology and geology whilst also performing research in those areas.[289]

All these museums are a part of the broad political commitment of trying to educate the public. It also shows how deeply rooted the inclusive conceptualisation of science, with not only the natural but also the social sciences and the humanities, is in the cultural and political life in Sweden.

Continuing with the Swedish and Belgium cases, we can see how disparate political systems uses museums and science centres differently. Two trends can be identified. Firstly, there is one using museums as instruments to reach certain objectives of cultural policies. This instrumentalist perspective can be divided into two parts: one of strengthening cultural identity and integration, and one of adapting citizens to the knowledge society by making them more attuned to modern science and technology.

An example of the former can be found in the case of *Världskulturmuseet* (The National Museums of World Cultures), in Göteborg. Established in 1999, it is a state museum authority that groups together four museums with collections originating mainly from outside of Sweden and Europe. Three of the museums are located in Stockholm: The Museum of Far Eastern Antiquities, the Museum of Mediterranean and Near Eastern Antiquities, and the National Museum of Ethnography; and one in Göteborg: the Ethnographic Museum in Göteborg. The Museum of World Culture in itself is one of the largest museum projects in Sweden in recent years. The general mission of the National Museums of World Culture is to display, represent, and interpret the various cultures of the world. The museum authority strives to further the understanding of the world and humankind through cross-disciplinary scientific work, and through new forms of exhibits and public outreach activities, using a range of artistic, archaeological, ethnographic, historical, and other perspectives. The aim is to promote public

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[288] See http://www.gustavianum.uu.se.

[289] See http://www.nationalmuseum.se and http://www.nrm.se.

understanding and appreciation of different cultures, their history, as well as their interrelationships.[290]

Examples of the ambition to adapt citizens to the knowledge society can be found in the Belgian investments in science centres. Traditionally, the boundary between science and technology is more transient in a science museum. They are also more oriented towards modern findings of science. The PASS in Mons, for instance, includes a section called “Grebier des histoires” displaying the industrial past to the technological future. The Science Centre of Parentville will open a new permanent area devoted to biotechnology in 2004, and the Technopolis in Mechelen has as one of its missions to bring science and technology closer to the public. As science centres by nature also are more interactive, with ideas of learning by doing, than is usual in museums, the process of showing the possibilities and future developments of modern science and technology to the people will be more practical in its spirit. Large parts of these ideas are present in every science centres built in Europe and are probably a main explanation to the large investments in science centre in recent decades.

Against this trend of viewing museums and science centres instrumentally, there is a more conservative and neo-liberal perspective. This is perhaps most clearly evident in the example of UK and the policy change coming with New Labour.

Earlier, successive Conservative governments sought to reduce the dependency of museums on state funding, through gaining a bigger audience and charging entrance fees or through gaining sponsorship or offering corporate hospitality (Hooper-Greenill 1994; Hooper-Greenill 1996). Marketing managers were appointed during the 1980’s and museums were encouraged to brace themselves to engage with the cool winds of market forces. As Barry notes, what was deemed to be required is ‘a new recognition of the competitive character of the visitor business in addition to the older preoccupation with scholarship and public education’ (Barry, 1998:101).

The need to open up new audiences became ‘a matter of survival’ for many museums in the UK. A steady withdrawal of public funding coupled with an economic recession ensured that the museum industry itself in Britain experienced a severe recession in the mid 1990’s. Thus Hooper-Greenhill could report in 1995:

Museums in Britain, and especially local authority museums, are now at a time of great crisis. Many museum people are losing their jobs, and many others are under threat. Nearly every local authority museum has been restructured, and some of the larger independent museums are on the verge of bankruptcy (Hooper Greenhill 1995:2).

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[290] In order to establish closer collaboration between Göteborg University and The National Museums of World Cultures, *Museion* has been created. As a multidisciplinary research and educational agent *Museion* is also said to embody the “Third Assignment” thus initiating seminars and university courses with alternative forms of exams. This however has illustrated the difficulties trying to merge university culture with its strict demands for knowledge control in exams and the museum culture Frank Oppenheimer described as “nobody fails in a museum”. See James M. Bradburne (1998) “Dinosaurs and white elephants: The science centre in the twenty-first centrury”, in *Public Understanding of Science*, vol. 7, pp. 237-253.

Now, under New Labour, museums are increasingly identified as part of a broader government strategy to capitalise on the UK strengths in the cultural industries. In this respect, they have been increasingly viewed as part of the creative economy and been expected to open new cultural networks which might foster creativity in society (Anderson, 1999). Perhaps the defining feature of the current government policy agenda, though, has been its concern with ensuring that the arts (broadly conceived) are accessible, that they play a central role in tackling social exclusion and that they contribute to 'life long learning'.

To develop this agenda in May 2000, the Department of Culture Media and Sport published a policy document 'Centres for Social Change: Museums, Galleries and Archives for All'. This document seeks to ensure that museums view social exclusion as a policy priority. To achieve this various policy recommendations have been made which include:

- Ensuring that there is the widest possible access to collections and archives
- Making full use of ICTs to make collections more accessible
- Ensuring that outreach activities are an integral part of the museums activities
- Making catalogues and key documents available on line

(Department of Culture Media and Sport: 2000).

One of the most significant policy shifts that this has generated is that the government is more open to providing subsidies for national museums. Free admission for children has been in place since 1st April 1999, and for those aged 60 and over from 1st April 2000. The 2001 Budget introduced new VAT measures, which has allowed many museums to charge free admission for all adults from 1 December 2001.

In the examples discussed above, we can see how cultural and regional policies are used in a number of ways to deal with scientific knowledge and the public. This question is thus, not only a matter of science and technology policy, but interacts with other relevant policy areas. Examples for the latter become evident in the action of decentralisation of museums and science centres, as well in the usage of museums in strengthening cultural identity and education. What is also evident is that the goals of these policy actions are dependent upon the current political administration.

4. Dominating Institutions

By “dominating institutions” we refer to a situation in which there is a concentration of resources to a single national institution. This concentration gives it a certain advantage above other similar institutions. We note this as an interesting phenomenon. There seems to be certain advantages by having a dominating institution. For instance, it will have the resources to follow and act on the latest developments and have the potential to produce spectacular exhibitions that can draw crowds from far away. There are also drawbacks and these can be connected to the earlier discussion on decentralisation.

Thus, even though local regions are given resources for their own museums and centres, these will not have the same kind of attractiveness as found at a dominating institution, usually situated in the nation's capital. This is a variation of a common theme in PUS activities. What is difficult to avoid is that certain elite groups are privileged by PUS work. In a way, any activity that is locally situated and extremely successful will in a small way contribute to increasing the gap between those involved and groups at other sites. PUS activities can also be seen as a part of a larger structure in which cultural resource tend to be focused at the nation's capital city.

Most of the aforementioned European countries covered, have one or two dominating institutions on the scene of museums and science centres. In the UK this is particularly true, e.g. the Science Museum in London.

The Science Museum attracted over 2.8 million for the year 2000/2001[291]. It has been a leading institution in developing science-public relations. The Director of the Science Museum, Neil Cossons and his Head of Exhibitions, Gramhan Faremo have stated that effective communication is nothing less than "at the top of the Science Museum's agenda" (Cossons and Faremo, 2000:66).

In 1988, John Durant was appointed assistant director of the Science Museum as well as Britain's first Professor of the Public Understanding of Science at Imperial College. The Science Museum's increasing focus on the public understanding of science has led to a number of activities (see Cossons and Faremo 2000:66):

- an international PUS research group headed by John Durant
- a series of temporary exhibitions under the title 'Science Box and Technological Futures', which has toured 57 venues in the UK
- a unit that consults the public about exhibition plans
- the journal 'Public Understanding of Science' in association with the Institute of Physics
- organising the UK's first 'consensus conference' on plant biotechnology
- the first MA in Science Communication in the UK, with Imperial college
- the use of drama to interpret topics in the history of science, which began in 1987
- an Education and Programme Unit producing materials to support the learning of educational groups and family visitors, including the interactive galleries designed for children in the basement of the museum
- 'science nights' – where children sleep over in the museum and take part in a range of hands on workshops and demonstrations

[291] http://www.museums.gov.uk/museums/index.html

The 'Here and Now Conference' held at the Science Museum, London on 21-23 November, 1996, sought to explore how public engagement with science could be developed further. Central themes that were discussed at this conference included the relative merits of interactive and thematic exhibits, questions relating to how exhibits deal with scientific complexity (de Rosnay, in Durant, 1992); questions were raised about the specific message that museums were meant to convey.

Although in a very different cultural context, Portugal also has dominating institutions on the scene of museums and centres. The "classical" museums – namely, the Science Museum and the Natural History Museum of the University of Lisbon – are major structures established in the capital, Lisbon. They cover a broad range of subject-matters and historical periods of scientific knowledge and instruments. The new, more modern spaces tend to be decentralised from Lisbon. They are more flexible structures, using new and interactive technologies, and, in some cases, they specialise in particular subject-matters (e.g., astronomy, geosciences, climate change or mathematics), and historical periods, and target specific audiences.

Although, this does not mean a disinvestment in the "classical" museums – in fact, the latter have been politically supported in recent years and have also been following the modernising strategies employed in the science centres, including the use of interactive technologies – there has indeed been an important change in the conception of both the role and the organisation of these interface spaces between scientific knowledge and the public.

In a structurally similar way, Belgium have only one federal science museum devoted to scientific culture, The Museum of Natural Sciences in Brussels. The museum was created in 1846 and has been situated at its current location since 1891. It is a part of the Royal Institute of Natural Sciences, which is entrusted with the conservation and management of the State collections of natural sciences (zoological, anthropologic and prehistoric collections, minerals, fossils, etc.). Since the federalisation of the State, it is managed by the Federal Ministry for Scientific and Technical Affairs (SSTC/DWTC) as a "bi-cultural" institution. In 1997, the Museum got a radical "lifting", aimed at rejuvenating and modernising its design and image.

The restructuring process of the Museum pursues several purposes[292]:

- to implement seasonal thematic exhibitions, quite apart from the presentation of the collections, in order to organise scientific and cultural events at the national level;
- to improve the provision of services for teachers and groups from secondary schools;
- to get a more active involvement of the young public, through the organisation of holiday workshops or Wednesday / Saturday afternoon workshops.

[292] http://www.sciencesnaturelles.be/museum

During the last five seasons, very successful thematic exhibitions were organised: “Five billion humans, all parents, all different” (1998-99), “To live or to survive” (1999-2000), “Communication” (2000-01) and “Very touch” (2001-02). Most of these exhibitions have an international trajectory, being adapted from or exported to other museums in Europe.

The preparation and implementation process of thematic exhibitions sometimes involves a wide participation of university researchers and potential users. For instance, “To live or to survive” was prepared in close cooperation with the research teams involved in a federal R&D programme on sustainable development. Different groups from the civil society were also associated with the project: environmental groups, North-South cooperation organisations, parents and teachers associations, the Federal Council for Sustainable Development

In relation to the UK, Portugal and Belgium, Sweden is somewhat odd by lacking in a major actor. Both national (mostly located to Stockholm but in some cases also to Göteborg), local and regional museums are customary in Sweden. On the local or regional level, all larger cities have a museum of their own.[293] In additional, all counties (*län*) have museums with different focus.[294] These are often mirroring some of the local features, in and around the city. Different kind of Museums of Art and History are common throughout the country. In the university cities, more science-oriented museums are an important element.

The roots of Sweden’s different structural arrangement in relation to the other countries are possibly manifold. In part it is due to the geographical conditions of Sweden: it is a vast country with a sparse population. In addition, the population was not living in one or two large industrial areas but was scattered into small towns and villages. This meant that there was a greater need for many small museums in addition to one big. Furthermore, there is also a political dimension of this: the Social Democratic governments that ruled Sweden for almost the whole 20th century saw distribution of science to citizens and the use of scientific findings in public administration as important parts of democracy. Decentralised museums were therefore vital means to reach out to the citizens.

However, on the national level, there are a large number of important museums specialising in some specific area. In addition to displaying their huge collections, they execute research in line of the featured area. An example of this is Sweden’s *Naturhistoriska riksmuseet* (The National Museum of Natural History) which displays

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[293] For an example, see the City Museum of Norrköping, featuring exhibitions on the history of textiles and handicraft (http://www.norrkoping.se/stadsmuseet/).

[294] With a focus on cultural history and art, an example of a county museum is the one in Stockholm; see http://www.lansmuseum.a.se/.

large collections of and exhibitions in biology and geology whilst also performing research in those areas.[295]

Another new museum initiative in Sweden is the Nobel Museum (opened in 2001), which will become a major actor on the museum scene. This museum benefits from one of the strongest trademarks available in science. There will of course be a heavy emphasis on the great men and women of science but with an initial exhibition on the theme of creativity.

Preparations for this museum have been ongoing for several years. The name Nobel associates to excellence in several ways and of course the museum itself has to excel and have exhibitions of the highest possible quality. The museum project has also attracted both people with high competence and generous fund givers. The Nobel trademark is strong and there are many that want to be associated with it.

The first exhibition of the museum had creativity as its theme. It is thought that this will work to find something in common in research, literature and peace work. The exhibition was produced in three copies. One of these will stay put in Stockholm while the others two will tour the world.

Interestingly enough, there is a bridging of the two cultures involved in the project. The ideas put down by Alfred Nobel a hundred years ago make this connection necessary. Prizes are awarded both to natural science and to literature. The construction of the Nobel categories, formulated so long ago, places restrictions on how research can be treated in the museum. It also makes for strange bedfellows and a rather exciting combination, something that would not be put together like this in any other circumstances.

5. Current trends

There are a number of active trends on the scene of science museums and science centres. Some of these matters have already been mentioned earlier, but it is important to include them in this section too as somewhat of a summary of what we have stated. Three themes have been identified.

Decentralisation: Two Types

As seen above, both museums and science centres have, as institutional arrangements been used as means to reach different kind of political goals. This involves actions in cultural and regional as well as science and technology policy. In addition to being an instrument in general adult education, this involves ideas of

[295] See http://www.nationalmuseum.se and http://www.nrm.se.

strengthening cultural identity and adapting citizens to the modern knowledge society. To reach such goals, it is important to all parts of the population in the country. Thus the question of decentralisation has been almost omnipresent.

Decentralisation I: Cities and the countryside

It is possible to make a distinction between two different kinds of decentralisation. Firstly, there is one which locates museums and science centres in the country side and small towns. This is done to avoid continued practice putting large resources into a handful of large cities that traditionally have been privileged. An example of such a strategy is found in Portugal, where a change in the organisation and role of museums and science centres can be observed.

The “classical” museums – the Science Museum and the Natural History Museum of the University of Lisbon – are major structures established in the capital, Lisbon. They cover a broad range of subject-matters and historical periods of scientific knowledge and instruments.

The new, more modern spaces, tend to be decentralised from Lisbon. They are more flexible structures, using new and interactive technologies, and, in some cases, they specialise in particular subject-matters (e.g., astronomy, geosciences, climate change or mathematics), and historical periods, and target specific audiences.

Although this has not meant a dismantling of the traditional museums, the flexibility of the new structures has made it possible to expand their number and their distribution throughout the country.

In recent years, various science centres were created in different cities in Portugal. Additionally, the “Ciência Viva” programme has given rise to the establishment of “ciência viva” centres, conceived as interactive meeting spaces. Examples of these centres are:

- the “Centro Ciência Viva” of Algarve
- the Planetarium of the Centre of Astrophysics of Oporto
- and the Infante D. Henrique Exploratorium of Coimbra.

The “Pavilhão do Conhecimento” (Knowledge Pavillion), created in 1999, in the setting of EXPO-98 (“The Oceans – A Heritage for the Future”) at the ”Parque das Nações” (Park of Nations), in Lisbon, has offered on a continuous basis exhibitions on science themes, some “imported” from other museums or similar institutions of foreign countries and some other designed and set up with the assistance of Portuguese researchers.[296]

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[296] Until 2001, The Knowledge Pavillion received more than 300 000 visitors (A. F. Costa, P. Ávila and S. Mateus, 2001: 64).

Near Oporto, an interactive science centre has been established as well, the Visionarium, under the initiative of a private body, the Industrial Association from Oporto.

Six additional “Ciência Viva” centres are planned to open in the near future in cities of medium or small dimension all over the country. The underlying policy goal is to establish a dense network of science centres throughout the country, which, in articulation with the “classical” science museums.

Regarding science centres in Austria far too strong centralisation can still be observed. For the genre of the classical museums the situation is different. Each of the Austrian provinces keeps its own so-called *Landesmuseum* (Regional Museum) that focus on natural scientific as well as on cultural themes but, with a special bias on displaying topics that are relevant for the particular region. Similar to the Swedish museums of the counties, the aim is to underpin the local specialties of the region, albeit the Austrian ones covering rather the fields of history of science and history of culture. Since the museums are quite traditional, most of them were founded at the beginning of the 19th century, one can observe quite a different pattern of decentralisation compared to the Portuguese context where predominantly young, innovative forms of museums, e.g. science centres, are subject to decentralisation purposes.

Decentralisation II: First and second city

The second type of decentralisation is when museums and science centres are placed in other big cities and important regions, rather than at the largest city. The relationship between the first and second city in the country is often one of systematic skewness in the distribution of resources. It can therefore be argued that rather than decentralising by allocating money to smaller towns that have nothing, you might want to increase resources in the second and third largest cities. This will enable them to close in on the gap between them and the first city.

A good example of this can be found in Sweden, *Världskulturmuseet* (The National Museum of World Cultures), which is a new museum located in Göteborg, the second largest city in the country. To decentralise to other big cities can be a political alternative, if the institution is large-scaled as in the example of *Världskulturmuseet*. To locate a large museum on the countryside would be problematic and politically challenging in a number of ways. First of all, it would be economic difficulties, both to get the amount of visitors needed and the affluent corporate sponsors; secondly, there can also be a problem to engage and find the broad competent staff required in a large museum. In the case of *Världskulturmuseet*, there have also been collaborations with Göteborg University.

A second similar example is the *Haus der Natur* (Haus der Natur) in Austria, located in Salzburg, the capital of the identical named region, which is one of the few provincial science museums that have super-regional reputation.

From Museum to Science Centres

If the science museum is a relatively long established institution in the majority of European countries, science centres are more recent. Although new museums are created too, the tendency of more and more centres being built is very strong. In Belgium, the first three science centres have been erected in the last decade (The Park of Scientific Adventure (PASS), near Mons; The Science Centre of Parentville, and the Technopolis in Mechelen).

Sweden have around 20 science centres today, and have recently established a new sciences centre (The Universeum) in Göteborg, which carries a national responsibly and thus serving others science centres with innovation, knowledge and ideas. In Portugal, a number of science centres have been created and the overall policy is to establish a dense network of science centres throughout the country.

In the UK, the first science centres (Bristol's Exploratory and Cardiff's Techniquest) were established in 1986. The number of centres had grown to 40 in 1997 (Gregory and Miller, 1998:203), receiving an average of 50,000 visitors per year and centre. It has been estimated by ECSITE-UK (the network set up to represent the science centre sector) that over 90% of the UK population now lives within a two hour drive of a science or discovery centre (Durrant, 2002). The sector as a whole receives around 11 million visits a year (Durant, 2002).

@Bristol provides an example of the type of projects that are being developed in the UK. Explore@Bristol has a focus on science and technology; Wildscreen@Bristol focusses more on environmental matters. Both projects seek to combine the use of interactive exhibits, multimedia representations and hands-on activities to encourage public engagement with science. They are attempting to reach out to audiences that have been seen as traditionally difficult to attract to science museums, most notably teenagers, the elderly, the disabled, and people from lower socio-economic groups.

Plans to greatly expand the national network of science centres in the UK arouse suspicion that the public will be presented with a surfeit of new museums and exhibitions. The £6 billion (check) they received from the National Lottery has been described as 'the largest single investment in science communication to take place in the UK' (Thomas: 2000:64). This money must be matched by other sources of funding and revenue, and is not intended to cover operating costs. It has been argued by Durant that the Science Centre sector will need 30-35% of its income supported by state funds to maintain themselves over the longer period (Durant, 2002).

In contrast in Vienna there have been plans, for nearly a decade, of installing a science centre but its realisation still lacks of funding perspectives and a decision on its potential location in Vienna. The absence of an umbrella organisation that could provide a network basis for younger innovative kinds of museums and that could push the realisation of the devised science centre might be one reason for Austria's belated development compared to other European countries in this concern.

Instead the tendency goes towards adding science-centre elements to the classical science exhibitions, mostly in course of a thorough reconceptualisation of particular traditional museums. There can be mentioned the *Technisches Museum* (Technical Museum) in Vienna which functions since its reopening as a hybrid between traditional science and technology museum and a modern science centre as it includes hands-on-experiments as well as a stronger involvement of new media in the exhibition.

Science centres do not have the inheritance and solemn connotation of the science museum, making them more flexible both in their methods of presentation and objects of display. It is more common in centres, than in museums, to use hands-on exhibitions, utilising new and interactive technology. These centres also try to provide a public space of exploring the ethical, social and political dimensions of science. Such innovative moves by the centres on a scene earlier overloaded by tradition-bound science museums, are probably a part of the explanation to this success of the science centres.

Going into the classroom

A possible new trend for the science centre is to strengthen its links to schools by maintaining particular services that support daily classroom teaching. Such an outreach service is the Jason project, which was created by American deep-sea scientist Robert Ballard. As Ballard investigated the wreck of the *Titanic*, he also worked with the idea of sending a live broadcast of these types of research events. In connection with this, school classes could be in on science in action and thereafter pose questions to researchers.[297] The Jason Foundation today has two programs, one aimed at school children and another towards their teachers. The goal is to put more science and fascination for research activities into schools.

Ballard's ideas have been translated to other counties outside the US. In Sweden, for instance, the science centre *Universeum* maintains a Jason project since the year 2001. The project also serves to fulfil the requirement of having a national responsibility. 250 school classes from primary schools and gymnasiums participate in the project lead by Universeum. One fifth of these are located in the west of Sweden and thus are potential visitors.

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[297] See http://www.jason.org/; http://www.universeum.se/jason/.

A new theme is focused on each year. The year 2001 had as a theme “Frozen Worlds”, dealing with polar research. This year the theme is “From Coast to Sea”. One can speculate that themes relating to areas that are emphasised at the science centre are favoured since this would mean that it becomes easier to connect “Jason classes” to the stationary exhibits of Universeum.
There are seemingly many advantages of the Jason project. Children are ideally invited into the research process and meet science when it is still open-ended. There is also an opportunity to see “the messiness” of knowledge production. Perhaps it is easier for children to become involved with science when meeting it at this unfixed stage, being drawn into what can be framed as an adventure. There are also obvious drawbacks. The Göteborg broadcasts are dressed up as live TV shows. But in reality this can often be difficult to attain. One such broadcast that we viewed contained very little live material and interview. Instead of following scientists in action, we were delivered a fairly traditional science program with an emphasis on recruitment efforts. Additionally, instead of confronting senior researchers, graduate and Ph.D. students were interviewed. This may also reflect the ambition to display people in science that youth could easier identify with rather than more knowledgeable senior researchers.

How to change (or not to change) is the question

Partly due to this challenge and competition from science centres, the traditional science museums also have to reconsider their strategies. Ideas seem to be exchanged between different institutions, from centres to museums and vice verse. It is possible to distinguish between four answers to this question of how to adapt these institutions to meet the needs of the future:

1. to include different kinds of add-on features to existing institutions. This means creating institutional spaces for features like movie theatres (Cosmonova at The National museum of Natural History, Stockholm, and the Science Museum, London, with IMAX technology, the Haus der Natur (House of Nature)) to more traditional vivariums, planetariums and aquariums up to hands-on-experiments (Technical Museum in Vienna). Even including features normally associated with fairgrounds and science fiction is possible – an example for this is the Futurescope in France – or offering special leisure programs for kids as for example organising birthday parties on request in the museum where the exhibits are involved in the design of the party (Museum of Natural History). Another interesting and debated issue is that the two new institutions in Göteborg (Världskulturmuseet [the National Museum of World Cultures] and the science centre Universeum) are located in next to Liseberg, Sweden’s largest amusement park. Universeum also has collaborations with Liseberg on a jointly owned IMAX cinema and on ticket sells.

2. To working towards flexibility and interactivity. Not only in science centres the ideas of flexibility and interactivity is important, but even the most prestigious institutions are influenced by this. In 1995, the Science Museum in London embarked upon designing and building the largest new wing in its 150 year history. Funded by the national lottery (£23 million) and the Wellcome Trust (£17.75 million), the Wellcome Wing[298] focuses entirely on developments in contemporary science and is explicitly forward-looking. It provides the latest in interactive entertainment through a series of suites that provide continuously updated exhibitions.
3. To do business as usual. Even if this strategy is not so spectacular it is probably the most common one. Science museums are for the most part quite old; they have had their collections and buildings for several decades. This coupled with strained budgets, gives little room for new ideas and structures. Most museums have not been able to do more than create a home page on the Internet.

In recent years, there has been a discussion on the future of science centres and museums. James Bradburne, prolific exhibition designer and researcher, has claimed that the science centre in its current form is doomed. He argues that these institutions are doing rather badly. Maintenance costs are too high and since the exhibition area is so fixated there is little room for flexibility and linking on to current societal events. Furthermore, this will make it difficult to attract repeat visitors, i.e. once you been there your have seen it all and since it does not change there is no incentive to return. Those who disagrees with Bradburne, instead claims that science centres have never been more successful than now.[299]

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[298] http://www.sciencemuseum.org.uk/wellcome-wing

[299] James Bradburne (1998) “Dinosaurs and White Elephants: the science centre in the twentieth century”, *Public Understanding of Science* vol. 7, pp. 237-253. Also see Per-Edwin Persson (1998) “Science centres are thriving and going strong”, *Public Understanding of Science* vol. 9, pp. 449-460.

Science and technology on display: Austrian museums and exhibitions as spaces of science-public interaction

Ulrike Felt, Martina Erlemann

Introductory remarks[300]

Looking at the role of science museums and exhibitions from the perspective of what they contribute to shaping the relations between science, technology and the diverse public is interesting for a number of reasons.

First, museums have in their historical development always been institutions with a double vocation. They were places where scientists did research with the objects they had been "collecting", but also places where science was exhibited and staged, was contextualised and embedded in wider cultural settings, was ordered in particular ways and thus gave shape to a particular gaze. They were thus in a certain way rather powerful places of shaping the way in which science and technology were seen as contributing to the power of a nation.[301]

Second, museums are interesting because an important shift has been taking place in this landscape of institutions. New types of exhibiting practices are being realised as well as new ways of conceptualising and encountering the visitors have been developed. The idea of science-centres with hands-on exhibits and thus the possibility to engage with scientific and technological object has definitely created a counterbalance and has put pressure on the classical museums.

Thirdly it is revealing to take a closer look at museums as they seem to be increasingly torn apart between their educational vocation, which is still inscribed very much in the enlightenment paradigm and their wish to offer "scientainment" and thus to attract people of all age-groups.

Austrian science, technology and nature museums

Austria has got a relatively small number of museums that present science and technology, even if understanding the notion broadly. A large-scale science museum

[300] A more detailed analysis and description of the museums and exhibition scene can be found in Felt U., A. Müller, S. Schober (2003): (Techno)wissenschaften und ihre Öffentlichkeiten: Strukturanalyse und Standortbestimmung der Wissenschaftskommunikation in Österreich. (Project Report to the FederalMinistry for Education, Science and Culture).

[301] B. Anderson (1996): *Die Erfindung der Nation: Zur Karriere eines folgenreichen Konzeptes*. Frankfurt a.M., Campus

that covers the spectrum of scientific fields is missing and indeed most of the museums that deal with science are restricted to specific scientific fields.

Austria had throughout its history managed to build a large number of rather interesting scientific collections. Some of them are even quite old and have kept their expository structures for some hundred of years or more. As a consequence those are more interesting from the historical perspective of science museums and also the history-of-science perspective. Since the building of these collections combined both doing scientific research as well as exhibiting the objects and results of knowledge production, they reveal interesting insights into the production of scientific knowledge and in the practice of science in former days. However for a wider public these collections would need either a better contextualization or they would have to be re-conceptualized completely.

Virtually all the major Science and Technology museums are concentrated in Vienna, which is a clear indicator for the centralisation of power this town has over the past centuries.

The *Naturhistorische Museum* (Museum of Natural History)[302] in Vienna was founded as a private collection by the former emperor as early as 1748. About 20 years later it was opened to a wider public by Empress Maria Theresia, who is well known for her social reformist efforts at the time to educate a wider public and introduction of compulsory school attendance for all children in Austria. The museum contains several natural sciences collections such as zoology, botany, mineralogy, pre-history, geology, palaeontology, anthropology, all belonging to the classical fields of the musealisation of nature and natural science.[303] Each separate department does its own research, predominantly investigating issues on history of science and history of musealisation. Today, in part, the old-style musealisation has remained (representing for example huge collections of insects, rocks etc. in glass vitrines) but changing special exhibitions that are added on or newly redesigned exhibition areas (e.g. the sector for children was adapted to newer standards) try to embrace a more contemporary perspective on nature and science as well as allow for interactions between science and arts. Concerning special events, guide tours for children and school classes are offered next to a programme of public lectures on natural history. A more playful concept of dealing with science arises on birthday parties for children that are organised on request. The museum also opens its door on special evenings where one can have dinner on the roofs of the museum with a splendid view on the town followed by guided tours through the exhibition areas.

[302] See on http://www.nhm-wien.ac.at/NHM/

[303] It is interesting to note that in the 1990ies there was a heavy public controversy around the "Rassensaal" (Hall of the Races) where a categorisation of humans and ethnic groups into races was exposed.

Another museum in the style of the “nature cabinet” is the Vienna *Josephinum*, founded as a surgery academy in 1785. It hosts nowadays the department of History of Medicine of the Vienna University exhibiting numerous anatomical and gynaecological wax-preparations. A further significant collection of anatomical wax-models, founded in 1796, can be found in the *Pathologisch-anatomischem Bundesmuseum* (Federal Pathologic-anatomical Museum) in Vienna[304], located in the so-called *Narrenturm* (Madhouse Tower that is located on the Vienna University campus) that was built in 1784 as part of the first psychiatric hospital. It is allegedly the world's biggest and oldest of its kind.

In fact these “museums of museums” just described only marginally allow people to get into an interaction with science. They offer virtually no possibility to contribute in public communication on contemporary issues of science and technology. Aspects of societal relevance are generally only treated in the framework of the rare temporary exhibitions.

Worth mentioning in this respect would be the *Haus der Natur* (House of Nature)[305] in Salzburg, founded as the *Museum für darstellende und angewandte Naturkunde* (Museum for representational and applied natural history) in 1924, that has won much popularity during the last decades. This museum consists of an aquarium and several other departments dealing with space sciences, prehistory, human biology and ecology and even myths about nature (dragons amongst others). Also, the research of the museum is not to be neglected since there are several co-operations with the Institute for Ecology, a nearby national park and a research station in the Alps. Another important aspect of the museum’s profile are the changing exhibitions, for example in 1998 it hosted the genetics exhibition “Genetic Technology, Pros and Cons”, which was initiated in response to the public GMO controversy.

A similar concept of exhibiting nature is applied in the *Haus des Meeres* (House of the Sea) which is located in Vienna[306]. It presents the sea and its shores as the habitat of fauna and flora, the departments being arranged by the different natural environments of plants and animals. Consequently the museum shows zoological and botanical knowledge similar to a zoo by exhibiting animals and plants in their quasi-natural contexts. As a selected target group again school children are addressed with special offers of museum guiding tours.

Since the early nineties, there has been a discussion on the installation of an Austrian Science Museum in the style of North American science centres that would create innovative spaces for the science-public-interaction and would overcome the strictly didactic ideal of informing and enlightening the public towards a more dialog-oriented and interactive approach. Following a common concept for this type of interactive

[304] See on http://www.pathomus.or.at
[305] See on http://www.hausdernatur.at
[306] See on http://www.haus-des-meeres.at/

museums, doing scientific research is presented as adventure where hands-on-exhibits pledge fun at playing with them. Spending time in a science museum should be experienced as leisure time and as having fun.

This ideal has so far only partly been implemented in the newly reopened *Technisches Museum* (Technical Museum) in Vienna[307]. It was founded in 1908 and is the only larger-scale museum of science, technology and industry in Austria. After a seven year renovation period, it has now emerged as a hybrid between a classical technical museum, with departments of heavy industry, transport, musical instruments and others, and a modern science centre, where natural phenomena, science and technology are mediated interactively. This is realised by aid of the new media, by the possibility for hands-on-experiments for the visitors and by a special program for children and school classes.[308] Furthermore the museum hosts temporary exhibitions such as the exhibition "World-Information.org" dealing with the problematic of communication and control technologies or an exhibition conceptualised by CERN (European High-energy Phyiscs Lab) on elementary particles.

The most recent innovation in the science museums sector that should be mentioned is the *ZOOM Kindermuseum* (Museum for Children). It wants to be "a location for children where they can research, experience and learn in a playful way. The young visitors can "zoom" themselves onto (in the original it says *heranZOOMen)* facts and playfully seize their world with all senses"[309]. Parallel to the exhibitions for children the museum staff offers the possibility to experts and researchers to initiate research projects ("in the field of tension between children resp. adolescents and the knowledge fields of didactic, psychology, pedagogic, media, technology, medicine, neurology, physics and sociology"[310]) to be carried out within the museum and to contribute with their research results to the so-called research board. The research focus lies on issues about children's and adolescents' experience with technology and science, or, to put it shortly, with the exhibited scientific content and on the influences that the interaction with communication technologies will have on them. That means that the targeted audience is at the same time object of research. Insofar as the museum is not only a place where research products are mediated and presented to a specific lay public but also where research about the very target group is done. It is thereby an intermediate location between a knowledge producing space – about children and their education – and a knowledge mediating space – targeting children.

Unlike other countries in Austria there is no umbrella organization under which conceptually rather innovative museums could be linked to each other. However, there

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[307] See on http://www.tmw.ac.at/

[308] H. Burger, Maschinenzeit Zeitmaschine. Technisches Museum Wien 1918-1988, 1991; Vortrag 2000; Rebernik, Peter (1990) Museumskonzept Technisches Museum Wien "MUT", Wien: TMW

[309] See on http://www.kindermuseum.at/main2.html

[310] See on http://www.zoomlab.at/zoomlab/main2.html

are plans for a classical science centre in Vienna for several years. The so-called "Experimentarium" should be installed to "improve the understanding of new technologies via interactive and playful occupation with technology" as the public authorities state it.[311] But neither the question of funding nor that of location are yet solved.

Finally each of the Austrian provinces has a *Landesmuseum* (Regional Museum) focusing on local history in natural scientific perspective as well as in a cultural perspective. Instances are the *Landesmuseum Klagenfurt*[312] for the land of Corinthia or the *Vorarlberger Landesmuseum*[313] and the *Vorarlberger Naturschau*[314] (Vorarlberg's Natural History Museum) in Vorarlberg. Many of them were founded in the early nineteenth century; some of them contain historical scientific, e.g. astronomical, botanical and zoological collections, although they are not exclusively dedicated to science or technology. Their primary aim is to stress the local characteristics of the very region.

Astronomical Observatories, animal and natural parks

When speaking about science communication and exhibiting practices in a wider sense one would have to go beyond the classical museums and also look at the way science and nature are represented in astronomical observatories, in zoos and animal parks as well as in natural parks (Naturparks). The former are extremely interesting because in the field of astronomy there is exists a rather lively scene with regard to amateur scientists who also carry much of the science communication activities. In this sense a boarder-crossing between science and society occurs in many different ways. Zoos and nature parks are interesting because they try in a certain way to represent nature under "controlled conditions" and in that sense transmit very strong though implicit messages to the visitors.

One example of such an astronomical observatory would be the *Kuffner-Sternwarte,* an observatory for lay people, where popularisation of astrophysical knowledge for an interested public lies predominantly in the foreground. Science is presented from a rather academic angle with high educational claims since the observatory tries to convey a clear idea about scientific practises in astronomy. The institution puts it as: "Apart from regular guided tours, we are developing an educational and cultural programme. The programme focuses on a new concept of education in astronomy, astrophysics and space research. We aim to link education, science and culture in the

[311] See on http://www.magwien.gv.at/stadtentwicklung/donaucity/projekte/weitere.html
[312] See on http://www.landesmuseum-ktn.at/Information.htm
[313] See on http://www.vlr.gv.at/Landesregierung/iic/lmuse/lmusen.htm
[314] See on http://www.naturschau.at/index-e.html

field of astronomy and astrophysics."[315] In addition to being an educational institution the *Sternwarte* also undertakes its own research in history of astronomy and restores ancient astronomical instruments.

From the point of view of zoos one should mention the *Schönbrunner Tiergarten*[316] (the zoo). Under the new directorate, which was installed a few years ago the zoo was completely restructured and got a new image. Guided tours, visits in the night to watch animals and other more educational activities for different publics are now organised, clearly showing a repositioning in the sense of an increased will to do science-communication in selected areas.

Finally there is an increasing number of natural parks, which try to get involved with communication of scientific findings about the "natural object" they "exhibit" in their parcs. One example would be the Naturpark Hohe Tauern with the BIOS[317] visitors centre.

Between exhibition and event: Art meets technology and science

At last a rather special institution, the *Ars Electronica*[318] that combines science with art should be mentioned. This, in the subtitle called Festival for Art, Technology and Society, is carried out each year in Linz since 1979. Its main focus lies on the presentation of international artists using digital technologies – in the year of 1979 those were surely an avantgarde – exhibiting their work and provoking theoretical and critical reflection on new digital technologies which occupy more and more spaces in society. Although the reflection was focused on new possibilities for aesthetics and art, the discussion changed gradually towards possibilities, hopes but also threats for human lives that are posed by new technologies. Accordingly, the festival enlarged its focus in recent years to controversial issues, like the "info war" in 1998 which addressed the role of technology in warfare after the gulf war. In several years – 1993, 1997, 1999 and 2000 – the focus has been on genetic engineering, biotechnology and life sciences in their relation to digital technologies and art whereas other festivals are dedicated to non-scientific topics like the festival of 2002 that was on global conflicts. Generally, there is a two to three day-symposium where mostly prominent speakers from science and research, art theory, sociology and philosophy are invited to present their perspectives on the thematic motto.

The *Ars Electronica Center. Museum of the Future* is a permanent museum in co-operation with the festival thus, it shows also special festival exhibitions and organises

[315] Cited from http://www.kuffner.ac.at/eng/index.html
[316] http://www.zoovienna.at
[317] http://www.bios.mallnitz.at
[318] http://www.aec.at

events in the framework of the permanent exhibition about computing and its diverse aspects. It conceives itself "as an interface of art, technology and society"[319] and initiates art and science events as their mission is described. The approach to mediate technology and to bring it into discursive contact to the public is shown in detail by the following citation:

> *"Instead of embalming and preserving the history of technology, the Ars Electronica Center conceives itself as the prototype of a new sort of museum. The Museum of the Future calls upon visitors to display initiative, and makes the technologies of future generations accessible right now to individuals in every age group in a way that is fun and easy, and requires no prior knowledge of computers. The human being is the measure of all things - and not mere technical feasibility. The individual and the Information Society determine one another in reciprocal fashion. To be sure, work and society are increasingly shaped by communication technologies and the processing of information; nevertheless, these technologies can establish themselves only on the basis of broad social acceptance."* [320]

Additionally, courses in internet use and graphical design are offered throughout the year, some of them especially targeted to young people and – remarkably as being very rare – seniors. Besides this, there are guided tours on themes like virtual reality and robotics.

A variety of people visit the "Ars", though the tendency is towards young, academic visitors, working in computer-related fields.

Where have the social sciences and humanities gone?

In this ensemble of portrayed Austrian museums and museum-like establishments we restricted ourselves on institutions that deal with exhibited knowledge products coming from the natural sciences and/or technology. When one thinks of science museums they are generally the ones mentioned. However strictly speaking also folk and historical museums could and should be seen as mediating academic knowledge since they often underline the scientific nature of their representations. If one takes into account that the very process of exhibiting an artifact means to validate it as being relevant and as signifying a knowledgeable fact, it would be extremely important to closer investigate this side. It is however revealing that most of these places are attributed to the sphere of culture and not so much to science. In that sense – although we use in German the notion of "Wissenschaft" – it is apparently applied in the sense of the English word "Science".

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[319] See on http://www.aec.at/center2/english/index.html

[320] See on http://www.aec.at/center2/index.html

General observations:

- Over the past few years one could observe **movement in the museum and exhibition scene in Austria**. Many museums rethink or are about to reconstruct their exhibition areas. They inscribe themselves in an international trend to render science and technology museums more interactive and more accessible to a wider public from a large variety of educational background. In that sense Austria is maybe late in comparison to other European countries but the issues that are at stake have been realized.
- Some of them also realize the **role science and technology** play in the wider sense of **being a cultural heritage** and start to rethink their position.
- While museums are changing or are trying to investigate the possibilities of innovating their exhibition space, they are often still hesitating between focusing on the educational task they see for themselves and the fun character. Often it is seen as difficult to be reconciled.
- Within the group of museums there is a **split** to be observed between those who function still on the **classical** assumption that **museums** are places of scientific research **and** exhibition, while others have taken more the line of a **science centre**, which is exclusively oriented towards exhibiting science and technology.
- Problematic surely is that there is **little visible connection between the different museums and centers** and there is **little public debate about what roles they should and could play**.
- What is **exhibited** about science and technology is often strictly speaking only **artifacts** and **little space is given to the role of "science and technology in the making"**. Thus what is transmitted is a quite static picture.
- Through this **artifact orientation** in museums, it is **extremely difficult to "exhibit" social sciences and humanities**. Indeed there are rare cases where this has been tried out. Cultural objects are in most cases the center and the scientific knowledge that is embedded in the way an exhibition is conceptualized often remains invisible for many of the visitors.
- The **connection between art and science is only developed on a very spot-like basis**, but building on some interesting experiences in the framework of the Ars Electronica it **could be extended well beyond** as a means to bring communication about science on a rather different level.

Museums and science centres in Belgium: Dedicated to schools and children

Gerard Valenduc, Patricia Vendramin

1. Background

The creation of modern science centres is a very recent development in Belgium. In 1995 (a turning point in the development of PUST in Belgium – cf. national profile), the only well known science museum was the Natural Science Museum in Brussels. It was one of the last "bi-cultural" institutions remaining at the federal level, and was known mainly for its famous collection of dinosaurs. This museum was however undergoing a restructuring process. Other projects of creation of modern science parks were in gestation. The lack of national supply was however overshadowed by the fact that several foreign science centres such as the City of sciences and industry in La Villette (Paris) are located nearby and were accessible to many Belgian visitors.

In the French-speaking part of the country, two science centres were created: Parentville in 1996 and the Park of scientific adventures (PASS) in 2000. As they are located in the region of Mons and Charleroi, they have taken advantage of subventions from the European Social Fund for the conversion of declining industrial regions (Objective 1).

Technopolis was inaugurated in 2000 in Mechelen (between Brussels and Antwerp) In the Flemish-speaking part of the country as a spin-off of Flanders Technology International, a regional foundation created in 1988 in order to develop awareness on science and technology in Flanders and supported by the Flemish government.

ECSITE (European Collaborative of Science, Industry and Technology Exhibitions), a European network whose secretariat is hosted in Parentville, played an important part in stimulating these new initiatives in Belgium.

2. Overview of existing science centres

2.1. The Park of Scientific Adventures (PASS), near Mons

The PASS ([321]) is built on a former coal-mining site named "Le Crachet", which was closed in 1969 and which has since 1989 been classified as an industrial patrimony. This choice of location was explicitly intended to bridge the past with the future. The

([321]) http://www.pass.be

architecture traduces this option: a foot-bridge, designed as long coloured pipe, linking the old building with the new one, leads the visitor from the exhibition of the former industrial patrimony to the new area of interactive scientific activities.

The project is supported by DGTRE, the regional ministry for research and technology, and financed by the European structural funds (€16 millions from the European Fund for Regional Development (FEDER) and € 5 millions from the European Social Fund (FSE)). The design stage of the project started in 1996. The main reference sources used by the designers were the Futuroscope in Poitiers (F), the Experimentarium in Copenhagen, the Civilisation Museum in Québec and, to a lesser extent, the Cité des sciences et de l'industrie of La Villette in Paris. The construction of the project started in 1998 and it was inaugurated in May 2000. Private sponsors and public agencies are now involved with financing the activities and exhibitions of the PASS[322].

The PASS includes two permanent areas: the "Pass'age", dedicated to children, and the "Grenier des histoires" (from the industrial past to the technological future). Eight other areas are devoted to sometimes temporary thematic exhibitions (planned for one or two seasons). A set of "scientific and diverting expeditions" have been proposed Outside for the park of adventures (40 ha): an ecological exploratory walk, a walk-down in an ancient mining tunnel with experiments on sound and light, a park of experimental machines of human propulsion, and a set of scientific observatories disseminated in the park.

The management of PASS expects about 300 000 visitors a year, not only from Belgium, but also from the North of France. Through the European programme Inter-Reg II, agreements have been made with partners in France and Flanders. It is primarily targeting schoolchildren, students and teachers, who are estimated to provide about 40 % of the visitors. PASS develops specific marketing initiatives towards children, schools and teachers: packages for families, scientific documentation files for teachers and special conditions for school groups.

Another original initiative is that visitors are not left alone. A welcome team of scientific mediators address groups and individuals and propose pathways, schedules and expeditions in the park as well as documentation for a fruitful visit. This service is provided in French, Dutch and English. Scientific mediators are recruited and trained in the region of Mons, through a specific training programme supported by the European Social Fund.

More recently (2002), the PASS opened its activities to "arts and science", through the festival VIA (supported by Inter-Reg III), a new international festival of digital theatre, dance, music and arts, in close cooperation with the Manège project in Maubeuge (France).

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[322] Quintart J-C., *Pass … port pour l'avenir*, in *Athéna*, n° 159, mars 2000.

2.2. The Science Centre of Parentville, near Charleroi

This science centre[323] was created in 1996 and established in a castle and a park belonging to the Free University of Brussels (ULB), who inherited it from the well-known industrial family Solvay. The ULB transformed the ancient Solvay domain in a new infrastructure for science popularisation. The science centre is mainly designed for scholars and students. Its location near Charleroi allowed the University to get supplementary funding from the European structural funds, as an Objective 1 zone. Initially named "Museum of sciences and techniques", it was renamed "Centre of scientific culture" in 2002[324].

The science centre includes a permanent area of interactive scientific activities, named Experimentation Space, and another permanent Communication Space (sponsored by the regional administration DGTRE). A third permanent area, devoted to biotechnology, will open in early 2004. Other areas are devoted to temporary exhibitions. The science centre also organises workshops and conferences for the students in the last three years of secondary school aged between 15 and18 years. During the holidays, science weeks are organised for children aged 10 and14 and teenagers between the ages of 15 and18. The centre of Parentville also develops a series of partnerships with local cultural associations. Its integration in the ULB allows for close relationships with university researchers and professors, who are invited to give conferences and presentations in Parentville.

The science centre of Parentville takes part, as a Belgian correspondent, in several initiatives for scientific culture in France: for instance the night of stars (end of March) and the science week (November). The science centre of Parentville is currently hosting the coordination of the European network of science museums ECSITE.

2.3. Technopolis in Mechelen (Antwerp)

Technopolis was developed from the Flanders Technology International Foundation, a non-profit institution that was founded in 1988 by the Flemish regional authorities with the primary aim of organising an annual technology fair, Flanders Technology International, held in Ghent. In the early nineties the mission of the Foundation FTI was expanded to the mission of "bringing science and technology closer to the people". This occurs by a whole range of activities oriented towards the field of education as well as to the general public: such as science weeks, science festivals, activity books, television programs, a travelling science truck, teaching packages, science theatre and a lot more. The investment company Technopolis was founded in 1997, in order to create a permanent science centre in Flanders. All these projects and activities fit in

(323) http://www.ulb.ac.be/ccs
(324) Léonard J-L., *Quand un musée fait peau neuve*, in *Athéna*, n° 178, février 2002.

with the "Action Plan Science Communication" which is set up yearly under the authority of the Flemish government.

Technolopolis, which is defined as the "Flemish interactive centre for science and technology", was launched in 2000[325]. The regional government of Flanders made an initial investment of €12.4 million. The regional government, the Antwerp province and a set of industrial sponsors grant the operating budget. Technopolis includes a permanent area of 259 interactive experiments and demonstrations, an auditorium (Kegel, the cone) with similar functions to the Geode in La Villette and a cosy theatre (Zwarte Doos, the back box) with a performance of automatic 3-D theatre on the human body.

Like PASS, Technopolis is mainly oriented to the younger members of the public, either through schools or through their families. A welcome programme for school classes is organised (each day a different school level) and a series of leaflets are published in Dutch for teachers and pupils. Packages are designed for further experiments in the classroom, after the visit to Technopolis.

2.4. The Museum of Natural Sciences, in Brussels

This Museum created in 1846 and established in its current location since 1891, is the only federal institution devoted to scientific culture. The Museum is a part of the Royal Institute of Natural Sciences, which is entrusted with the conservation and management of the State collections of natural sciences (zoological, anthropologic and prehistoric collections, minerals, fossils, etc.). Since the federalisation of the State, the Federal Ministry has managed it for Scientific and Technical Affairs (SSTC/DWTC) as a "bi-cultural" institution. In 1997, the Museum got a radical "lifting", aimed at rejuvenating and modernising its design and image.

There are several purposes for the restructuring process of the Museum[326]:

- To implement seasonal thematic exhibitions, quite apart from the presentation of the collections, in order to organise scientific and cultural events at the national level.
- To improve the provision of services for teachers and groups from secondary schools.
- To get a more active involvement of the young public, through the organisation of holiday workshops or Wednesday / Saturday afternoon workshops.

During the last five seasons, very successful thematic exhibitions have been organised: examples of these kind of exhibitions include; "Five billion humans, all parents, all different" which ran from 1998 to 99, "To live or to survive" from 1999 to -2000, "Communication" from 2000 to 2001 and "Very touch" from 2001 to 2002). Most of

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325 http://www.technopolis.be

326 http://www.sciencesnaturelles.be/museum

these exhibitions have an international trajectory, being adapted from or exported to other museums in Europe.

The preparation and implementation process of thematic exhibitions sometimes involve extensive participation of university researchers and potential users. For instance, “To live or to survive” was prepared in close cooperation with the research teams involved in a federal R&D programme on sustainable development. Different groups from the civil society were also associated with the project: for example environmental groups, North-South cooperation organisations, parents and teachers associations and the Federal Council for Sustainable Development.

2.5. Miscellaneous

Besides these institutions that are formally recognised as science centres and integrated in international networks of science museums and science centres, other initiatives that participate in PUST albeit indirect should be cited:

- Leisure centres related to scientific or technological themes.
- Museums and centres of technical and industrial patrimony.

Leisure centres intend to combine tourist attractions with exhibitions related to technology or natural sciences. Examples of this category are (without attempting to be exhaustive):

- In all regions of the country, a lot of natural reservations are combining exhibitions of the local ecosystem and tourist activities.
- The Euro-Space Centre, located in Libramont (Belgian Luxembourg), is an interactive exhibition of space technology, mainly attractive for children and pupils.
- The Belgacom Centre in Lessive (Belgian Luxembourg) is a permanent exhibition on the history of the telephone and the new information and communication technologies, located in the site of spatial telecommunication antennas of the historical Belgian telecom operator.
- At the Belgian coast, the Sea Life Centre of Blankenberg is a permanent exhibition devoted to marine life and costal zone protection.

Technical and industrial patrimony also offers many opportunities of awareness of science and technology. Some of them are more oriented to the past, attempting to reconstitute the context of working and living conditions at the beginning of the industrial era. Others try to bridge the past and the future, and to show the trajectories from ancient techniques to new technology. Initiators of such centres claim to play an important part in public awareness of science and technology, as they are acting on a critical dimension of culture: such as memory, which is unfortunately increasingly absent from the education of scientists and engineers[327].

3. Concluding observations

3.1. About national trajectories

Why are science centres so recent in Belgium? There is no simple answer to this question as there are several contributing factors:

- The regionalisation process of science & technology policy and of cultural policy did not develop at the same pace. First steps of regionalisation of S&T started in 1984 and the process ended in 1993, while culture was established as a non-national matter in 1980. This long transition period was not likely to support new initiatives and new investments in areas such as PUST, which were considered as rather marginal. It is worthwhile to mention that the creation of new science centres was undertaken as an element of technological policy, both in Flanders and in Wallonia.
- The use of European structural funds and regional development funds was the better option for new decentralised science centres, but this process is rather slow (due to factors like integration in pluri-annual planning, approval by the Commission, approval of complementary regional funds, etc.)
- Even with the relative absence of modern science centres until 1996 (Parentville) and 1997 (renovated Natural Science Museum), the Belgian public was not really deprived of science centres, as foreign science centres in France (Paris, Poitiers), the Netherlands (Eindhoven) and Germany (and even London) can be easily accessed from Belgium. In this way, the creation of decentralised sciences and their integration in regional projects might be an answer to the competition with "bigger" institutions in neighbouring countries.

3.2. About transferability

Both the creation of new science centres and the renovation of the Museum of Natural Sciences refer to various sources of inspiration from other countries. Nordic countries, France, Canada and (California) USA are the most referred to sources. Inspiration was sought from foreign countries in two main areas: architecture of the science centres, and design of interactive exhibition spaces.

Although Belgium is certainly not at the forefront of scientific culture, it plays an important part in European networking of museums and science centres. The ECSITE network (European Collaborative for Science, Industry and Technology Exhibitions),

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[327] Berckmans P., Charlier G., Daels L., *Van industrie tot erfgoed*, Ministerie van de Vlaaamse Gemeenschap, Brussel, 1989.

created in 1989, was set up and implemented from Belgium[328]. The creation of ECSITE was supported by the Federal science policy office (SSTC/DWTC), an interesting argumentation: “The vocation of ECSITE, based on the recognition of the different cultures and the development of these cultures through their dissemination, is very much in keeping with the Belgian mentality, which is particularly well acquainted with the cohabitation and cross-fertilisation of various cultures”[329].

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[328] http://www.ecsite.net

[329] Wautrequin J. (general secretary of SSTC) at the inauguratory meeting of ECSITE in 1991, quoted in the presentation paper of ECSITE by W. Staveloz, downloadable from their web site.

Exhibiting science and technology in France: Between education and leisure

Philippe Chavot, Anne Masseran

We have opted to limit the scope of this chapter to main achievements (i.e. seminal institutions in France) while also providing information on smaller structures (e.g. Musée Pasteur and Musée Curie in Strasbourg). Indeed, a comprehensive catalogue including all museums and exhibitions existing in France in the field of CST is impossible to establish for a variety of reasons.

First, from a purely geographical standpoint, France is quite a large country where despite (or should we say "due to") a well established centralism, regional characteristics remain strong. Initiatives are therefore both numerous and strongly influenced by their regional background.

Along the same lines, it should be stressed that French regions vary significantly from one another: some, like Lyonss at present, experience powerful development whereas others are more subdued. Although there is a definite national determination in France in favour of facilitating initiatives, distinct differences do exist between regions. Thus when the Centres de Culture Scientifique, Technique et Industrielle (CCSTI – Centres for Scientific, Technological and Industrial Culture) were developed in the 80's, a certain determination to spread across the entire national territory was observed. However, it is clear now that certain CSSTI developed rather randomly, in some areas and not in others, and that they varied in importance and dynamism. These differences are mainly due to the degree of determination at regional level and to the level of local funding.

Furthermore, if drawing up an inventory of all initiatives is impossible, it is not solely due to their sheer number but also to the multiplicity of their forms. As an example, it is extremely difficult to draw a comparison between, say, an institution such as La Cité des sciences – nurtured by the various governments, centre of attraction for tourism and genuine national showroom – and a small natural history museum like the one in Colmar or Marseilles, which are confronted with financial difficulties.

Third point, museology specialists in charge of these establishments adopt a variety of philosophies and objectives, even if a certain unification may now be observed, or should we say a tendency to be strongly inspired by a limited number of models like La Villette and Le Futuroscope.

Finally, the scientific museological scene is currently undergoing an important phase in the course of its evolution: new projects are on the horizon (Jardin des sciences in

Strasbourg, Musée des confluences in Lyonss), older structures are to be re-organised or are already in the process of being so (Musée de l'homme and Muséum d'histoire naturelle, both in Paris). Furthermore, many organisations combine the traditional functions of a museum with new roles created by the present context: interactive spaces are being designed, aiming to place societal themes related to the development of science and technology in perspective (through the means of multimedia technology or the creation of discussion or information forums bringing together scientists and the general public, etc).

Introduction

Although they are often considered as part of our national heritage, most museums have changed greatly during the two last decades and, simultaneously, new forms of communicating scientific and technical knowledge have appeared. During the same period, new sites were created, such as La Cité des Sciences et de l'Industrie de la Villette. In addition, thanks to the actions of the Minister of research of the 1980s, Jean-Pierre Chevènement, new organisations devoted to CST were created: the Boutiques des Sciences (Science shops) and the Centres de Culture Scientifique, Technique et Industrielle (CCSTI, Centres for Scientific, Technological, and Industrial Culture). The latter have largely contributed to the multiplication of initiatives in science popularisation.

All these spaces – from the new Museums to the CCSTI – can be ranked in two categories: the Commemorative spaces and the Science centres. This typology accounts for the general goal of these institutions, the way they put science into context and the way they intend to make the public active or not when faced with exhibitions or other demonstrations.

Because these institutions integrate a temporal dimension (either by accounting for the history of nature or the history of science and technology), we have grouped together, under the name of commemorative spaces, the Natural History Museums, the Museums of science and technology, and the sites of scientific remembrance. The fact that the new arrangements of the Natural History Museums tend to integrate commemorative spaces – accounting for the works of people who had contributed to the advancement of science or to the creation of the Museum – confirms the relevance of this grouping.

Taking into account the goals of Museums of Natural History, one may consider that these institutions should be neutral with regards to the social context of scientific development. However, it is worth noting that these institutions pursue several vocations: education, science popularisation and research. Hence, CST actions that these institutions develop may carry a particular meaning, not disconnected — even if these links do not appear clearly — with a representation of “proper science” conveyed by natural scientists.

The second category of institution, the Science Centres, does not attach so much importance to the past. Instead, it focuses on the current and future development of science and technology. Indeed, the main vocation of these institutions is to inculcate a scientific culture to the public, in order to raise their awareness of the importance and of the usefulness of science and technology in our society. Hence, these spaces are often submitted to a much wider political project and sometimes transform themselves into propaganda places.

A – Commemorative spaces

1 – The museums of natural history

At first, most Natural History Museums were created with the aim of establishing collections for research purposes. The MNHN of Paris constitutes the archetype of these institutions. Its creation dates back to the 17th century, with the establishment of a Cabinet d'Histoire Naturelle within the Jardin Royal des Plantes Médicinales. Soon after the French Revolution this establishment acquired the status of public museum with the creation of the Museum of Natural History in 1793 thanks to the actions of two collaborators of Buffon, Joseph Lakanal and Louis Daubenton. Its main purpose, according to a decree voted by the Convention, "would be the education of the public to natural history, in its widest sense". Several collections were gradually opened to the public, such as its prestigious Galerie de Zoologie, inaugurated in 1889. Based on this model, numerous Museums were created in the province until the beginning of the 20th century, most of them being connected with the Parisian institution. Nowadays, there exist 187 Museums of Natural History grouped in a network.

Since the 1980s, these ageing institutions are being modernised in many ways. In most cases, the aim is to preserve or even amplify the patrimonial function of these museums. The most prestigious collections are valued by making them part of the history of science. In a few cases, the modernisation of the structures allowed to re-order part of the collections according to a new dynamics, closer to contemporary scientific thought. Besides, attempts have been made to use new information technologies to enhance interactivity in knowledge acquisition.

In this movement, the most prestigious realisation of the last years is the transformation of the Galerie de Zoologie du MNHN, renamed Grande Galerie de l'Evolution in 1994. There, numerous innovations have been made: the use of electronic and audio-visual interactive devices, exhibitions integrating a strong aesthetic component, the opening of a new exhibition accounting for the actions of Mankind on Nature. However, the function of the Museum as a scholar space remains intact. Since renovation, the MNHN also intends to raise issues of a societal nature, relating to the development of science and techniques. Its organisation revolves around evolution mechanisms and, above all, around the concept of biodiversity. In a way, the original objective set by the team in charge of modernising the Grande galerie combines all these elements, as highlighted by Van Praët, Grande galerie director (…): "on behalf of the museum, showing the nature of our work, being connected to society, enabling society to see the collections, fulfilling a role in terms of education and learning to facilitate the transmission to society of concepts which, we feel, it should master – the importance and the origins of biodiversity. Evolution appears from the outset […], but what we intended to demonstrate is that evolution explains biodiversity"[330].

It would be impossible to present here a consistent catalogue of the Natural History Museums in France. However, it is worth noting that each Museum seems to have developed its own approach to CST. These differences in the way of communicating science and technology may be due to local contingencies: peculiar history made these Museums depend for funding either on the local university, the city, or local administrative powers. Apart from the MNHN, we notice that generally only Museums that are independent from academic institutions made or are going to made in-depth transformations. In addition, the aim these refreshed institutions pursue may be quite different according to the city considered. For instance, in Besançon, the Museum has been transformed into an education and entertainment centre and all the renovations were a matter of design. The project to be carried out in Strasbourg follows the same path. However it would include a small theatre expected to host a troupe, who perform plays staging prominent scientists or scientific controversies. Other cities have chosen to value other perspectives. In Lyons, for instance, the transformation of the Museum will be part of the re-organisation of a big part of the Museums network of the city and, thanks to the contribution of natural and social scientists, would integrate a reflection on the relations between science, technology and society.

2 – Places of remembrance

Besides the spaces devoted to natural history, there are numerous sites dedicated to the history of science and technology. These institutions can be very different depending on the institution or the group of persons who initiated the project.
Among these sites, the most prestigious is the recent Musée des Arts et des Traditions (MAT, Art and Traditions Museum) of the Conservatoire National des Arts et Métiers (CNAM, Arts and Crafts Academy), inaugurated in Paris in March 2000. It presents an

[330] Interview with M. van Praët conducted by Ph. Chavot and A. Masseran (Paris, 2002).

impressive collection of scientific objects and instruments supposed to have greatly contributed to the development of our society. However, only objects are visible: the context or the knowledge which allowed such developments are not – apart from a few exceptions – accessible to the public. The only possibility left to the public to give a meaning to these objects is to join a guided tour (if they arrive at the appropriate time and if the Museum is not too crowded) that allows to obtain further information and experiment with copies of the exhibits. The MAT is an apologia of scientific and technical progress. Arranged by themes and ordered according to the evolution of the objects, this space makes current science and technology omnipresent: because of the lack of explanation, only present knowledge will be called for to explain past developments – as is the case when, during the visit, experienced people attempt to explain to the youngest generation how old objects worked.

Other initiatives appeared well before the established of the MAT. Several sites have been created as a means to protect historical scientific sites or instruments (of a more or less impressive size). In some cases, these actions crystallise around the work of "prominent scholars". However, only a few initiatives succeeded in getting support either from the CNRS, the Ministry of Culture or from the local administrative power.

One successful example among these initiatives is the Musée Curie that has been established in the premises of the former Curie Institute in Paris. The project was initiated by the Curie family who managed to recruit friends and researchers to establish the Association Curie et Joliot-Curie, whose goal was to celebrate this family who won five Nobel prizes. Firstly, they organised for the Curie Institute – after decontamination of the premises – to be fitted out and opened to the public. Visits of the site became possible, first with appointments, and the structure became fully open to the public in 1992. It welcomes about 10,000 visitors every year. Since then the initial project has been deeply transformed. Researchers and archivists have colonised the project and collected archives on the Curie family. Progressively, this Museum which was expected to focus on the Curie family has widened its scope to embrace the multidimensional aspects of the history of radioactivity.

A different action initiated by the Curie Museum consisted in extending the project to a whole sector of the fifth district, the Montagne Sainte Geneviève, presented as the scene of important scientific achievements: sight-seeing tours have already been organised to present sites that played an important role in the emergence of modern science at the beginning of the century, such as the Ecole de Chimie and the Institut de Géographie. This initiative was supported mainly by archivists who obtained funding from the Ministry of Culture.

The actions that led to the institution of the Musée Curie are not isolated. Numerous initiatives, generally coming from natural scientists, aim to protect the scientific heritage or to glorify the past, as was done with nuclear physics. It is the case with the Espace

Zoé, instituted round the nuclear reactor Zoé, in 1985. First established by researchers against the wish of the administration, this arena is now part of the facilities of the Commissariat à l'Energie Atomique (CEA) and open to public visits. Similarly, soon after the dismantlement of the Collision ring of Orsay, near Paris, in 1988, several scientists tried to protect this historical instrument by establishing a Museum. In both cases, scientists are trying to revalue a research domain which, for a decade or so, has been of secondary interest for the authorities. Hence, support comes less from the Ministry of Research – except by the means of the CCSTI – than from the Ministry of Culture. The Orsay Collision ring project is still waiting for money and acknowledgement by the administration.

Similar actions have appeared also in the provinces. Strasbourg's case illustrates well the current tendencies, as well as the difficulty that CST people encounter in the provinces when they wish to establish new sites. There, a group of scientists have made, since the early 1980s, several attempts to protect the scientific heritage. These actions have led to the rehabilitation of the astronomical observatory and the establishment of the Museum of Seismology and Earth Magnetism. In addition, they have saved lot of scientific instruments dating back to the 1870's. While they succeeded in these actions this group of scientists had a more ambitious project: to establish a science centre in Strasbourg. To do so, they have established an Association, l'AMUSS (Association for the Strasbourg Museum of Science) which until now has hosted most activities these people have carried out since the 1980s. However, this effort is hardly acknowledged by the institutions. While both the University and the town authorities managed to obtain support from the State and the local administrations to establish a Science Museum at Strasbourg, none of the Strasbourg people involved in CST since the 1980s have been consulted.

B – Science centres

At its creation, the aim of the MNHN was to spread enlightenment, to redistribute knowledge acquired within the institution and help with the progress of humanity. In order to pursue this goal, the Museum entrance was kept free for several decades.[331] Similarly, when the first science centres were established – The Palais de la Découverte in the 1930s and, later, the CCSTI in the 1980s – they were expected to fulfil precise political goals. During these two periods, the same prevailing idea existed: society should follow the path given by science and technological developments. Hence, new institutions were needed that would help to improve the scientific education of citizens and facilitate the social acceptance of the new knowledge and

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[331] Cf. LIMOGE C., "The development of the Muséum d'Histoire Naturelle of Paris, 1800-1914", in FOX R. & WEISZ G. (eds), *The Organization of Science and Technology in France 1808-1914*, Maison des Sciences de l'Homme and Cambridge University Press, 1980.

technologies. In addition, as was the case in the 1980s, these sites may help stop the destructive criticism of science. Thus, in most sites science would be exhibited in its purest form, devoid of historical, sociological, or political perspectives.

The creation of the Palais de la découverte was largely inspired by the model of the Universal Exhibitions, where scientific and technological progress was staged as a spectacle.[332] That may be due to the circumstances of its creation: the Palais was first conceived as a temporary exhibition established within the framework of the international exhibition "Arts and techniques in modern life". Hence, it is not by chance that it turned science into a spectacle, playing with the magic that accompanies scientific demonstration. However, a more fundamental motive existed: spectacle was the best way to present "science in the making" (la science en train de se faire), to quote the founder of the Palais, Jean Perrin.[333] Spectacle and demonstration were necessary to make science accessible to all. Founded by a group of scientists, the Palais would remain within their hands: within this structure scientists can become either designers, demonstrators or speaker… Everything goes as if scientific truth could not withstand mediation: it should stand out by itself in front of the public or not exist at all.[334]
The Palais de la découverte would not be a model for further developments. Its fault has been to leave the public distant from the demonstration: they can do nothing except remain passive and watch the truth unfold in front of them. In the 1960s, a different attempt at communicating scientific truth was made with the creation by Oppenheimer of the Exploratorium of San Francisco. There the public was no longer distant from science but could experiment physical or sensory phenomena thanks to simple devices or instruments. They could directly experiment and integrate “scientific truth”. That is this model of direct experiment – more than that of the Palais de la découverte – that will spread in France in the 1980s, when numerous science centres were created.

One of the political orientations of the socialist government of the early 1980s was to base economic development on scientific and technical developments. In order to be efficient, this policy needed a large support from society. As stated during the colloquium Recherche et technologie, organised in 1982 by the Ministry of Research, there was also a need to answer destructive criticisms of science which had remained

[332] Before the creation of specific sites, the only places where science and technology were put into spectacle and glorified were the Universal Exhibitions that largely embodied the idea of progress.
[333] For a comparison of the philosophies supporting the creation of the *Palais* and the other scientific museums of the 1930s, see SHAFFER S., "What is Science", in *Science in the XXth. century*, KRIGE J. & PESTRE D. (ed), Harwood Academic Publisher, Amsterdam, 1997, P. 27-41
[334] The current objective of the *Palais* remains rather identical to its initial vocation: "make science and its applications understandable by all". The only visible change concerns the use of new information technologies.

active since the 1968 revolution. Both the Ministry and scientists feared to face an ascent of anti-science movements that, with the repercussion of the economical crisis of the mid-1970s, may endanger France's social and economical stability. The 1982 colloquium, underlines Patrick Petitjean,[335] terminated the public debates on science development and constitutes the starting point of new ways to include science in culture.

In the early 1980s, the socialist government set up two new institutions aiming at promoting CST: the Boutiques des sciences (Science Shops) and the Centres de Culture Scientifique, Technique et Industrielle (CCSTI). A third initiative appeared in the 1990s, with the organisation of the Fêtes de la Science.

The first institution, the Boutiques des Sciences, had a rather short-lived existence. One of the only Boutique which is still functioning is the Boutique des sciences of Strasbourg (whose actions are quite similar to those of a CCSTI). Furthermore, what they were supposed to do is difficult to appreciate. According to some, Boutiques were created to answer questions citizens may ask on specific scientific issue: Boutiques are shops-like structures devoted to scientific reasoning. For others, the Boutiques des Sciences had to play the role of bringing a new dynamics in the different attempts made to promote scientific culture at the local level.

The CCSTI benefited from a better existence than the Boutiques des sciences and are still playing a crucial role in promoting CST actions. Of the about forty CCSTI that exist today some manage big Museums or Science Centres, such as the Centre national de la mer Nausicca in Boulogne-sur-Mer, Oceanopolis in Brest… But the role of the CCSTI is mainly to promote scientific culture through different delocalised actions. They have initiated numerous itinerant exhibits, publish local magazines, they also organise conferences, debates, Cafés des Sciences, workshops and animations for children. CCSTI are also responsible for organising local demonstrations for the yearly Fêtes de la science. Hence, the CCSTI have created numerous new spaces promoting CST. But these spaces can, in return, be colonised by institutions, politicians or associations. Nonetheless, because CCSTI actions are supported mainly by the Ministry of Culture and the Ministry of Education, they benefit from a certain autonomy with regard to scientific institutions. Even if an orientation is often given to their actions or demonstrations, the CCSTI contribute in some way to the democratisation of the debate on scientific and technological developments.

As was already the case for the museums of natural history, it would be very difficult to propose an inventory of the various actions undertaken at local level by the various CCSTIs. We will try, in the next report, to describe the main trends as well as some of CCSTI's actions that we consider to be the most innovative.

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[335] PETITJEAN P., "La critique des sciences en France", *Alliage*, n°35-36, automne 1998, pp. 118-133

In spite of the variety of actions made at the local level, the French reference in CST is the Cité des Sciences et de l'Industrie de la Villette ("La Cité"). The initial project that led to the establishment of La Cité was twofold: to establish a museum of techniques that will promote the collections of the CNAM; to enhance the development of history of sciences with the creation of a media centre, of a history of science institute and an archives centre. However, in 1986, when La Cité was inaugurated, it looked like a mere institution aiming at promoting French technosciences, with large spaces devoted to Space or Energy sciences. Nonetheless, the media centre would soon be considered as an important resource for historians of science. However, historians and archivists who had been recruited within the new establishment scarcely contributed to the actions undertaken to promote the CST within La Cité.
Although it is still considered a showcase of French science and technologies, La Cité des sciences de la Villette has progressively widened its action and initiated new ways of promoting CST. Soon after its creation, it has accommodated an Exploratorium built on the model of the San Francisco site (cf. infra). In addition, thanks to the large spaces devoted to temporary exhibitions La Cité benefited from enough flexibility and freedom to promote new concepts, to inform about new subjects or implement new practices in science communication. Indeed, these spaces often present exhibitions on the development of sciences that are problematic and are at the core of public controversies. These exhibitions, together with public debates or conferences organised around the exhibit, offer food for thought to a public who generally discovers that science may be problematic through the media. However, even if these initiatives may enhance reflection, the main research institutions (CNRS, INSERM, INRA) are often present in the organisation of these exhibitions as well as in public debates and, often, they act to preserve the legitimacy of science.

As has been said in the introduction to this report, La Cité des Sciences is a model in the field of scientific information and communication. It is one of the largest cultural sites visited in France, with more than 3.5 million visitors per year. But La Cité also plays an important role as a provider of services or ready-made exhibitions. Indeed, most temporary exhibitions presented in Paris may thereafter be proposed to other sites in the provinces. Hence, they could be visited by 500,000 additional persons per year. Finally, La Cité constitutes also a model to create new CST spaces in the provinces. Despite this dependency being badly perceived by local people, La Cité is often present in projects made in the provinces either as a consulting expert, or as promoter. It is one of the effects of French centralism that has already been mentioned in the introduction.

C – Scientific and technical leisure parks

As may be observed at present, there is a firm connection between leisure parks, in the realms of recreation and consumption, and museums, which belong to education and culture. A manner of cross-fertilisation has caused the emergence of a specific offer, highly recreational, aiming at attracting a wide audience and more particularly families, with the added intention to fulfil a role in science and techniques popularisation. These hybrid structures, to which we refer as "scientific and technical leisure parks", represent an important trend which was developed in France in the 90's. It places an emphasis on state-of-the-art technical means – particularly multimedia and info-electronics – and uses these to entertain the general public. Le Futuroscope in Poitiers and La Cité de l'espace in Toulouse, are among the most famous cases illustrating initiatives of this nature and give a concrete expression of this approach to science and techniques.

Therefore, these structures belong to the field of CST and may be considered "related" to La Villette – they are also somewhat linked to the concept of leisure parks, defining themselves as tourist attractions in their own right, on an equal footing with national monuments[336].

Le Futuroscope

Le Futuroscope is the eldest of these scientific leisure parks. Located near the town of Poitiers, it offers a specific presentation of science and techniques. Firmly adopting a spectacular approach – advertising materials emphasise themes like discovery, emotion, imagination, sensation[337] – its main objective is to entertain its visitors. Le Futuroscope is therefore at the crossroads where CST meets leisure parks. It may be defined as a "Palais de l'Image" (a temple of images) offering a large number of films perpetually renewed. Giant or hemispheric screens, 3-D effects, simulators and all manners of technical means are developed to stimulate sensations, emotions and a sense of wonder.

Open to the public in 1987 following several years of construction (works started in 1984) – Le Futuroscope was created on the initiative of the Conseil Général de la Vienne (council of the French territorial district Vienne) and its president, René Monory, former minister for education. The first two attractions were Le Pavillon du Futuroscope and Le Cristal (225,000 visitors). At a later stage, Le Futuroscope developed further and offered additional attractions (giant screens, raised images, 360° projection, moving seats and, from 1996, 3-dimensional imaging). Le Futuroscope has been run

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[336] Vulcania, located in the Auvergne region, was designed with similar mind-sets although science is less prominent in this project.
[337] See http://www.futuroscope.com/. It should be mentioned that some laboratories of Poitiers University are accommodated within *Le Futuroscope*.

by the Amaury Group since April 2000 but the hypothesis of future nationalisation has been put forward – also in 2000, business was stimulated with the opening of a high-speed train station in the vicinity.

It seems, however, that the playful approach to "science-entertainment" might have reached its limits since, following remarkable success in the mid-90's (with over 2 million visitors in 1994), Le Futuroscope now experiences a constant drop in attendance despite attractions being constantly renewed and themes being diversified (these range from the life of pandas to "taste workshops", including the theme of Atlantis and a visit in outer space).

***La Cité de l'espace*[338]**

La Cité de l'espace is a scientific park intended to provide entertainment and aimed at the general public. It was created on the initiative of the city of Toulouse with numerous partners[339] and was inaugurated on 27 June 1997. It is located in the heart of a wide landscaped park, close to the city centre of Toulouse. La Cité de l'espace (the CE) is self-defined as being in contrast with the traditional museum model and intends to make the public take an active part[340], providing visitors with the opportunity to experiment and placing them in "real-life" situations. In brief and according to its own specifications, the CE is defined as "a theme park with a scientific purpose where the public comes to be entertained as much as to learn." Thus the CE is set to fulfil three main objectives: to educate, to be a tourist attraction and to act as a technological showroom.

The attractions evoke "the odyssey of outer space", staging it with a variety of activities, interactive exhibitions, shows and audio-visual elements. The CE is organised around four centres of interest: the Park, which allows for reckoning distances and scales, the Exhibitions Pavilion, where interactive experiments take place, the Planetarium which includes a hemispheric screen and finally the Terr@dome.

This entertaining set up includes original items of primary importance: a real-size MIR station, inaugurated in 1998 in the presence of a large number of former crew members and a life-size model of the Ariane 5 rocket. Since the beginning of the new millennium, the theme of outer space has been enlarged to include planet Earth with the addition of the Terr@dome. The Terr@dome is a giant sphere in which visitors

338 http://www.cite-espace.com/.

339 The Regional Council of *Midi-Pyrénées*, the ministries of Public facilities, Transport, Defence, Education, Research and Technology, CNES (Centre National d'Études Spatiales), Météo-France (French meteorological office), EADS, Astrium, etc, also including many companies with the status of "associated members".

340 Indeed, website visitors are encouraged to participate.

discover "the origins of the earth" and its evolution. The entertainment factor is combined here with an environmentalist approach as the objective is to highlight the importance and fragility of our terrestrial heritage.
Thus, while the CE may be concentrating on large items "making" history and large-scale science, it also draws from current affairs and contacts with the men and women who take part in conquering outer space. As an example, the CE organised an event which drew much media attention. In October 2001, it broadcast a dialogue between "the first Frenchwoman in space" – i.e. the famous Claudie Haigneré, now minister of Research – live from the International Space Station with individuals from various backgrounds (politicians, scientists, technology specialists). It should be stressed here that dialogues with "those who make science" are regularly organised by the CE: personalities such as JC and C Haigneré or Hubert Reeves are invited to meet the general public. The fact that these individuals are the focus of media attention, or have a somewhat symbolic personality (Reeves the storyteller, Haigneré the first Frenchwoman astronaut) is indeed to be related to this determination to stage science and present it as an entertaining spectacle[341].

Le Futuroscope and La Cité de l'espace represent several of the current trends in French CST:
The will to decentralise structures, with the initiative given to local authorities.
The preference for "giant scale" projects: indeed, the projects undertaken are large in size, in ambition and in the way science is staged to fulfil its role, one of the objectives being to attract visitors from the entire French territory and even from the whole world. In this perspective, CST entails a universal element, holding the ability to draw attention to a city or even a region.
The concept that science and techniques have to be staged in shows, endowed with a power of entertainment to stimulate the public's interest.
Finally, the fact that "large-scale sciences" – and aerospace in particular – involving a high level of technological investment are almost naturally more interesting than others.

In this respect, this "culture of scientific entertainment" is in line with the concept of "showroom" which was clearly dominant in the 80's (only now it is not so much a showroom for French science and technology and has developed a wider European dimension) while having also broken away from this approach. Whereas formerly the interactive dimension of scientific exhibitions was limited – and indeed often criticised as merely providing "button pushing" activities – we now have access to interactions of spectacular magnitude: all events are staged in such a way that the most "sophisticated" information technologies which are supposed to represent a symbol of

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[341] Unlike *Le Futuroscope*, since it was opened to the public the *Parc européen de l'espace* seems to be in a position to keep up its number of visitors (i.e. over 300,000 visitors per year).

our modernity (simulation, 3-D, multimedia, internet, etc) come to reinforce the "state-of-the-art" aspect of the relevant science and technologies.

D – Structures at project stage: the intention to synthesise

New projects are currently being developed within the sphere of influence of this trend. Combining science and spectacle, they also intend to include "civic concerns" (whatever the meaning given to the expression). They seems to constitute an attempt in synthesising past experience – or at least their most positive aspects – while also intending to bring about an original approach. The novelty of these projects rests in the fact that they are not solely based on an inventory and reflection on existing structures but also includes pooling the experience of the various partners. Two observations stand out:
The experience taken into account is not limited to France anymore but is truly enlarged to encompass Europe. Thus in 2002 a series of round table discussions was organised in Strasbourg to foster a common reflection revolving around scientific museology. The personalities invited to take part in the project naturally included parties involved in French scientific museology and also European counterparts from Barcelona, Luxembourg, Neuchâtel, Munich, etc.
A new profession seems to develop an increasing importance in the design stages of projects: that of scientific museology specialist. It is currently undergoing a fundamental redefinition.

For the sake of illustrating the above points, we propose to examine briefly two specific projects: the Musée des confluences in Lyons and the Jardin des sciences, in Strasbourg.

Musée des confluences

Symbol of this determination to renew scientific museology and of some trends in French CST, the Musée des confluences, in Lyons, attempts to integrate several aspects which, up to recently, were often disjointed in scientific museology. Specifically, the objective is to combine:

- the concept of "civic science" within a large structure,
- a large-scale project anchored locally whilst also having the ambition of nation-wide recognition,
- the inclusion of human and social sciences – “poor relations" of scientific museology in France – and nature sciences,
- collections and interactions,

- presentation of specifically developed products (exhibitions, collections), accommodation of products developed by other organisations and facilitating a sphere of influence.

Thus this museum, covering 2,000 sq. m, will be situated in the heart of the city centre, located on a peninsula at the confluence of two rivers, the Saône and the Rhône. The main building was the subject of an international architectural competition. It will be cloud-shaped, stand over the rivers whilst being rooted in the earth. Following the will of its designer, the Canadian architect Michel Côté, it will be a museum dedicated to science and society as its ambition is to analyse the interactions between science and society with an aim to raise questions and bring about an awareness of the challenges of our times, both on a small and a large scale.

The origins of this project are to be found in the need to renovate an old natural history museum and other existing structures (this background is similar to what we find in Strasbourg). The initial project has spread rapidly to include the creation of a science and society centre, to be developed over four locations disseminated over the entire city: a park/museum, a research centre with the collections, a museum dedicated to world cultures and the future Musée des confluences, designed to be the overall driving-force.

Finally, the determination to synthesise the various fields of science, society and nature also appears in the overall theme chosen for Musée des confluences: Life itself. Firstly, this theme allows for endless developments (a large proportion of surfaces will be dedicated to temporary exhibitions) and, secondly, the magnitude of this theme demonstrates the ambition of a project where all is orchestrated with the intention of creating overall links and making connections.

Jardin des sciences

More modest in size and still in its early stages[342], the project of a Jardin des sciences in Strasbourg stems from a reflection where common ideas were shared with the underlying philosophy of synthesis as described above. Again, the starting point was the renovation of the zoological museum, property of both the city of Strasbourg and the university (this shared ownership is a fact worth mentioning). Over the years, the project developed and spread to finally encompass the university park, the planetarium, the seismological museum, etc, and includes the synergy of various facilities, structures and partners (negotiations were stormy and included a succession of partners). The intended public is extremely wide-ranging: individuals involved in the academic world, who are already aware of these issues and may be specialised, people with an interest in science, the regular visitors of museums and also others –

[342] The first phase should be finalised in 2006.

children and adults – who are not necessarily aware of the subjects covered. The objective is to raise the awareness of the general public with regards to science and techniques whilst also providing entertainment (reference is clearly made to the large-scale projects of Poitiers and Toulouse). Furthermore, the intention is to present a history of science, its current state and integration in current affairs, therefore following the steps of La Villette, combining spaces dedicated to permanent or temporary exhibitions and information products such as discussion forums like Osez le savoir[343], i.e. a meeting place where researchers and the general public raise topical issues. Like in Lyons, the overall theme of this museum will be particularly wide and directed to Life itself.[344] It should be stressed that this project is somewhat cautious when it comes to the philosophy favouring "manipulations", and this indicates a redirection of the presuppositions underlying scientific museology.

Conclusion

The new role of mediator is currently emerging but the partners involved in CST have not yet agreed on its identity. Should it be a scientist? It seems that this possibility is less and less envisaged and, increasingly, the mediator is seen as being a museology specialist or expert in popularisation.

New projects and recent restructuring grant human and social sciences a more prominent place.

Activities related to CST museology are increasingly turned towards the coexistence of various types of structures and do not fit the former model of scientific museology which seems to be affected by chronic disaffection (see La Villette, etc).

The willingness to synthesise is perceptible at all levels with the development and participation in the network of European science museums, the concept of a balance having to be struck between nature and human sciences, the existence of an array of themes relating simultaneously to science and society, the combination of entertainment and education while also aiming at the adult public.

[343] The designer of the *Jardin des sciences* is indeed coming from *La Villette* where he implemented *Osez le savoir*.
[344] Themes are not yet firmly determined and, according to Gaudenzi, the overall theme should be along the lines of "from the inert to the living".

Science museums in the Portuguese context

Maria Eduarda Gonçalves, Paula Castro

1. Background

The science museums are generally seen as decisive arenas for the creation and diffusion of scientific and technological culture. In this case, the agents of the popularisation of science and technology have the control over the instruments of diffusion, whereas in the case of the mass media, they remain dependent on journalists. It is also true that in the past, science museums were usually seen as part of “high culture”, and this socio-cultural definition[345] was an obstacle to a popularisation strategy comprising larger sections of the population.
The recent tendency to consider science museums as “mass media” may be seen as part of an attempt to bring them from “high” to “mass” culture.
In recent years, this trend has had an important impact on the organisation and role of science museums in Portugal, through the involvement of political institutions in the design of a strategy for the popularisation of scientific and technological culture. The major indicator of this evolution is that the concept of the “science museum” seems to be progressively replaced by that of the “science centre”.

2. New trends

This change implies a strategic reorientation of the organisation and role of these institutions. The “classical” museums namely, the Science Museum and the Natural History Museum of the University of Lisbon are major structures established in the capital, Lisbon. They cover a broad range of subject-matters and historical periods of scientific knowledge and instruments.
The new more modern spaces tend to be decentralised from Lisbon. They are more flexible structures, using new and interactive technologies and in some cases, they specialise in particular subject-matters (e.g., astronomy, geosciences, climate change or mathematics), historical periods and target specific audiences.
Although this does not mean a disinvestment in the “classical” museums – in fact, these have been supported in recent years by political institutions and have also been following the modernising strategies employed in the science centres, including the use of interactive technologies there has indeed been an important change in the

[345] Here the science museums share the characteristics common to the art or archaeological museums.

conception of both the role and the organisation of these interface spaces between scientific knowledge and the public.
The flexibility of the new structures has made it possible to expand their number and their distribution throughout the country.
In recent years, various science centres were created in different cities. Besides, the "Ciência Viva" programme has given rise to the establishment of "ciência viva" centres, conceived as interactive meeting spaces. Examples of these centres are:
the "Centro Ciência Viva" of Algarve,
the Planetarium of the Centre of Astrophysics of Oporto,
and the Infante D. Henrique Exploratorium of Coimbra.

The "Pavilhão do Conhecimento" (Knowledge Pavillion), created in 1999, in the setting of EXPO-98 ("The Oceans – A Heritage for the Future") at the "Parque das Nações" (Park of Nations), in Lisbon, has offered on a continuous basis exhibitions on science themes. Some of these will be "imported" from other museums or similar institutions of foreign countries and others designed and set up with the assistance of Portuguese researchers.[346]
An interactive science space, the Visionarium has been established near Oporto, as well, under the initiative of a private the Industrial Association from Oporto.
Six additional "Ciência Viva" centres are planned to open in the near future in cities of medium or small dimension all over the country. The underlying policy goal is to establish a dense network of science centres throughout the country, which, in articulation with the "classical" science museums.

[346] Until 2001, The Knowledge Pavillion received more than 300 000 visitors (A. F. Costa, P. Ávila and S. Mateus, 2001: 64).

Science museums in Sweden

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

As is the case in many countries, Sweden has a rich variety of museums. In addition, these museums have traditionally played an important role in initiatives of public understanding of science. As such, this text cannot cover all aspects or all museums in a profound way, but instead will try to highlight the most important and distinct features regarding PUS. It is also important to remember the Swedish definition of 'vetenskap' (science), incorporating the social sciences and the humanities as well as the natural sciences, as this effects the possible selection of museums here. To this end, and for purposes of this text, it is not only museums of the natural sciences which will hence be considered.

Sweden has a number of science centres, similar in purpose and nature to other countries. Arguably, these institutions are remarkably similar from country to country.[347] Therefore, the decision has been made to focus on the 'regular' museum. An exception has been made for the new science centre, Universeum, which carries a national responsibly.

Museums: the Swedish context

After the Second World War, in which Sweden was not directly involved, a thorough welfare state was created. This meant a large investment in the public sector. The distribution of scientific knowledge to citizens and the use of scientific findings in public administration were seen as important parts of democracy and rational governmental ruling. Two effects of this can be observed at the policy level during the second half of the century: the 'sectorial principle' and the "Third assignment".

In the early 1970s, the 'sectorial principle' (a Swedish variant of the Rotschild principle), was introduced into Swedish science policy.[348] In accordance with this idea, the

[347] See James M. Bradburne (1998) "Dinosaurs and white elephants: The science center in the twenty-first century", in *Public Understanding of Science*, vol. 7, pp. 237-253. For a critique of Bradburne, see Per-Edvin Persson (2000) "Science centers are thriving and going strong!", in *Public Understanding of Science*, vol- 9, pp. 499-460.

[348] Elzinga, A, 1993, "Universities, Research, and the Transformation of the State." In Sheldon Rothblatt & Björn Wittrock (eds) *The European and American University since 1800. Historical and Sociological Essays.* Cambridge University Press, p 191-233. The Rotschild principle is a policy initiative, which entail a contractual relationship between researcher and funder, in which the latter supplies resources on the condition that the knowledge produced has specific policy and social relevance; see *A Framework for Government Research and Development*. London: HMSO 1971, usually referred to as the Rothschild report.

university is the main public repository for science that may solve problems within various societal sectors, be it housing, supply of energy, national transportation and local systems, environmental protection, health and welfare, etc.[349]

In the Swedish context it therefore became important to view research in the academic domain as open to public scrutiny and transparency. This means that efforts must be made to inform a wider audience about the existence of this kind of research, making it accessible particularly to various *user* categories.

During the 1970s, a number of new sectorial funding councils were created. With this came an increasing attention to *user information*, both in the initial and final stages of projects.[350] The information was, for example, transferred via contacts with the media, special brochures, research catalogues, and the creation of sectorally oriented publications funded by the sectorial councils themselves.

The second important policy initiative is the requirement for researchers to disseminate their results.[351] In the new University Act of 1977, this new task supplemented the earlier two officially proscribed responsibilities assigned to the universities, teaching and research, and it was thus called the "Third Assignment" (*tredje uppgiften*). Such disseminated research information (*forskningsinformation*) should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have come to modify the text, changing its intent somewhat. Some core ideas are, however, still present, which goes back to the fact that the universities are part of a unitary national system and are publicly funded.

An important element of the "Third Assignment" is the emphasis on the democratic significance of research-based knowledge. Research as a resource for changing society produced, from a political perspective, two democratic problems.[352] One of them was that the citizens needed to increase their awareness and control over these changes. As knowledge increasingly became important for the possibility of citizens exercising their democratic rights, it also seemed increasingly problematic that the

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[349] See Elzinga, A, 1980, "Science Policy in Sweden: Sectorisation and Adjustment to Crisis", Research Policy, vol 9, no 7, April, p 116-146; 1990, "Triangeldramat bakom [349]forskningspolitiken", (Triangleplay in research policy), in Wilhelm Agrell (ed), Makten över forskningspolitiken Lund: Lund University Press, p 41-60. This means very little applied research is done in special government laboratories or institutions that fall under the direct authority of one or another ministry. Instead ministries support special research funding agencies that receive both unsolicited and solicited grant proposals from universities. These are sometimes called "sectorial research councils" to distinguish them form the more traditional basic research oriented councils which continue to allocate funds on the basis of a pure peer review process. The sectorial councils combine criteria of societal relevance and scientific excellence in their review procedures. In some cases the former dominate over the latter, in other cases the two-tier approach starts with scientific merit. Of course there has been a lot of debate around these procedures, they may be compared to the notion of "extended peer review".

[350] Several studies have been carried out during the 1980s on research utilization and modes of disseminating results linked to sectors: Björklöf, S, 1986, "Byggbranschens innovationsbenägenhet." *Linköping studies in management and economics, no 15*, Diss; Boalt, C & Lönn, R, 1987, "Forskningsanvändning." *Tidskrift för arkitekturforskning,* vol 1, nr 1; Ericson, B & Johansson, B-M, 1990, *Att bygga på kunskap. Användning av av samhällsvetenskaplig FoU inom byggsektorn.* BRF Rapport R 3; Nilsson, K & Sunesson, S, 1988, *Konflikt, kontroll, expertis*. Arkiv, Lund.

[351] Svensk författningssamling 1977:218.

[352] Om forskning. (About research) Forskningsproposition 1986/87:80.

dissemination processes traditionally were relatively marginal and skewed in favour of those in power, at the cost of a broader public.

Sweden museums often have a certain research activity and sometimes also publish scientific journals. The main task of these types of museums is to popularise scientific knowledge, but through their research work, they often also possess large amounts of scientific competence.

The aforementioned policy context with its emphasis on democracy and scientific accountability is a reason for the thorough engagement of various Swedish governments in museums during the 20th century. Museums became a vital means to reach the public. Besides direct support to museums, there also exist cooperative agreements between governmental bodies, different institutions and museums. An example of this was *Forskningsrådsnämnden* (Swedish Council for Planning and Coordination of Research (FRN)), which, due to the recent structural change in the Swedish funding system was replaced by *Vetenskapsrådet* (the Science Council).

In some projects, FRN tried to link different actors in the Swedish PUS landscape; this was the case with the national initiative of *Populärvetenskapens vecka* (The week of popular science). The arrangement is localised at a different university each year working as a hub in an array of activities linking universities, museums, science centres, communes and business companies. FRN also had a role of initiating and giving support to projects directed towards schools at the gymnasium level (ages 16-18). A strong ambition was to overcome the culture gap between natural sciences and the humanities. This has resulted in a nation-wide theme around the environment as history. Taken up by gymnasium schools around Sweden, this has led to a variety of exhibitions at museums and public presentations.

Traditional and New Museums

Both national (mostly located to Stockholm), and local/regional museums are customary and prevalent in Sweden. On the local or regional level, all larger cities have a museum of their own.[353] In addition, all the counties (*län*) have museums with their own specific focus.[354] These often mirror some of the local features, in and around the city. Different kinds of Museums of Art and History are common throughout the country. In the university cities, more science-oriented museums are an important element. A good example of this is Gustavianium in Uppsala, erected in 1677 and located in the oldest building owned by the university. The museum aims to inform visitors about both the institutional history of the university and of the research performed within the

[353] For an example, see the City Museum of Norrköping, featuring exhibitions on the history of textiles and handicraft (http://www.norrkoping.se/stadsmuseet/).

[354] With a focus on cultural history and art, an example of a county museum is the one in Stockholm; see http://www.lansmuseum.a.se/.

university. Today, the museum features four permanent exhibitions; the first highlights the history of the university from 1477 to the present; the second exhibits anatomical and medical studies in the Anatomical Theatre; the third is the Augsburg Art Cabinet, showing objects such as the thermometer of Celsius; the fourth is an exhibition of the antiquity and the Middle Ages in Sweden. In addition, the museum also has a space for temporary exhibitions.[355]

On the national level, there are many museums specialising in one specific area or another. In addition to displaying their huge collections, they execute research in their featured field. Examples of this are *Nationalmuseum* (The National Museum), featuring both exhibitions of and research in art and art history; and *Naturhistoriska riksmuseet* (The National Museum of Natural History), with displays large collections of and exhibitions in biology and geology whilst also performing research in those areas.[356]

Another large and important museum is *Tekniska museet* (The Museum of Science and Technology), founded in Stockholm 1924 by the Federation of Swedish Industries, the Swedish Academy of Engineering Sciences, the Swedish Association of Engineers and Architects and the Association of Swedish Inventors. The building currently housing the museum was built in 1934-1936. The idea of a museum of Swedish engineering and industrial history had been around since the start of the twentieth century. The museum's collections and exhibition area have grown considerably over the years, and the total exhibition area is now 18,000 square metres. The museum attracts around 200,000 visitors every year.

Although most large museums are quite old and well established, investments in new ones still occur. Göteborg was recently the scene for a massive political and economic effort in creating a new institution, *Världskulturmuseet* (The National Museums of World Culture). Established in 1999 it is a state museum authority that groups together four museums with collections originating mainly from outside of Sweden and Europe. Three of the museums are located in Stockholm: The Museum of Far Eastern Antiquities, the Museum of Mediterranean and Near Eastern Antiquities, and the National Museum of Ethnography; and one in Göteborg: the Ethnographic Museum in Göteborg. The Museum of World Culture is in itself one of the largest museum projects in Sweden in recent years. The general mission of the National Museums of World Culture is to display, represent, and interpret the various cultures of the world. The museum authority strives to further the understanding of the world and humankind through cross-disciplinary scientific work, and through new forms of exhibits and public outreach activities, using a range of artistic, archaeological, ethnographic, historical, and other perspectives. The aim is to promote public understanding and appreciation of different cultures, their histories, as well as their interrelationships.

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[355] See http://www.gustavianum.uu.se.
[356] See http://www.nationalmuseum.se and http://www.nrm.se.

In order to establish closer collaboration between Göteborg University and The National Museums of World Culture, *Museion* has been created. As a multidisciplinary research and educational agent, *Museion* is also said to embody the "Third Assignment" thus initiating seminars and university courses with alternative forms of exams. This, however, has illustrated the difficulties in trying to merge university culture with its strict demands for knowledge control in exams and the museum culture which Frank Oppenheimer characterised with the phrase "nobody fails in a museum".[357]
Another new museum initiative in Sweden is the Nobel Museum, which opened in 2001. This museum benefits from one of the strongest trademarks available in science. There will of course be a heavy emphasis on the great men and women of science but with an initial exhibition on the theme of creativity.
The Nobel Foundation is an institution that has changed very little during its 100 years. The activities undertaken are rather circular, whereby each year; everything is done according to the same procedure as last year, culminating in the Nobel festivities. Nearing its Centennial in the year 2001, the foundation decided to do something radically different. It was decided to make Nobel more public. A Nobel museum would be erected to celebrate the prize-winners, science, literature and peace. There are already several other Nobel museums in the world, placed were the donator Alfred Nobel has marked his presence. Sweden and Stockholm are thus rather late in joining the list.
Preparations for this museum have been ongoing for several years. The name Nobel is associated with excellence in several ways, so of course the museum itself has to excel and have exhibitions of the highest possible quality. As such, the museum project has attracted people with high competence and also generous fund givers. The Nobel trademark is strong and there are many that want to be associated with it.
While most reactions to this initiative have been very positive, there has been some criticism regarding its funding. The Nobel Foundation is obviously very wealthy, yet the foundation has claimed that it cannot fund the museum out of its own resources. It is said that the money in the foundation can only be used for the Nobel awards and the ceremony surrounding it, since that is what is stipulated in the testament of Alfred Nobel. This has meant that the municipality of Stockholm has agreed to finance the building, while the foundation is responsible for filling it with content of high quality. Thereafter, the foundation applied for funds from a large amount of Swedish fund givers and also from various business sponsors. Most of these reacted positively. However, there have been some complaints that if the testament could have been interpreted more generously, then the foundation would have been able to use some of its own wealth for the project. Instead, money has been taken from fund givers who would otherwise have given it to research.

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[357] See James M. Bradburne (1998) "Dinosaurs and white elephants: The science center in the twenty-first centrury", in *Public Understanding of Science*, vol. 7, pp. 237-253.

While this has been a valid complaint, the people working with the museum have answered that the total amount of money being taken is, in perspective, so slight and taken from such a diverse amount of fund givers that it does not warrant such complaints. In addition, what comes out is the opening of a great public window for science in Sweden and an added profile for Swedish research. Therefore, this is a prime example of the “Third Assignment” in action.

The first exhibition in the museum had creativity as its theme. It is thought that this will mean common ground can be found between research, literature and peace work. The exhibition was produced in three copies; one of these will stay put in Stockholm while the others two will tour the world.

Interestingly enough, there is a bridging of the two cultures involved in the project. The ideas put down by Alfred Nobel a hundred years ago make this connection necessary. Prizes are awarded both to natural science and to literature. The construction of the Nobel categories, formulated so long ago, places restrictions on how research can be treated in the museum. The categories make strange bedfellows, but offer a rather exciting combination, something that would not be put together like this in any other circumstance.

Science centres

Apart from a range of museums based on the specialities specific or several scientific disciplines, there also exist some 20 different science centres in Sweden, most of them established during the 1980s. In Göteborg, a more ambitious science centre – *The Universeum* – has been created (inauguration in June 2001). The centre is supposed to have a national responsibility, thus serving others science centres with innovation, knowledge and ideas.

The objectives of this centre are to generate experiences that increase the desire to enhance knowledge and active involvement with science and technology; to publicise know-how and research at universities and in the world of business; and to enhance the attractiveness of the region of West Sweden. The primary target group is children and young people. The centre is a joint venture by the Municipal Association of the Göteborg Region, Göteborg University, Chalmers University of Technology and the Western Swedish Chamber of Industry and Commerce, in close collaboration with the business community.

New initiatives among traditional and new museums

Swedish museums, both new and old, are, for the most part well represented on the Internet. One objective of having a web presence is of course to attract visitors, but many of museums have very comprehensive presentations of their particular areas of science. A good example is *Naturhistoriska museet* (The National Museum of Natural History). In addition to a presentation of their collections, they offer in-depth information resources regarding animals, planets and the environment and introductions to the areas in which the museum pursue research (e.g. biology, geology and palaeontology).[358] For the newly established *Världskulturmuseet* (The National Museums of World Culture), it is also a natural step to have an Internet page. In addition to providing information on the museum, it shows a complete physical representation of the museum.[359]

[358] See http://www.nrm.se
[359] See http://www.universeum.se.

Museums and science centres in the UK: Interactivity, infotainment and viability

Damian White, Josephine Anne Stein

Background

Museums in the UK have long played a central role as institutions presenting the world of science to the public. Barry argues the modern science museum originally developed in Britain in the 19th century as a place where the success of the imperial state could be displayed (Barry, 1998:100). He also notes though science museums also sought to be ‘a liberal space within which a bourgeois public would participate, and be seen to participate in their own cultural and moral improvement’.

Until recently, science museums presented a largely celebratory account of humanity’s mastery of the natural world (Durant, 1996). As Durant notes, most science museums were ‘founded by industrial cultures that were imbued with a sense of great optimism about science and technology’ (Durant: 1996: 158). A visit to a science museum is as MacDonald notes: ‘…a cultural ritual…a visit to a temple to gaze upon the holy relics…an object lesson in the progress of civilisation’ (MacDonald, 1995).

Museums in the UK attract a mass audience (Hooper-Greenhill, 1994:60). While difficulties exist in gaining accurate museum visitor statistics (& many researchers do not include people under 16 in their figures) it is estimated that more than 80 million visits are made each year to the United Kingdom's 2,500 museums[360]. In 1990, the Science Museum and the Natural History Museum, both in London, were amongst the top 39 tourist attractions in the UK, attracting 1 million visitors (Hooper-Greenhill, 1994:60). The Science Museum attracted over 2.8 million for the year 2000/2001[361].

The museum remains a bourgeois preserve; according to Eckstein and Feist (1992:77) ‘museum visiting in the UK remains primarily a white/upper middle class pastime’. Those from more highly educated backgrounds are more likely to become a museum visitor in the UK, and Afro-Caribbean and Asian groups tend to be underrepresented. (Hooper-Greenhill, 1994:65).

However, over the last twenty years the challenges posed by the spread of neo-liberal policy agendas; cultural developments such as detraditionalisation, the rise of heightened reflexivity and the challenge of coping with a perceived crisis in the relations between science and publics has generated significant changes in the status and functioning of science museums in Britain.

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[360] http://www.museums.gov.uk/museums/index.html
[361] http://www.museums.gov.uk/museums/index.html

As public bodies, museums in general in the UK have been accused of being 'too paternalistic, too dominated by the concerns of curators and the fetishism of the artefact, and too dependent on public subsidy' (Barry, 1998:101). As a consequence science museums (alongside museums in all other sectors) have been required to become more market friendly, interactive and more accessible to a public which is increasingly critically questioning many features of the classic enlightenment understanding of science. According to Barry, the Science Museum, 'is increasingly expected to respond to the public's demands rather than simply tell the public what it needs to know' (Barry, 1998:98).

The result has been that museums of science in Britain have come to adopt new technologies of display, new interpretative experiments and new concerns with their visitors and communities (MacDonald, 1998:14). Pressure is on for science museums and indeed for museums in general to move from being 'static storehouses for artefacts into active learning environment for the public' (Hooper-Greenhill, 1994:1). In addition the UK has also seen a significant extension of science centres, industrial heritage sights and more very modest experimentation with science shops as part of expanding the public understanding of science.

Museums under Conservative Governments 1979-1997

Successive Conservative governments sought to reduce the dependency of museums on state funding, through gaining a bigger audience and charging entrance fees or through gaining sponsorship or offering corporate hospitality. (Hooper-Greenill, 1994; 1996). Marketing managers were appointed during the 1980's and museums were encouraged to brace themselves to engage with the cool winds of market forces. As Barry notes, what was deemed to be required is 'a new recognition of the competitive character of the visitor business in addition to the older preoccupation with scholarship and public education' (Barry, 1998:101).

The need to open up new audiences became 'a matter of survival' for many museums in the UK. A steady withdrawal of public funding coupled with an economic recession ensured that the museum industry itself in Britain experienced a severe recession in the mid 1990's. Thus Hooper-Greenhill could report in 1995:

'Museums in Britain, and especially local authority museums, are now at a time of great crisis. Many museum people are losing their jobs, and many others are under threat. Nearly every local authority museum has been restructured, and some of the larger independent museums are on the verge of bankruptcy' (HooperGreenhill 1995:2).

Museums under New Labour

Under New Labour, museums are increasingly identified as part of a broader government strategy to capitalise on the UK strengths in the cultural industries. In this respect, they have been increasingly viewed as part of the creative economy and been expected to open new cultural networks which might foster creativity in society (Anderson, 1999). Perhaps the defining feature of the current government policy agenda though has been a concern with ensuring that the arts (broadly conceived) are accessible, that they play a central role in tackling social exclusion and that they contribute to 'life long learning'.

To develop this agenda in May 2000, the Department of Culture Media and Sport published a policy document 'Centres for Social Change: Museums, Galleries and Archives for All'. This document seeks to ensure that museums view social exclusion as a policy priority. To achieve this various policy recommendations have been made which include:

- Ensuring that there is the widest possible access to collections and archives
- Making full use of ICTs to make collections more accessible
- Ensuring that outreach activities are an integral part of the museums activities
- Make catalogues and key documents are available on line

(Department of Culture Media and Sport: 2000).

One of the more significant policy shifts that this has generated is that the government is more open to providing subsidies for national museums. Free admission for children has been in place from 1 April 1999, and for those aged 60 and over from 1 April 2000. The 2001 Budget introduced new VAT measures which has allowed many museums to charge free admission for all adults from 1 December 2001. The new policies were intended not only to increase the numbers of visitors, but to diversify the population of museum-goers to include less advantaged social groups.

Free admission has, at least on paper, doubled the numbers of visitors to participating museums by 2003. To some, this demonstrates the efficacy of the policy of free admission in making science etc. more accessible to a wider public. Sceptics have argued that museums may simply be attracting more repeat visitors, or attracting more people from the same socio-economic groups. However, no data exists that would confirm or refute this hypothesis. Direct observation by one of the co-authors of this paper (JS), though highly anecdotal, indicates that museums have become much more interested in counting visitors. Those returning after a lunch break outside the museum may get counted twice.

PUS and interactivity

The emergence of the PUS movement over the past two decades has placed further pressure on British science museums to contribute more directly to facilitating the emergence of a scientifically literate society and a more communicative relationship with the public (Durant, 1996, Hooper-Greenhill, 1994). Following the Bodmer report in 1985, museums were increasingly expected to become involved in developing science communication strategies in the UK.

The hands-on movement in the UK has indigenous roots that can be traced back to the introduction of push button working models in the Children's Gallery in the Science Museum of the 1930's (Durant 1996:156-157). The model for modern interactive museums in the UK has come from the Exploratorim in San Francisco, California (Simmons, 1996:79). Many of the interactive technique developed in the US were first introduced into the UK via the Bristol Exploratorium in 1987. With the opening of the 'launch pad' gallery at the Science Museum, interactive ideas have gone on to exert a 'significant degree of influence in museum displays in a wide range of areas'(Simmons, 1996:79). Barry argues proponents of interactively constituted something akin to a movement with the formation of associations such as the British Interactive Group (BIG).

It has been argued, however, that the radical concerns of the San Francisco Exploratorim with empowerment have been marginalised in favour of more concerns such as the attractiveness of science to visitors. (Barry, 1998:104). Conservative cultural critics have viewed the spread of hands-on exhibits as an example of 'dumbing down'. Alternatively, Richard Gregory, founder of the Bristol Exploratorium, has argued that one of the ironies of traditional science museums is that they have very little science in them. He argues if we see the essential feature of science as experimentation, hands on experiences are of critical importance. (Gregory, 1989 quoted in Barry, 1998:104)).

There seems no doubt though that as elsewhere the explosion of the science wars in the UK has generated stimulating forms of academic discussion over the 'social relations, celebrations and omissions of science cultures' (MacDonald, 1995:8). Critical questions clearly have emerged concerning such issues as:

- what are the motives for displaying science to the public?
- who shapes the displays?
- why are certain stories told and others admitted?
- whose interests are served?
- What are the effects of particular technologies of display?
- How do audiences interpret them?
- How do exhibitions influence the public understanding of science?

- What kinds of understandings of science are available? (MacDonald, 1995:8).

Questions have also emerged from public constituencies directly. The Parliamentary and Scientific Committee organised a discussion meeting on "Communicating Science: The role of museums and science centres" on 17 July 2000, which attracted a diverse audience.
At a reception following this meeting, several teenagers, who had sat largely in silence during the discussions in the imposing Grand Committee Room of the Palace of Westminster, were invited to offer their opinions of science museums in a more informal setting. These young people, most of whom were planning to go into science, made the point, quite forcefully, that most science museums seemed designed "for kids". In other words, for children aged 15 and older, there wasn't enough of the sort of information they were interested in. What they would prefer, they said, was an opportunity to meet real scientists, to have them explain their work through exhibits and hands-on experiments, and to be able to ask them questions.

The Natural History Museum

The Natural History Museum in South Kensington has been credited with leading the way towards developing more innovative engagement with the PUS agenda as an academic curatorial style has increasingly given way to more popular presentations of its collections. (House of Lords, 2000). Sterile display cases with row upon row of rocks and minerals, difficult for most adults to cope with let alone children, have been replaced by rather more exciting, dynamic displays that are more accessible, imaginative and entertaining. This has been accompanied by other innovations in the museum's provisions for the public (see Bloomfield: 63):

- Making science ‘fun’ and popular – most notably in the context of encouraging interest by younger people through careful design of exhibitions and linking classroom work to exhibitions, providing worksheets etc.
- Opening access – recent shifts have seen attempts to provide much greater access to the archives and to the museum as a whole by providing ‘behinds the scenes’ tours where the public are given an opportunity to meet scientists and curators that are involved in developing the exhibitions.
- Providing a basic framework for understanding science as a process though the development of thematic exhibitions
- Providing knowledge resources – examples here include lecture programmes and courses for self motivated adults; contributions to tertiary education and post graduate training (see Bloomfield: 63). The National History museum has

recently opened the Clore Centre for Education in the basement which seeks to provide an exploratory area for life sciences.

On this latter issue, Bloomfield also notes that as the Natural History Museum has extensive libraries and research collections, ‘it also aims to move significantly beyond popular communication towards providing much greater public access to ‘knowledge resources’ (House of Lords, 2000). Information technology and the Internet may well play a central role here. The Natural History Museum is presently exploring the possibility of effective science databases from its collections which could be accessed by the public through the internet. (See section on Internet as a space of Interaction Between Science and Publics in the UK for further details here)

The Science Museum, South Kensington

The Science Museum in Kensington has been a leading institution in developing science-public relations. The Director of the Science Museum, Neil Cossons and his Head of Exhibitions, Gramhan Faremo have stated that effective communication is nothing less than "at the top of the Science Museum's agenda" (Cossons and Faremo, 2000:66).
In 1988, John Durant was appointed assistant director of the Science Museum as well as Britain’s first Professor of the Public Understanding of Science at Imperial College. The Science Museum's increasing focus on the public understanding of science has led to a number of activities (See Cossons and Faremo: 66, 2000):

- an international PUS research group headed by John Durant
- a series of temporary exhibitions under the title ‘Science Box and Technological Futures’, which has toured 57 venues in the UK
- a unit which consults the public about exhibition plans.
- the journal ‘Public Understanding of Science’ in association with the Institute of Physics.
- organising the UK’s first 'consensus conference' on plant biotechnology.
- the first MA in Science Communication in the UK, with Imperial college.
- the use of drama to interpret topics in the history of science, which began in 1987.
- an Education and Programme Unit producing materials to support the learning of educational groups and family visitors, including the interactive galleries designed for children in the basement of the museum.
- 'science nights' –where children sleep over in the museum and take part in a range of hands on workshops and demonstrations.

The 'Here and Now Conference' held at the Science Museum, London on 21-23 November, 1996 sought to explore how public engagement with science could be depended further. Central themes that were discussed at this conference included the relative merits of interactive and theme exhibits, questions relating to how exhibits deal with scientific complexity (de Rosnay, in Durant, 1992); questions were raised about the specific message that museums were meant to convey.

In 1995, the Science Museum embarked upon designing and building the largest new wing in its 150 year history. Funded by the national lottery (£23 million) and the Wellcome Trust (£17.75 million), the Wellcome Wing[362] focuses entirely on developments in contemporary science and is explicitly forward-looking. It provides the latest in interactive entertainment through a series of suites that provide continuously updated exhibitions and an IMAX cinema.

The Science Museum is planning a new National Centre for the Public Understanding of Science, to be "a forum at which scientists and the public can debate issues concerning science and technology." (Cossons and Farmelo:66, 2000).

Science Centres

Science centres in the UK have sought to develop pioneering hands-on exhibits, to provide a public space for exploring the ethical, social and political questioned raised by science and to develop a space for science education. They have become increasingly important sites for science communication, particularly for children.

The first independent science centres in the UK, Bristol's Exploratory' and Cardiff's 'Techniquest', were established in 1986. In 1997, there were 40 science centres in Britain (Gregory and Miller, 1998:203) receiving an average of 50,000 visitors per centre a year (Thomas, 2000). The UK has also seen the growth of a similar number of 'discovery centres' in museums, botanic gardens, zoos and aquariums. It has been estimated by ECSITE-UK (the network set up to represent the science centre sector) that over 90% of the UK population now lives within a two hour drive of a science or discovery centre (Durant, 2002). The sector as a whole receives around 11 million visits a year (Durant, 2002).

@Bristol provides an example of the type of projects that are being developed in the UK. Explore@Bristol has a focus on science and technology; Wildscreen@Bristol will focus more on environmental matters. Both projects seek to combine the use of interactive exhibits, multimedia representations and hands-on activities to encourage public engagement with science. They are attempting to reach out to audiences that

[362] http://www.sciencemuseum.org.uk/wellcome-wing

have been seen as traditionally difficult to attract to science museums, most notably teenagers, the elderly, the disabled, and people from lower socio-economic groups.

Plans to greatly expand the national network of science centres in the UK arouse suspicion that the public will be presented with a surfeit of new museums and exhibitions. The £400 million they (and similar projects) received from the National Lottery awarded by the Millennium Commission in 2000 has been described as ‘the largest single investment in science communication to take place in the UK’ (Thomas: 2000:64). It has gone to support science centre projects such as @Bristol, a National Space Science Centre in Leicester, Millennium Point in Birmingham, which focuses on technology and innovation, Magma, a museum on the site of a disused steel mill, Dynamic Earth in Edinburgh and Island 2000, on the Isle of Wight. This money must be matched by other sources of funding and revenue, and is not intended to cover operating costs. It has been argued by Durant that the Science Centre sector will need 30-35% of its income supported by state funds to maintain themselves over the longer period (Durant, 2002). Even those promoting the scheme admit it is a risky business, arguing that by spreading the money around they are spreading the risk.

Many people are asking what fate will befall all these new science centres. Are they merely a sponge to soak up both public and private funds for the benefit of a relatively small (and invariably underestimated) segment of the British population, and would they in reality cater to the "converted" at the expense of the "masses"? Is the balance between conveying knowledge, building mutual understanding with the public and sheer entertainment appropriate? Will the funding arrangements be adequate to maintain the new science centres over the long term?

Science Shops

Two science shops also exist in the UK. The Northern Ireland Science Shop opened in January 1989 and is linked to the University of Ulster and Queens University Belfast. The Merseyside Science Shop ‘Interchange’ began in January 1990. It is supported by three of the local Universities in Liverpool and the City Council (Irwin, 1995). Irwin has stressed here the positive potential the Science Shop could play in the UK as a mediation point between academic institutions and community groups (Irwin, 1995: 2). Responses amongst community groups to science shops have been ‘overwhelmingly positive’ (Irwin, 1995:3). However, academic responses to this venture have been ‘more cautious’ since work related to this has ‘neither the prestige nor the income generating potential other forms of research activity’ (Irwin, 1995:3).

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CHAPTER 3.3.

Science Festivals and Weeks as Spaces for OPUS

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

Introduction

If the science museums are the oldest and most prestigious institution in public understanding of science, the science weeks and science festivals are one of the most recent initiatives in the current PUS landscape. However, there are examples of festivals- and week-like activities much older: Gregory and Miller have observed that since the beginning of the 19^{th} century, the British Association for the Advancement of Science has held an annual weeklong meeting where leading scientists gave public lectures to ensure that the latest research had the broadest possible audience (1998:225).

Notwithstanding this, probably the first modern annual festival of science in Europe was started in Edinburgh (The Edinburgh International Science Festival) in 1988. Since then, events like this have spread around Europe and different kinds of science festivals and weeks are nowadays quite common. They do appear on both international, national, regional and local levels and serve a number of different objectives.

This chapter will try to review both festivals and weeks. The first section will discuss festivals. The second will concentrate on weeks, while the third will mention activities which carries similarities with festivals and week, but have another name or can not be included under our definition of festivals and weeks respectively. Lastly, we will go in-depth with a case study of the emergence of the science festival in Göteborg and in particular the festival of the year 2000.

Definitions of Science Festivals and Science Weeks

To be able to work analytically with our material, it is necessary to distinguish festivals from weeks. Two major points of difference can be emphasised.

Firstly, there is a geographical difference. The popular science week is usually not based just at one location. On the national basis a science week involves the universities of the country and on the regional basis it involves the region around the university. The University of Lund's science week is a clear example of the latter, where scientists travel all around southern Sweden giving lectures adapted to local interests.[363]

The science festival, on the other hand, is an initiative located to the city of the university. As a consequence, it therefore enjoys a higher profile: everybody in Edinburgh or Göteborg knows that there is a science festival going on when it is.

A second difference can be seen in the presentation of science in festivals and weeks. In the former, the perspective is much more of a popular science event with an emphasis on science as being fun. In addition, the festivals are often engineered by non-scientists. In comparison, the science week is more university driven, arranged by scientists at the university. The presentation of science is in effect more serious in tone.

Another entity from which the Science Festival should be distinguished from is the Open House, in which a faculty or a university for one or a few days shows samples of their activities. This constitutes a local initiative, which however, is much smaller in scale often being a result of efforts of single departments. To further complicate things, an Open House activity can however be a part of a science week or festival.

Another aspect that should be mentioned is the different definition of science. The Anglo-Saxon definition of "science" (used in the UK) incorporates only the natural and physical sciences, where the German notion of "Wissenschaft" (utilised in for example Scandinavia or in Austria) also includes the social sciences and the humanities besides the natural sciences. This has repercussions on the actual activities during the festivals and weeks: a broader notion of science will easily allow events from the humanities to be included, where this possibly will be a problem with a more narrow idea of science.

Science Festivals

From Cultural Festivals to Science Festivals

The idea of science festivals is a kind of translation of activities found in other areas of society and culture. There are festivals about almost everything, for instance food, beer, art, dance and folklore. These often have a common denominator in their attempt of allure people to their activities by making them entertaining, not seldom offering samples of the festival free of charge. This legacy of festivals has also been influential when translating the ideas into science festivals.

Celebrated Science

In consequence, this has meant that there are a large portion of celebratory activities in the modern science festivals. This has been important to attract a large audience, working with topics as the great discoveries of science, displaying simplified scientific

[363] "LUM; Lunds universitet meddelar"; (*LUM: Information from The University of Lund*), nr 10, 1997.

experiment and giving lectures on exciting subject matters in a popular tone. Despite attracting a large amount of attendants, a central objective of the festivals has been recruiting people to science: the organisers have wanted to interest young people in a future in science.
In this perspective, a popular display of science, scientific work and subjects are probably important. However, these ideas and the celebratory presentation of science become somewhat of a paradox: in one respect science festivals are a clear example of efforts of public understanding of science, but in another they lack essential components from the research of PUS. In the effort of attracting people, the problems of science – social, political and ethical – is seldom discussed. The complex inner workings of scientific activities are also sacrificed in the quest for celebration and entertainment. Such topics have been a central part of the last decade of PUS research. Seen from this perspective, this must be considered somewhat of a contradiction.

Different levels: International, National and local/regional festivals

International

There are a couple of examples of science festivals profiled as international, the Edinburgh International Science Festival (UK) and the International Science Festival in Göteborg (Sweden). By “international” the festival marks that the participants not only come from the hosting country. Also, it implies that there is some kind of international collaboration in producing the festival. In the case of Göteborg, universities in Norway, Finland, France and other European countries were involved. However, international festivals such as those at Edinburgh and Göteborg still are very much regional manifestations in respect of visitors and sponsors.
Drawing from the city's historical role as the centre of the Scottish Enlightenment, the Edinburg festival was launched in Spring 1988. The festival receives government support. Contributions are also made by the district councils of Edinburgh and Lothian, and further ‘financial and practical support’ given by industry, commerce, professional scientific bodies, charities and the univerisites (Scottish Office, 1994). We will discuss the case of the Göteborg festival at length later on.

National

A national festival can be found in the UK. The Festival of Science, run by the British Association for the Advancement of Science (the "British Association" or just the "BA"), is held in a different city in England or Wales every September. This festival is aimed at school children, journalists and the general public, and attracts thousands of people every year. The Festival features displays, interactive exhibitions, lectures, site visits, discussions and special events. It has been criticised as "preaching to the converted", but the level of enthusiasm amongst the participants does lend the Festival a highly positive and energetic atmosphere.

"Creating Sparks", the BA's millenium festival, was a major, monthlong science festival. Drawing together nine organisations, 450 events were staged which attracted over 250,000 people. At one event, Exhibition Road, home of the Science Museum, The Victoria and Albert Museum and Imperial College, was closed to traffic for the first time in its history. Crowds were treated to choreographed abseilers descending down the face of the Natural History Museum and a floating heliosphere swooping down on the crowd. The 2002 BA Science Festival will take place at the University of Leicester, exploring the theme 'Science and the Quality of Life'.

One of the principle aims of The Festival of Science has been to 'create a burst of publicity for science' (Ghosh, 2001). Ghosh has argued that during the 1980's, the festival often served a useful purpose in this respect as science stories were often difficult to get into the national press or on TV. As science coverage matured, gained increasing importance and became increasingly critical in the 1990's, it has been argued that the BA festival has made less of an impact. More recent shifts in the Festival have seen scientists become more outspoken in their criticism of government and commerical interests, leading some to claim that the festival is renewing itself (Ghosh, 2001).

Regional and local

Although not called a "festival", Belgium has examples of regionalised activitities called "science feast" and "science happening". Both are held in correspondence with the European science week (in the autumn), the "feast" every even year (6th edition in 2000) and "Science happening" each odd year (7th edition in 2001). Although different in their practical organisation (location, duration), both events have similar target publics: families and school kids. They also involve the same partners, among which universities have a leading role.

The UK also have examples of more regional oriented festivals. The BA sponsors science festivals at the regional level, such as those organised by its North West Branch with a range of events for adults and children. In addition, there have been a number of independent ventures emerging over the last decade, a disproportionate amount of these in Scotland. An annual science festival is held in the Orkney Islands[364], in which energy and environmental issues are prominent. The festival is noted for its large number of participants from Iceland and Scandinavia (Scottish Office, 1994:23). The Moray Science Festival, is held at Moray College, Elgin, Scotland. The Argyle Science Festival occurred in 1993. Elsewhere, the Newcastle

[364] www.orknet.co.uk/scifest/exhibit2001.html

Science Fair ran a open day fair in 1999 supported by COPUS in a school in Staffordshire (COPUS, 1998).
Established cultural festivals have also added science to the list of concerns that they address. Thus, in Wales the 'Urdd Eisteddfod' (a festival celebrating Welsh language and culture) has asked the Centre for Alternative Technology to run workshops in its science and technology pavillion. The Cheltenham Festival of 2002[365] has added a new five day Festival of Science to events.

Initiatives and support of the festivals

Different sponsors are involved in festivals for different reasons. It is common that festivals are supported as well from governmental bodies (local or national), industrial actors and the scientific community. For the universities in Sweden, it is a matter of fulfilling The "Third Assignment"[366] with an emphasis on cultural understanding of science and also to work in a proactive way in recruiting students. Other sponsors are interested in attracting good will and also in the long-term strategy of getting more people into the universities and then into local companies, that is implementing a long-term practical understanding of science. Some sponsors also see this as good citizenship more stressing the civic aspects of public understanding of science.

Expectations and results

As seen, there are possibly many active festivals in a single country. These are of course somewhat of in competition with each other. How this has effected the results of the festivals, is not easy to say. It is, however, possible to see that some of the bigger festivals are successful and attracting a mass audience. A good example of the is the BA's millennium festival, which got a quarter of a million visitors.
Some smaller events, like the International Science Festival in Göteborg, are also successful. The expectations for the first year was to attract 25,000 people, the outcome was a good 40,000 (Göteborg has 550,000 inhabitants). Since then the results has been around 48,000, but much hinges on the nature of the May weather and the number of activities offered. The volume of activities in 1999 was rather too extended and it was radically cut back for the next year.
There are of course other ways of measure success than by attendencies. Since 1999 in Belgium, a sample survey is carried out after each event, in order to analyse the

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[365] www.cheltenhamfestivals.co.uk/

[366] In the new University Act of 1977, this new task supplemented the earlier two officially proscribed responsibilities assigned to the universities, teaching and research, and it was thus called "the Third Assignment" (*tredje uppgiften*). Such disseminated research information (*forskningsinformation*) should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have come to modify the text, somewhat changing its intent. Some core ideas are, however, still present, which goes back to the fact that the universities are part of a unitary national system and publicly funded.

attitude and expectations of the public, the changes induced in their perception of science and technology, and (among the young people) the influence on their selection of future curricula[367]. The surveys are carried out in two sub-samples (participants and non-participants), in order to achieve comparisons. Results of these surveys show a growing interest and awareness among the Flemish population, a growing interest for scientific curricula in higher education, and a higher trust in the potential benefits of science and technology for society. Along the time, there are increasing differences between the sample of those who never took part in any of the events and those who did it.

Science Weeks

In comparison with festivals, as stated in the beginning, science weeks are more serious in tone. They are also clearly research oriented, trying to use current research to discuss and highlight different questions that concern people. There seems not to be as clear celebratory elements in science weeks as in festivals. However, there are of course exceptions: in the UK, The National Science week is known for its 'refreshingly madcap approach to presenting science' (Boddington and Coe, 2000) to the general public; or in the case of Austria the subtitle of the science week even underlines explicitly the entertainment character.

Different levels: National and local science weeks

As with festivals, there are science weeks at different levels. There are not, however, any international science week organised in one of the countries, there are a number of national and local activities.

In addition, the European Union has a annual science and technology week. Here, the activities across Europe will try to inform and enlighten people with an emphasis on "*showing*, rather than *telling*, Europeans how science and technology affects them, from the simplest gadgets to the most sophisticated satellite technology. Science is above all a quest for knowledge and how it can be used to improve our lives, lifestyles, and our living world"[368]. In 2002, examples of activities organised by the EU were "It's your call - the science hotline", where citizens could call scientist asking questions on burning topics, and "Shadows of the infinite", where scientist and artists unite to "knock down the walls between science and the arts to widen interest in scientific concepts using the large audiences currently enjoyed by the visual arts".[369]

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[367] Sofres-Dimarso, *Effectstudies wetenschapsfeesten en wetenschapshappeningen in Vlaanderen*, http://www.innovatie.vlaanderen.be/wetenschapsweek/index.htm
[368] http://www.cordis.lu/scienceweek/home.htm
[369] http://www.cordis.lu/scienceweek/act_act.htm

It is notable that this is not an effort to co-ordinate existing national and/or regional science weeks, but a rather top-down initiative. On their homepage, one can find a request for interested parties to apply for financial support and a stamp of official approval from the European Commission.[370]

National

In the UK, the National Science Week (formerly SET –Science Engineering and Technology week) has run as such since 1994. It was initiated by Brian Gamble of the British Association, who sought to emulate the success of Edinburgh in a more dispersed fashion (Boddington and Coe, 1998). The first science week, known as SET7 was the first major event in the government's PUS campaign (Scottish Office, 1994). The annual event is co-ordinated by the BA and supported by the Department of Trade and Industry. The central aim of this week is to 'celebrate science and its importance to our lives'[371]. It endeavours to open up opportunities for the general public to engage in science activities and discussions in a range of venues from shopping centres to disused railway stations and churches.

In Portugal, each year since 1997, a Science and Technology Week is organised by the Ministry. During this week, which includes "the national day of scientific culture", a series of events take place all over the country, including the opening of the doors of some scientific institutions to the public, films, conferences and seminars on different scientific topics. There is also an exhibition of the projects developed by the students within the programme networks.

Austria is the latest in this group, having started the science week only in 2000. So far it was held every year organising many hundreds of events throughout the country. Organised by a private enterprise and financed by the Ministry during the first three years, it was a bottom-up organised event in which scientists could decide if, what and where they presented their research. It is now being reviewed and it remains to be seen in what form, under what label and with what public support such a kind of event will continue in the years to come.[372]

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370 http://www.cordis.lu/scienceweek/act_bepart.htm
371 www.The-ba.net/
372 Ulrike FELT, Annina MÜLLER, Sophie SCHOBER (2001): Evaluierung der Science Week @ Austria 2001: Analyse eines Experimentes der Wissenschaftskommunikation im österreichischen Kontext. And Ulrike FELT, Annina MÜLLER, Sophie SCHOBER (2002): Evaluierung der Science Week @ Austria 2002: Analyse der Interaktion zwischen Wissenschaft und Öffentlichkeit im Rahmen der Science Week. Both to be downloaded from www.univie.ac.at/wissenschaftstheorie/virusss

Regional and local

An example of science weeks more regionally oriented is to be found in Sweden. Since 1994, The University of Lund has arranged a science week. The information section at the university draws up the content and design of the week. They co-operate with the surrounding cities, for instance Ängelholm, Hässleholm, Landskrona, and Ystad, to be able to meet these cities needs of staff training, enlighten local problems and reflect upon different local interests.[373]

In 1997, some of the headings were "Regional Development", "Sustainable Development", and "Employment in the Information Society". More humanistic questions of "cultural identity", philosophy, theology and even "new age" were also raised.[374]

Some of the new and growing colleges in Sweden, such as the colleges in Skövde, also arranges science weeks. In 2001, the focus was on the importance of science and technology for the commonweal. In this way, the science week vindicates economic investments in the city college.[375]

Expectations and results

In the UK, National Science Week has seen a steady growth. In 1994, SET7 co-ordinated over 400 events (Boddington and Coe, 1998). In 2001 over 1,500 science, technology and engineering enthusiasts ran more than 2,500 events which were attended by over 1.4 million people (www.The-ba.net/).

Atttempts are made by the BA to ensure that the event is as inclusive and participatory as possible. Prior to the week, the BA organises a series of National Science Week Awareness meetings. These provide opportunites for people who might wish to organise events to gain more details of funding opportunities (www.The-ba.net). Small grants are available to support new initiatives.

Questionnaires administered at the 1998 week revealed that less than two thirds of organisers believed the event to be effective or very effective at promoting public understanding of science (Boddington and Coe, 1998:9). Boddington and Coe note that while empirical evidence reveals 'no single reason' for this response, they suggest that 'there has been a general increase in scepticism about the effectiveness of public understanding of science events'. Anecdotal evidence suggests that two factors may be responsible:

'a dampening of enthusiasm and confidence after the initial rapid and innovative growth of public understanding activites in the late 1980's and early 1990's'

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373 "LUM; Lunds universitet meddelar"; (*LUM: Information from The University of Lund*), nr 10, 1997.
374 See "LUM; Lunds universitet meddelar"; (*LUM: Information from The University of Lund*), nr 10, 1997.
375 See http://www.skovde.se/jubileet/sidor/seminarier.htm.

'several organisers and commentators have recently expressed disappointment in progress; they had expected to have achieved a greater increase in public understanding and support by now' (Boddington and Coe, 1998:9).

It has also been suggested that the engineering and industrial communities provide 'feeble' (Famelo, 1997:180) support for the event. As Brian Gamble notes, 'industry has been slow to grasp the opportunities presented by the Weeks, perhaps because they do not fit comfortably with the public relations campaigns mounted by industry' (cited in Farmelo, 181). Farmelo has argued that a key factor in the success of media coverage of Science Week is the backing provided by the BBC.

Other activities

There are some activities resembling science festivals and science week, but is named something else. Above we saw an example of the in the case with Belgian "feasts" and "happening". Another important one is the "Science Year", which is organised in the UK.

2001-2002 was declared as Science Year[376] by the UK Government. This project is sponsored by the Department of Education and Skills, who have committed £6 million to its support. The event is co-ordinated between the BA, the Association for Science Education (ASE) and the National Endowment for Science, Technology and the Arts (NESTA).

The event has been described as 'a UK-wide educational initiative aimed at 10-19 year olds, their teachers, parents and other members of the community' (www.scienceyear.com). Science Year has various aims, notably to:

increase pupil engagement in science subjects particularly in the 10-15 age group
increase parent engagement in science
strengthen links between schools, industry and higher education
celeberate achievements in science and identify role moels
increase pupil engagement with science subjects,

Numerous activities have been organised to achieve these aims which include:

awards for outstanding young scientists

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[376] www.scienceyear.com

a nationwide system of science clubs at science centres
mass participation experiements such as ‘Laugh Lab’[377], created in partnership with the University of Hertfordshire; it seeks to find the nation's funniest joke and explore the psychology behind it.
touring productions which look at ethical issues in genetics, aimed at fourteen year olds
a travelling musical hosted by the popular children’s entertainer and science TV presenter Johnny Ball, which aims to stimulate chidren to consider science as a career option through introducing them to leading figures of science in a fun and accessible way.
special lectures orientated to science teachers
BA Conference "The Future of Science in Society" in September 2002, to be run as part of the Festival of Science; it will ‘take a hard look’ at the role of formal and informal education sectors on attititudes to science and technology. (BA Annual Review 2001).

Prior to the launch of Science Year, applications were invited from organisations and individuals seeking funding for projects that would become part of the programme. Applications were judged by how far they engaged with the target audience and the extent to which projects might be inclusive and sustaining beyond the end of the year (see Scienceyear.com). Nine projects were selected, including after-school science clubs, dramatisation of science photography and enhanced teaching resources for schools[378]. Science Year also attracted funds from a range of corporate bodies, including from INTEL and Pfizer, both of which sponsored additional set of projects.

A Case Study: The Establishment of a Science Festival

The Science Festival in Edinburgh served as a model for the Göteborg initiative. Several trips were made to study its set up. It was noted that the two cities had some structural similarities, suggesting that matching arrangements could work in Göteborg. Ideas for a festival in Göteborg started in the late eighties and early nineties with a small group of people working in the intersection between Göteborg University and the municipality of Göteborg. In 1994, a survey was made among schools, companies, municipality and the university on attitudes towards a possible science festival. The survey had a positive outcome. With this result in hand it was rather easy to set things in motion and start implementing the idea.
The key institution is Göteborg & Co., which works to promote the development of all types of activities in Göteborg. This institution is divided into several sections, for instance one dealing with tourism, another with industry and a third engaged in

[377] www.laughlab.co.uk
[378] www.scienceweek.com

attracting major events to the city. Mostly Göteborg & Co. only has a supporting role in the latter. However, the Science Festival is one of two events that they actually organise themselves, with a staff of four people working full time to draw in necessary funds and implement the festival.

In implementing the Science Festival in Göteborg one tried to imitate the simplicity, creativity and sense of excitement from Edinburgh. A major difference, however, was that in Edinburgh events cost money, in Göteborg almost all attractions were to be free of charge. The basic idea was to have two programmes, one for schools and one for the general public. To attend the school programme, there was an initial charge. The public programme was to be free of charge. The rationale for this lay in their outlook on target groups. Basically, the organisers wanted to reach everybody in the City. Still, the people were divided into five different target groups. These were: academics, non-academics, senior citizens, students and youths. An additional target group was children, which was automatically covered by the school programme. Extensive yearly evaluations have shown that members of groups that rule more freely over their time are more prone to interest – academics, senior citizens and students – are extensively involved in the festival. The problem groups are non-academics and youths and in order to have a good chance in attracting these groups it was necessary to have the attractions free of charge.

There exists a necessary ambition to work with flexible concepts and rejuvenate the Festival each year. Surveys have shown, not surprisingly, that the most popular subjects are medicine, space and history. The Festival will thus typically revolve around themes connecting to these. At the same time, there is a need to connect with current events. In the year 2000 the work started with the selection of four themes. These were communication, scientific turning points, science in everyday life, and life and medicine. In addition, a project leader was selected for each of these. Thereafter, a general invitation was made to researchers to give talks on subjects of their own choice. Contributions coming in this way that could not fit into the themes were instead put under the heading of a fifth theme: Elementary and extraordinary.

To take care of the logistics, some 80 students are recruited and trained into working as festival hosts. They serve as guides and see to it that the attractions work smoothly, checking equipment and so on.

Some of the most interesting activities at the Festival should be noted. In the middle of the central shopping complex of Göteborg, the festival sets up a scene, which features the "academic quarter". Here, researchers are invited to attract crowds in a 15-minute talk. Usually, this is a condensed version of a full talk that is scheduled later at some other place. This is thus a vehicle for trying to get new people into visiting new places. Many researchers shy away from this scene, perceiving it as both unserious and unsettling. Many however have found it a refreshingly relaxed experience. In the first year, only three of a large number of invited retired professors showed up for this activity. In 2000 there were 43 researchers doing the academic quarter.

The idea of new places for new crowds is essential for other activities as well. The ambition is to attract people who are not used to and uncomfortable with the buildings associated with the university. Instead, attractions are placed in buildings and places, which are not associated with science, such as coffeehouses, museums, squares, parks and shopping malls.

Another interesting activity is the co-operation with the local science centre. The science centre is invited to test its new instruments and machines during the Festival. These are then thoroughly evaluated by staff as large crowds have a go at them.

An innovation this year was the so-called "private shows". In these, a researcher sits in a tent, available for private consultations. Each individual is given five minutes. This quickly turned into a very popular attraction and queues could become rather long.

The Science Festival has been arranged one year at the time, each year awaiting an evaluation to see if there is to be a continuance next year. Perhaps there will soon come a decision on a commitment for three years. This would make it easier to collect funds for the Festival, which is always a difficult process. The budget is 5.2 million Swedish crowns (SEK). Of these, the main sponsors provide 2 million, this being Chalmers University of Technology, Göteborg University, Business Region Göteborg and Göteborg & Co. Each of these invests 500,000 SEK. In addition, large amounts of money are donated by two industries in the region: Volvo and SKF. Some 20 other partners donate smaller amounts of money. The regionally dominating morning daily, *Göteborgs-Posten*, also plays an important part, freely printing and distributing the festival programme to its subscribers. The newspaper also puts in free advertisements of activities each day of the festival. In the year 2000 there also was a co-operation with a local commercial radio channel. Surprisingly, none of the big research fund givers put up support.

It is important to note that starting up a major event like this is something relatively easy in Göteborg. There exists an easy-going and rather quick decision-making structure among major actors. This can be contrasted with the situation in Stockholm, with many more actors, with both a national and local responsibility, exhibiting a much more complex and time-consuming decision-making process. Perhaps this is one of the advantages of being a second city, such as Göteborg. It is not uncommon for major initiatives to first be set up in Göteborg and after a few years be copied in Stockholm. Such has been the case with the Göteborg Film Festival and the Book Fair. Both of these have been successes and later copied in Stockholm and now this also is the case with the Science Festival.

Science Week and festivals in Austria: An experiment in science communication

Ulrike Felt, Annina Müller

In fact the "Ars Electronica", which we have described in the chapter on museums and exhibitions, was for a long time the only event, which could, in the Austrian context, be classified as a science festival if one uses the term in a broader sense. In the years where science topics had been chosen as the leading topic one could find a large variety of different manifestations, ranging from workshops, to exhibitions and artistic special events.

Nothing else can be listed for the Austrian context under this heading until in May 2000, when the first Austrian "Science Week"[379] took place. It was modelled along similar events organised in other European countries since years like the "National Science Week" in Britain, "La Semaine de la Science" or "Science en fête" in France, Belgium and Switzerland. The undertaking was initiated and organised by a private firm, however it was almost entirely financed by the two Ministries in charge of research and technological development.

The main feature of this science week is, with contrast to other "Open House" events, that academic research activities should not be presented within the scientific institutions and laboratories, but science should move into the public space. Under the heading SCIENCEWEEK @ AUSTRIA: „EINE VERGNÜGUNGSREISE DURCH DIE WISSENSCHAFT" (a pleasure trip through science) during more than a week university departments, schools, associations and very view private firms presented throughout Austria their work and their results in shopping centres, on streets and public places, in railway stations and on markets. In this setting science should not be presented by professional mediators, but the scientists themselves should play an active part in this interaction. It were also the scientists who would decide whether or not they participated in the science week, they would chose the precise topic they wanted to present, the kind as well as place and time of presentation. In that sense the Austrian science week was conceptualised as a complete bottom-up event, the organiser having the role of a platform where information would be pooled and distributed to a wider public.

Two specificities make this concept different from other events of this type: First all scientific disciplines were to take part and not only the natural sciences as this was the case in Britain. Second, school classes would not only get the role of "consumers" of

[379] www.scienceweek.at/

presentations during the science week, but could get involved actively through preparing their own presentations.
The benefit of such an interaction between scientists and the wider public was seen to be manifold. First lay-people would meet science in their everyday context, and thus the threshold for them to enter into communication with scientists was much lower than in other contexts. One hoped that through this direct interaction both sides would learn to appreciate the visions and perceptions of the other. And finally the public would not only be confronted with results, as this is the case in many other classical communication settings, but scientists could try to convey the complexity of scientific work, but also the fascination as well as the limitations that go with it.
Right from the start many hundreds of events took place during the science week and the number of events has increased in the following year to more than 700 in 2001 and nearly 1000 in 2002 – a fact which raised some criticism as it became increasingly difficult to get a clear overview of what was happening when and with what quality. For 2003 no public funding was made available as the decision was taken to rethink the concept as it was used so far. Thus only a much smaller version of the event could take place.

As our research unit had two contracts to do qualitative evaluations of the science week in 2001 and 2002[380] it is possible for us to say a bit more about the way these interactions with the public took place and how the idea managed to be turned into reality. While the details can be read in two extensive reports the idea is to only pick out a few relevant points that seem important to our reflections on public understanding of science initiatives.
To start with it is interesting to see the science weeks as an experiment to transfer a concept that was developed in a different context to Austria. In fact it turned out that a number of rather important adaptations to the direct environment had to be made. In the case of other countries such as the UK or France the science weeks were embedded as part of a broader spectrum of initiatives, which all were meant to communicate science. Thus they could draw on the fact that people were quite used to meeting science in varying forms and in different contexts. In Austria science popularisation is not a very well developed field. As a consequence the need to engage in such an enterprise was not seen as a belonging to their tasks by many of the researchers, the publics were not used to getting in touch with science in such a direct and intense way as also, the organisers did not manage to create wider visibility and get synergy effects through a broad media coverage. In that sense the science week

[380] Ulrike Felt, Annina Müller, Sophie Schober (2001): Evaluierung der Science Week @ Austria 2001: Analyse eines Experimentes der Wissenschaftskommunikation im österreichischen Kontext. And Ulrike Felt, Annina Müller, Sophie Schober (2002): Evaluierung der Science Week @ Austria 2002: Analyse der Interaktion zwischen Wissenschaft und Öffentlichkeit im Rahmen der Science Week. Both to be downloaded from www.univie.ac.at/wissenschaftstheorie/virusss

had, in the Austrian context, to develop into a recognisable and legitimate space in which science and publics could meet and interact. This need for fine-tuning and adaptation was definitely underestimated by the organisers, a fact that caused tension and some problems. To leave the whole event only to bottom-up initiatives of scientists without any activity of clustering, networking or focusing, turned out to make the event difficult to become a publicly recognisable event. Thus one could say that the transfer of the idea of the science week did work out only partially, as there is still a lot of work to be invested in order to better tune it to the specific local context.

Let us now mention a few more specific points that appeared during the evaluation.
First of all one can say that people were in principle rather positive towards the idea of a science week. In particular the visitors appreciated strongly the possibility to directly get in touch with scientists, to get to know them also as human beings and to be able to directly formulate questions. What is more the fact of being able to personally participate in doing experiments, to have hands-on-exhibits and to get additional information material to take along was seen as essential to such an undertaking.
The concept of leaving the institutional places where knowledge was produced and to enter public places showed in fact to be crucial if one was not only addressing the higher educated segments of the population. Indeed the overwhelming majority of the people present in events that took place with Universities had at least finished high-school as educational background, whereas in science week events which took place in more public spaces also people with a working-class or with lower formal educational background would participate.
Particularly highly appreciated by the visitors were those events, which had a clear connection to some kind of every-day experience. In a certain way people then were able to link their own experiences to what they saw in the science week presentations and thus could better make sense of the information they received.
What was quite interesting to observe was the way scientists and the public perceived and imagined each other. For example the central organiser and also many scientists underlined that the public would only be ready to engage with science when the fun character was very high, some of the visitors explicitly criticised the partly exaggerated “scientainment” character. They underlined their readiness to engage with science in a much more in-depth way than part of the scientists actually imagined. On the other hand the visitors had also quite stereotyped imaginations about “the scientist” which were linked a lacking capacity to understand what the public is interested in, to be self-referential and to be unable to use everyday language to explain his/her work. It turned out that these projections were a source of quite numerous misunderstandings in the respective communication processes.
But also scientists felt rather ambivalent about the fun-character of their representations of science. In a certain way they seemed to hesitate between the more

education oriented approach and the entertainment character, both approaches remaining however in many cases in the mode of classical linear communication.
Finally it should be underlined that scientists partly invested a considerable amount of time with the number of visitors remaining relatively low. Thus regularly the issue of balance between investment of time and return in form of public awareness about science was brought up. While the institutional rhetoric about the importance of communicating science to large segments of society was high in the Austrian context, scientists underlined that the evaluation criteria for their work had not changed in any significant way (e.g. there is not clear statement in the duties of a university researcher with regard to communicating his or her results to a wider public) to take into account this type of activity. Thus on the one hand there was always the question whether or not to participate. On the other hand many scientists also underlined the implicit profit they had taken from organising such events as they had to rethink their research. In that sense some of the scientists saw it as an important reflexive exercise.

In May 2003 the Austrian Ministry for traffic, infrastructure and technology launched a call for proposing a new concept for what they labeled “Fest der Wissenschaft” (title similar to the French “Fête de la science”). This competition of ideas is meant to encourage the development of concepts that would be more closely adapted to the Austrian context. At the time this report is completed it is unclear if and how a science week-type event will be taking place in 2004 and whether or not it will be funded from public sources.

Science weeks in the Belgian context

Gérard Valenduc, Patricia Vendramin

In Belgium, the activities related to science weeks are mainly designed and organised by universities. In both parts of the country (Flanders and Wallonie), there is a contract between the regional government and the universities in order to carry out a set of activities of science communication, including the organisation of science weeks.
For this reason, topics related to science weeks are included in the chapter on universities.

Science weeks and festivals in France: Science as entertainment

Philippe Chavot, Anne Masseran

In France, several scientific festivals are organised on a regular basis at national level and, less frequently so, on a regional scale. Generally, these involve a synergy between the various categories of partners (ministries, industrialists, local authorities, associations, CCSTI and scientists). However, despite the amount of aid granted to these festivals, particularly at national level, it clearly appears that the manner in which sciences are presented remains close to the traditional pattern, i.e. the aim is educational in nature and involves the establishment of a "master / pupil" relationship. Observing the festival scene in France, it appears that the Science days (*la Fête de la science*) represent, for local communities, the major source of expressiveness. Science days have the benefit of strong supportive actions (at institutional, political and financial levels). They tend to be predominant compared to local festivals of a more modest size and are becoming the model to be followed.

Two examples of federative national celebrations: *La fête de la science* (Science days) and *La nuit des étoiles* (Stars night).

Since the mid-1980s, France has developed impressive yearly celebrations related to CST. In some cases falling outside the scope of our study, the goal is to sensitise the public to problems involving sciences, technology and society. This has been the case, for instance, with issues related to health and the environment. Yearly national events were established at which experts could speak, explain or raise specific issues through the media or local activities: the *Telethon* or the *Sidaction* (at least under its previous format), focussing on genetic diseases and AIDS, represent typical examples of this kind of initiative.

At the same time, two important yearly celebrations have been established with a view to federate the active forces of CST and to decentralise cultural activities: *La fête de la science* (Science days) and *La nuit des étoiles* (Stars night), both initiated by the Minister of Research and Space and the physicist Hubert Curien in the early 1990s. These two yearly celebrations carry different philosophies, invest in different areas and mobilise significantly different actors or organisations and audiences.

1 - Science days (La fête de la Science)

Initiated in 1991, the Science days was successively named *Science en fête*, *Semaine de la science*, *Fête de la science*. These changes highlights the difficulties its various designers were faced with in defining the nature of this celebration. They have assigned several missions to it and achievements vary according to the main organisers and to the local contexts. This polymorphous celebration can be perceived as a means to inform, to put science in culture, to give the public the opportunity to experiment with scientific knowledge, to educate, to promote institutions and scientific heritage, to help the public to discover scientific areas (such as laboratories and universities). That celebration could also be an opportunity to attract young persons to scientific careers.

In 2000, the ninth Science days pursued two main goals. On one hand, the aim was, of course, to enhance CST through decentralised means whilst also ensure the various groups develop an appreciation of science and technology. All institutions concerned were involved in the general coordinating action of the Ministries of Research and the Ministry of Education, these included major associations and federations as well as the local energies of 700 towns and cities, universities, research institutions and museums (*Cité des sciences et de l'industrie de la Villette*, *Musée des arts métiers*, *Palais de la découverte*), the CCSTI, several radio stations and TV channels. Various demonstrations were organised: conferences, debates on major issues related to ethics and society, visits of laboratories and major technological sites, workshops and various events.

The second goal was of a more conjectural nature. Since 2000 was the "international year of mathematics", institutions seized this opportunity to attract young persons not only to mathematics but also to natural sciences. Indeed, in France as in many other countries, the number of science students is steadily falling and both the government and the scientific community are trying to counter this relative disaffection. France is proud to be one of the first four or five "mathematical" nations, and this position must be defended.[381] Hence, Science days 2000 also represented an opportunity to promote mathematics, its central role in our society having to be highlighted or even amplified. This action was more specifically aimed at girls, who are considered more reticent than boys to undertake scientific studies.[382]

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[381] See the article by AUGUERAU J.F in *Le Monde*, "La Fête de la science veut réconcilier les jeunes avec la recherche", 17-10-2000.
See also the web site, http://www.recherche.gouv.fr/fete/2000/default.htm

[382] The Minister of Research, Roger Gérard Schwarzenberg, addressed this issue in his opening speech. He underlined "the excellence of the women" who enlist in science, referring not only to Marie Curie, but also to the chief director of CNRS, Genevieve Berger, and to the perpetual secretary of the Academy of Science, Nicole Douarin. Suddenly, the need appears for breaking with the archaic attitude which "directed boys towards natural or "hard" sciences and the girls towards the literary careers". The need for science to gain new forces makes appear an issue in the public space, which did not seem very problematic until now. Source: http://www.recherche.gouv.fr/discours/2000/fete/fetesc.htm

These Science days are based on a will to promote science and scientists, addressing a public who, for the youngest part, may constitute for the institution a wealth of future scientists.

It should be stressed that France, banking on the experience gained in organising the Science days, is increasingly trying to take the lead in the effective establishment of a science week deployed at European scale.

2 - Stars night (La nuit des étoiles)

The night of the shooting stars is a national celebration that traditionally takes place in mid-August, when the shooting stars are most visible in the night skies. Learned societies and astronomy clubs created this event in the late 1980s. However, it is in 1990 that this celebration became what it is today, as TV channel France 2 turned it into a media event. Up to 1:30am France 2 broadcasts programmes produced by many national and local associations of astronomy enthusiasts (AFA and *Le Ciel et l'Espace*, SAF, ANSTJ, etc) and by research institutions opening their observatories to the public. Since the first year, the same two persons present this TV show: Claude Serillon, a journalist playing the candid part, and astronomer Hubert Reeves, who acts as the expert. With the passing years, the programme slightly freed itself from its initial informative purpose and focused on other issues such as astronomy, history or mythology related to stars and planets, and later on environmental issues (as was the case in 2000: "In 5 billion years, the end?", "Can we help save the sun?"). This TV program aims to get the public involved by giving people the opportunity to ask questions via the internet, on *Minitel*, by telephone and email. This programme benefits from a strong popular passion for astronomy.

Stars night pursues two principal objectives. On one hand, it aims at informing the general public on astronomy. On the other hand, it may assist those who wish to discover and observe the skies. These two goals mirror in some ways the two philosophies involved in this celebration. The France 2 program popularises science by providing films and experts. The large number of associations involved in the event - particularly local associations – also aim at popularising science but, above all, represent an attempt to make the greatest number of people enjoy observing the starry sky. Hence, this celebration is made up of two different areas with different underlying philosophies which sometimes compete or confront each other. The yearly media event has "colonised" an activity that amateur astronomers practised for a long time. Moreover, the TV channel by now decides the dates of the "Nights of the stars". Hence, local actors who wish to take part in the event and organise activities are likely to lose part of their members of the public who may prefer to follow the event on the screen. But alternative demonstrations are organised more and more often. Local associations prefer to leave the official date for TV presentation and organise their activities a day before or after the TV event, benefiting from their best argument: the sky can never observed as well as in the open air.

Science celebrated at local level

In addition to national events, celebrations of science are also offered to the public at local level. These events are usually organised around specific themes or techniques, they are a regular occurrence (annual or biennial) and are aimed at a very wide audience. It should be stressed that although these initiatives are taken at local level, their link with regional traditions is rather weak. A few examples are provided by:

1 - The International Film Festival on Insects

Organised for the first time in 1995 on the initiative of scientists and local partners (e.g. the town of Narbonne, …), this festival is a biennial event. Being originally a regional festival, it has been acknowledged at European level with the successive award of several labels (*Année Européenne pour la Conservation de la Nature* (European year for the preservation of nature) followed in 2001 by *L'Europe, un patrimoine commun* (Europe, a shared heritage), etc.

Not only is the objective of this festival to promote scientific films focussing on insects, it also aims at raising the public's awareness on biodiversity with the organisation of a genuine street festival. The public is presented with a playful approach where all points of view are encouraged and various outlooks on insect life are confronted. Thus the International Film Festival on Insects is made up of several activities:

- the international audio-visual competition (documentaries, cartoons …), dealing with themes revolving around insect life and, generally speaking, terrestrial invertebrates ;
- the scientific and naturalist forum, bringing together laboratories (INRA, IRD, CNRS), associations involved in general public and environmental education, etc ;
- citizens round-table discussions (agriculture and biodiversity, the role of environmental associations in society,…) ;
- the organic market, a pointer to new agricultural practices respectful of the environment ;
- arts exhibitions: facilities, photographs, sculptures, drawings and recyclable sculptures competitions ;
- live shows: temporary street events, "insectoid" carnival parades and choreographic creations including concrete music highlighting the cultural heritage ;

- discovery outings on the natural heritage.

2 – Other festivals

Beside the Film Festival on Insects, several scientific film festivals are regularly organised, particularly by the town of Palaiseau, with the support of the major scientific institutions (between 1984 and 1998) and by the *Maison des Jeunes et de la Culture* (youth club) of the town of Oullins which will organise its 16th festival in 2003.

Amongst other local festivals, "Sciences frontières" in the town of Cavaillon is worth a specific mention. It was initiated by a journalist in 1984 with the support of the local authorities and a number of private businesses. Offering conferences, workshops and various actions this festival attempts to offer a diversified approach to scientific themes related to society. Contributors include scientists as well as artists and writers.

The science week in Portugal

Maria Eduarda Gonçalves, Paula Castro

Every year, in November, since 1997, a Science Week has been held under the auspices of the Portuguese National Agency for Scientific and Technological Culture. This is the body in charge of the Ciência Viva programme, a programme for the popularisation of science launched in 1996 by the Minister for Science and Technology. During this week, scientific institutions, universities, schools, scientific associations and museums, all over the country, open their doors to the public. The main objective of the Science Week indeed is to familiarise members of the public with the activities carried out in scientific institutions. While researchers present their projects, visitors are encouraged to engage in practical experiments so as to get a notion about the concrete workings of science.

Being part of the Ciência Viva programme, the Science Week seeks to mobilise teachers and professors of secondary schools. The titles of some of the events undertaken in 2002 may give us a flavour about their nature: “My mother is a scientist”, where science underlying domestic tasks is revealed; Discrete treasures”, on strange botanic specimens; “the marvelous world of mushrooms”, involving the participation of a scientist and a famous cook.

All the Science Weeks held until the present also included a high number and variety of events, from exhibitions on special topics to conferences and colloquia.

The Internet page of the Agency and the Ciência Viva programme, together with daily newspapers, operate as the main sources of information about the Science Week.[383]

This initiative has been generally held as one of great success.

[383] See http://www.cienciaviva.pt/semanact/ .

Science weeks, science festivals and PUS in Sweden

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

As in many other European countries, both science festivals and science weeks are present in the landscape of Swedish PUS. This text observes two specific cases, the *International Science Festival in Göteborg* and *The University of Lund's Science Week*. Firstly, however, we will try to define what we mean by and show the difference between science weeks and science festivals.

Science Festivals and Science Weeks: A Definition

Arguably, there is only one science festival in Scandinavia. However, this depends on how you define a science festival and put it as something apart from a popular science week, something that exists in the other Scandinavian countries as well as in Sweden (and elsewhere). The major difference is that the popular science week is usually based in more than one location: on the national basis a science week involves all the universities, on the regional basis it involves the region around the university. The University of Lund's science week exemplifies the latter, where scientists travel all around southern Sweden giving lectures adapted to local interests.[384] The science festival, on the other hand, is an initiative located solely in the city of the university, and it therefore enjoys a higher profile. Everybody in Göteborg knows that there is a science festival going on, you cannot miss its activities and the trademark orange colour is everywhere. Another important difference is that the festival is engineered by non-scientists, is more popular and there is an emphasis on the fun aspects of science. The Popular Science Week by comparison is more University driven and serious in tone.

Another entity from which the Science Festival should be distinguished from is the Open House, in which a faculty or a university for one day or more shows samples of its activities. This constitutes a local initiative however, which is much smaller in scale and also university driven.

[384] "LUM; Lunds universitet meddelar"; (*LUM: Information from The University of Lund*), nr 10, 1997.

The International Science Festival in Göteborg: a case study

It often takes a long time for good concepts on a grand scale to be realised and the correct setting needs to exist. An example of this is the Science Festival in Göteborg, which has now been running on an annual basis since 1997, covering 10 days in May.[385]

Ideas for the International Science Festival in Göteborg started in the late 1980s and early 1990s with a small group of people working in the intersection between Göteborg University and the municipality of Göteborg. The key institution is Göteborg & Co, which works to promote the development of all types of activities in Göteborg. This institution is divided into several sections, for instance one dealing with tourism, another with industry and a third engaged in attracting major events to the city. For the latter, Göteborg & Co has more of a supporting role. However, the Science Festival is one of two events that they actually organise themselves, with a staff of four people working full time to attract the necessary funds and to implement the festival.

The Science Festival in Edinburgh served as a model for the Göteborg initiative. Several trips were made to study its set up. It was noted that the two cities had some structural similarities, which suggested that a similar arrangement might work in Göteborg. In 1994 a survey was made among schools, companies, municipality and the university on attitudes towards a possible science festival. The survey had a positive outcome. With this result in hand it was easier to set things in motion and start implementing the idea.

It is important to note here that starting up a major event like this is a relatively straightforward thing to achieve in Göteborg. There exists an easy-going and rather quick decision-making structure among major actors. This can be contrasted with the situation in Stockholm, which has many more actors, with both a national and local responsibility. As such, this leads to a much more complex and time-consuming decision-making process. Perhaps this is one of the advantages of being a second city, such as Göteborg. It is not uncommon for major initiatives to be set up initially in Göteborg and after a few years be imitated in Stockholm. Such has been the case with the Göteborg Film Festival and the Book Fair. Both have been successful and were later copied in Stockholm, and now this is also the case with the Science Festival.

In implementing the Science Festival in Göteborg, an attempt was made to imitate the simplicity, creativity and sense of excitement found in Edinburgh. A major difference, however, was that in Edinburgh, events cost money, whereas in Göteborg almost all attractions were to be free of charge. The basic idea was to have two programmes, one for schools and one for the general public. To attend the school programme, there was an initial charge. The public programme was to be free of charge. The organisers'

[385] Most of the following is based on an interview with Annika Lotzman Dahl, project leader, Göteborg & Co, August 21, 2000.

rationale for this lay in their outlook on target groups. Basically, the organisers wanted to reach everybody in the City. Still, the people were divided into five different target groups; academics, non-academics, senior citizens, students and youths. An additional target group was children, which was automatically covered by the school programme. Extensive yearly evaluations have shown that members of groups that rule more freely over their time are more prone to interest – academics, senior citizens and students – are extensively involved in the festival. The problem groups are non-academics and youths and in order to have a good chance in attracting these groups it was necessary to have the attractions free of charge.

There exists a necessary ambition to work with flexible concepts and rejuvenate the Festival each year. Surveys have shown, not surprisingly, that the most popular subjects are medicine, space and history. The Festival will thus typically revolve around themes connected to these three fields. At the same time, there is a need to connect with current events. In the year 2000 the work started with the selection of four themes. These were communication, scientific turning points, science in everyday life, as well as life and medicine. In addition, a project leader was selected for each of these. Thereafter, a general invitation was made to researchers to give talks on subjects of their own choice. Contributions which could not be pigeon-holed by these categories were instead included under the heading of a fifth theme: Elementary and extraordinary.

To take care of the logistics, some 80 students are recruited and trained into working as festival hosts. They serve as guides and check equipment and so on ensure that the attractions work smoothly. The expectations for the first year was to attract 25,000 people, the outcome was at least 40,000 visitors (Göteborg has 550,000 inhabitants). Since then the results has been around 48,000, but much hinges on the nature of the May weather and the number of activities offered. The volume of activities in 1999 was rather too extended and it was radically cut back for the next year.

Some of the most interesting activities at the Festival should be described further. In the middle of the central shopping complex of Göteborg, the festival organisers place a scene, featuring the 'academic quarter'. Here, researchers are invited to attract crowds for a 15-minute talk. Usually, this is an abridged version of a full talk that is scheduled later at a different venue. Thus, a vehicle is created for attempting to get new people into learning and visiting new knowledge and places. Many researchers shy away from this scene, perceiving it as too frivolous and somewhat unsettling. However, many have found it a refreshing experience, both relaxed and interesting. In the first year, whilst a large number of retired professors were invited to this activity, only three actually appeared. By 2000 there were 43 researchers participating in the 'academic quarter' exercise.

The idea of new places for new crowds is essential for other activities as well. The ambition is to attract people who are not familiar with or are uncomfortable with the buildings associated with the university. Instead, attractions are placed in buildings and places which are not usually associated with science, such as coffeehouses, squares, parks, shopping malls and museums. Another interesting activity is the expanding co-operation with the local science centre. The science centre is invited to test its new instruments and machines during the Festival. These are then thoroughly evaluated by staff as large crowds are invited to use or test them. An innovation this year was the so-called ‘private shows’. In these, a researcher sits in a tent, available for private consultations. Each individual is given five minutes. This quickly turned into a very popular attraction and queues tended to be on the long side.

The Science Festival has so far been arranged one year at a time, each year awaiting an evaluation to see if there is to be a continuation the next year. It is a possibility that soon, decision-making will be committed to three year cycles. This would make it easier to collect funds for the Festival, which is always a difficult process. The budget is 5.2 million Swedish crowns (SEK). Of these, the main sponsors provide 2 million; Chalmers University of Technology, Göteborg University, Business Region Göteborg and Göteborg & Co. Each of these invests 500,000 SEK. In addition, large amounts of money are donated by two large industrial firms in the region: Volvo and SKF. Some 20 other partners donate smaller amounts to the Festival. The regionally dominant morning daily, *Göteborgs-Posten*, also plays an important part, freely printing and distributing the festival programme to its subscribers. The newspaper also includes free advertisements for activities on each day of the festival. In the year 2000 there was also co-operation with a local commercial radio channel. Surprisingly, none of the large research fund givers provided any support.

Different sponsors are involved for different particular reasons. For the universities, it is a matter of fulfilling the “Third Assignment”[386] with an emphasis on cultural understanding of science and also to work in a proactive way in the recruitment of students. Other sponsors are interested in attracting good will and also in implementing a long-term practical understanding of science by way of long-term strategies to get more people into the universities and subsequently into local companies. Some sponsors see the act of sponsorship as good citizenship, stressing the civic aspects of the public understanding of science.

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[386] In the new University Act of 1977, this new task supplemented the earlier two officially proscribed responsibilities assigned to the universities, teaching and research, and it was thus called ”the Third Assignment” (*tredje uppgiften*). Such disseminated research information (*forskningsinformation*) should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have come to modify the text, somewhat changing its intent. Some core ideas are, however, still present, which goes back to the fact that the universities are part of a unitary national system and publicly funded.

Science Week

Since 1994, The University of Lund has arranged a science week. The information unit at the university formulates the design and content for the week. They co-operate with the surrounding cities, for instance Ängeholm, Hässleholm, Landskrona, and Ystad, in order to meet these cities needs of staff training, to highlight local problems and to reflect upon differing local interests.[387] As such, in 1997, some of the sub-headings of science week were "Regional Development", "Sustainable Development", and "Employment in the Information Society". More humanistic questions of cultural identity, philosophy, theology and even 'new age' were also raised.[388]

Some of the new and growing colleges, such as the colleges in Skövde, also arrange science weeks. In 2001, the focus was on the importance of science and technology for the commonwealth. In this way, the science week vindicates the existence of economic investments in the city college.[389]

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387 "LUM; Lunds universitet meddelar"; (*LUM: Information from The University of Lund*), nr 10, 1997.
388 See "LUM; Lunds universitet meddelar"; (*LUM: Information from The University of Lund*), nr 10, 1997.
389 See http://www.skovde.se/jubileet/sidor/seminarier.htm.

Celebrating science in the UK: Science weeks, months, years and the Millenium

Josephine Anne Stein

Introduction

Science festivals and science weeks/years in the UK have various roots. Gregory and Miller have observed that since the beginning of the 19^{th} century, the British Association for the Advancement of Science has held an annual weeklong meeting where leading scientists gave public lectures to ensure that the latest research had the broadest possible audience (1998:225).

The Great Exhibition of 1851, where the 'scientific genius' of Imperial England was displayed for all the world to see, is also an important precursor of modern events. Covering 21 acres in South Kensington, London, The Great Exhibition attracted over 14,000 exhibitors and 6 million visitors (Gregory and Miller, 1998:198). This event left an indelible mark on South Kensington and on the broader development of scientific culture in the UK as profits of this event were subsequently used to fund what became The Science Museum and the Victoria and Albert Museum in South Kensington (Gregory and Miller, 1998:198).

The Festival of Britain of 1951 was a national celebration of British science and technology, designed to bolster national pride and raise morale in the context of a post war Britain still in the midst of food rationing. Firth (1999) however believes that contemporary British science festivals have roots less in creating symbols of national pride than in the need for economic development of urban cities.

Two major science festivals now take place in the United Kingdom on an annual basis. The Festival of Science, run by the British Association for the Advancement of Science (the "British Association" or just the "BA"), is held in a different city in England or Wales every September. This festival is aimed at school children, journalists and the general public, and attracts thousands of people every year. The Festival features displays, interactive exhibitions, lectures, site visits, discussions and special events. It has been criticised as "preaching to the converted", but the level of enthusiasm amongst the participants does lend the Festival a highly positive and energetic atmosphere. The Edinburgh International Science Festival is the older of the two, and as the name suggests attracts international participation.

Annual Festivals and National Science Weeks, which take place every March, have become increasingly important as showcase events for the UK PUS movement. The idea has been extended, with 2001-02 being the first National Science Year in the UK.

The Edinburgh International Science Festival

The Edinburgh Science festival claims to be both the world's first annual science festival and its biggest (Scottish Office, 1994:23). Drawing from the city's historical role as the centre of the Scottish Enlightenment, "The Edinburgh Festival of Science and Technology" was launched in Spring 1988. The festival receives government support. Contributions are also made by the district councils of Edinburgh and Lothian, and further ‘financial and practical support’ given by industry, commerce, professional scientific bodies, charities and the universities (Scottish Office, 1994).

British Association Science Festival

In contrast to the ‘general public’ orientated National Science Week, the BA Festival of Science is an annual event hosted by scientists for scientists and the scientifically literate (Boddington and Coe, 2000). "Creating Sparks", the BA’s millennium festival, was a major, month-long science festival. Drawing together nine organisations, 450 events were staged which attracted over 250,000 people. At one event, Exhibition Road, home of the Science Museum, The Victoria and Albert Museum and Imperial College, was closed to traffic for the first time in its history. Crowds were treated to choreographed abseilers descending down the face of the Natural History Museum and a floating heliosphere swooping down on the crowd. The 2002 BA Science Festival will take place at the University of Leicester, exploring the theme ‘Science and the Quality of Life’.

One of the principle aims of The Festival of Science has been to 'create a burst of publicity for science' (Ghosh, 2001). Ghosh has argued that during the 1980's, the festival often served a useful purpose in this respect as science stories were often difficult to get into the national press or on TV. As science coverage matured, gained increasing importance and became increasingly critical in the 1990's, it has been argued that the BA festival has made less of an impact. More recent shifts in the Festival have seen scientists become more outspoken in their criticism of government and commercial interests, leading some to claim that the festival is renewing itself (Ghosh, 2001).

Regional Festivals

The BA sponsors science festivals at the regional level, such as those organised by its North West Branch with a range of events for adults and children. In addition, there have been a number of independent ventures emerging over the last decade, a disproportionate amount of these in Scotland. An annual science festival is held in the

Orkney Islands[390], in which energy and environmental issues are prominent. The festival is noted for its large number of participants from Iceland and Scandinavia (Scottish Office, 1994:23). The Moray Science Festival, is held at Moray College, Elgin, Scotland. The Argyle Science Festival occurred in 1993. Elsewhere, the Newcastle Science Fair ran a open day fair in 1999 supported by COPUS in a school in Staffordshire (COPUS, 1998).

Established cultural festivals have also added science to the list of concerns that they address. Thus, in Wales the 'Urdd Eisteddfod' (a festival celebrating Welsh language and culture) has asked the Centre for Alternative Technology to run workshops in its science and technology pavillion. The Cheltenham Festival of 2002[391] has added a new five day Festival of Science to events.

National Science Week

National Science Week (formerly SET –Science Engineering and Technology week) has run as such since 1994. It was initiated by Brian Gamble of the British Association, who sought to emulate the success of Edinburgh in a more dispersed fashion (Boddington and Coe, 1998). The first science week, known as SET7 was the first major event in the government's PUS campaign (Scottish Office, 1994). The annual event is co-ordinated by the BA and supported by the Department of Trade and Industry. The central aim of this week is to 'celebrate science and its importance to our lives'[392]. It endeavours to open up opportunities for the general public to engage in science activities and discussions in a range of venues from shopping centres to disused railway stations and churches.

National Science Week has seen a steady growth. In 1994, SET7 co-ordinated over 400 events (Boddington and Coe, 1998). In 2001 over 1,500 science, technology and engineering enthusiasts ran more than 2,500 events which were attended by over 1.4 million people (www.the-ba.net/).

Attempts are made by the BA to ensure that the event is as inclusive and participatory as possible. Prior to the week, the BA organises a series of National Science Week Awareness meetings. These provide opportunities for people who might wish to organise events to gain more details of funding opportunities (www.the-ba.net/). Small grants are available to support new initiatives.

An evaluation by Boddington and Coe (2000) suggests that while paid professional science communicators play a central role in the development of the week, alongside them stands a 'strong amateur tradition' who put on events with little grant money. They found that science week organisers have the following profile:

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390 www.orknet.co.uk/scifest/exhibit2001.html

391 www.cheltenhamfestivals.co.uk/

392 www..the-ba.net/

- 30% are professionals whose principal job is in science education or public understanding
- 35% occasionally run public understanding events during the year
- 35% are 'science weekers' who only run events during science week

In terms of atmosphere, The National Science week is known for its 'refreshingly madcap approach to presenting science' (Boddington and Coe, 2000) to the general public. Much of the activities of Science Week are often reported through the local media in contrast to the more national media focus on Science Festivals (Boddington and Coe, 2000). Statistics collated by the BA suggest that participants record high levels of satisfaction in events. Over 73% of visitors thought the events they attended met or exceeded expectations (www.the-ba.net/). However, whether this event provides an effective engagement with science is a moot point.
Questionnaires administered at the 1998 week revealed that less than two thirds of organisers believed the event to be effective or very effective at promoting public understanding of science (Boddington and Coe, 1998:9). Boddington and Coe note that while empirical evidence reveals 'no single reason' for this response, they suggest that 'there has been a general increase in scepticism about the effectiveness of public understanding of science events'. Anecdotal evidence suggests that two factors may be responsible:

- 'a dampening of enthusiasm and confidence after the initial rapid and innovative growth of public understanding activities in the late 1980's and early 1990's'
- 'several organisers and commentators have recently expressed disappointment in progress; they had expected to have achieved a greater increase in public understanding and support by now' (Boddington and Coe, 1998:9).

It has also been suggested that the engineering and industrial communities provide 'feeble' (Famelo, 1997:180) support for the event. As Brian Gamble notes, 'industry has been slow to grasp the opportunities presented by the Weeks, perhaps because they do not fit comfortably with the public relations campaigns mounted by industry' (cited in Farmelo, 181). Farmelo has argued that a key factor in the success of media coverage of Science Week is the backing provided by the BBC.

Science Year

2001-2002 was declared as Science Year[393] by the UK Government. This project is sponsored by the Department of Education and Skills, who have committed £6 million

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[393] www.scienceyear.com/

to its support. The event is co-ordinated between the BA, the Association for Science Education (ASE) and the National Endowment for Science, Technology and the Arts (NESTA).

The event has been described as ‘a UK-wide educational initiative aimed at 10-19 year olds, their teachers, parents and other members of the community’ (www.scienceyear.com). Science Year had various aims, notably to:

- increase pupil engagement in science subjects particularly in the 10-15 age group
- increase parent engagement in science
- strengthen links between schools, industry and higher education
- celebrate achievements in science and identify role models
- increase pupil engagement with science subjects,

Numerous activities were organised to achieve these aims which include:

- awards for outstanding young scientists
- a nationwide system of science clubs at science centres
- mass participation experiments such as ‘Laugh Lab’[394], created in partnership with the University of Hertfordshire; it seeks to find the nation's funniest joke and explore the psychology behind it.
- touring productions which look at ethical issues in genetics, aimed at fourteen year olds
- a travelling musical hosted by the popular children’s entertainer and science TV presenter Johnny Ball, which aims to stimulate children to consider science as a career option through introducing them to leading figures of science in a fun and accessible way.
- special lectures orientated to science teachers
- BA Conference "The Future of Science in Society" in September 2002, to be run as part of the Festival of Science; it will ‘take a hard look’ at the role of formal and informal education sectors on attitudes to science and technology. (BA Annual Review 2001).

Prior to the launch of Science Year, applications were invited from organisations and individuals seeking funding for projects that would become part of the programme. Applications were judged by how far they engaged with the target audience and the extent to which projects might be inclusive and sustaining beyond the end of the year (see Scienceyear.com). Nine projects were selected, including after-school science

[394] www.laughlab.co.uk

clubs, dramatisation of science photography and enhanced teaching resources for schools[395]. Science Year also attracted funds from a range of corporate bodies, including from INTEL and Pfizer, both of which sponsored additional set of projects.

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[395] www.scienceweek.com

CHAPTER 3.4.

Universities as actors at the science-society interface: Similarities and differences in the different national contexts

Ulrike Felt

Investigating Universities as actors at the science-society interface is of particular interest as they represent a typical example of an institution that holds a double role: it holds a dominant position in the production of scientific knowledge while at the same time being a central actor in communicating it to different publics. This specific position has – we argue – an important influence both on the institutions' but also on the scientists' motivations for engaging in PUS activities as well as on what is communicated about science, when and how they enter in contact with society at large and whom they target as specific audiences.

Yet, looking at the role of these scientific institutions in the PUS landscape we observe major differences in our sample of countries. These differences are not specific to the PUS-activities as such. It is essential to keep in mind that in the six countries under investigation, the universities as institutions are structured in fundamentally different ways, do not even have a homogeneous profile within one national context, look back onto different histories; their place in the national science system as a whole varies largely, they have been reformed more or less radically over the past decades and thus have rather different points of departure also with regard to the PUS activities.

Motivations for engaging in PUS-activities

The changing boundary conditions for universities – in some cases linked to radical reforms as for example in the UK and more recently in Austria – were in all countries central for making them rather active players in the PUS field over the last years.

Concretely, two reasons for this growing presence of universities on the "PUS terrain" were given for all countries under investigation.

The first was the apparent **difficulties in attracting young people** to university studies in the core fields of the natural sciences as well as in some more technically oriented domains. This in some contexts had rather dramatic consequences for the institutions, as the financial support by the state was proportional to the number of students that would enrol. Consequently, declining interest from the side of young people would indirectly also threaten the research activities of the universities. Thus through an increased number of PUS-initiatives targeting school children in particular one hoped to revive their interest in the sciences and raise their motivation to engage in studies in these domains. This situation of crisis has lead to the **"discovery" of women as a central target group** in some countries, as they represent a so-far "unused" resource of brainpower in these scientific areas. Such a move can definitely be observed for example in the case of Austria. While this could on the one hand be judged as a positive development – given the under-representation of women in the national science systems – it should on the other hand not be overlooked that they are mainly called to enter these domains at a moment when they are loosing attractiveness in the eyes of male students.

Secondly, the growing activity of universities in the PUS-domain was triggered by **budgetary constraints and the increasing demand for accountability** for the public money spent. Under these circumstances universities are expected to increase their visibility in the public sphere. It became regarded as unacceptable, that Universities would engage in research without sufficiently communicating about their findings, but also about the impact they would have for society at large (however often this vision of "society at large" meant in concrete terms the economic system). Thus regular and more intense contacts to the media as multiplicators and actors in creating public visibility became central and science journalists became a central target group to be addressed for the universities.

Apart from these two more pragmatically oriented motivations for starting PUS-initiatives, which are both direct reactions to a change in the universities' environment, the engagement with the public was also framed by a number of other ideals. Despite the radically new rhetoric which would speak about dialogue and interaction with the public, one ideal still strongly present was that of citizen enlightenment. Indeed much of the communication work carried out could still be subsumed under the classical ideal of "educating the public" in order to make them more "rationally functioning citizens" in their positioning towards techno-scientific developments. We find this in a number of countries – it was explicitly mentioned in the French and Austrian case – even though expressed in slightly different ways. Here, universities should play the role of an expert institution and of a source of valid and reliable information. As a consequence less importance was attached to more open and interactive settings were people could meet and question science, although this was partly formulated as an explicit aim. This mindset is partly explainable by the above-mentioned double role universities hold as knowledge producers and as knowledge communicators aiming at establishing and assuring both a good work environment for the near future as well as an unquestioned position of holding expertise.

In the French case and less clearly in Portugal one can also see a second layer of arguments overlapping the educational approach. Communication was needed in order to reach the aim of making science an integral part of culture. The universities would, from their particular position, be a central actor for reaching that goal.

How is the task of communicating with wider publics defined for the Universities?

This is the second question around which to organise our comparative observations. Indeed the attribution of the role as science communicators and as institutions that should contribute to community life is not really new and has been formulated in some countries as long as 20 to 30 years ago. In other national contexts, however, this task has never been explicitly assigned – neither on the institutional level nor as role to the individual researchers and teachers. In the Swedish case for example the so-called "Third assignment" – service to local communities and communication with the wider public – was formulated explicitly as a task of Universities as early as 1977 and was reformulated in the late 1990's; for Belgium – to give another example – this was explicitly formulated in the late 1980's. A case of a country where such a task was not clearly addressed is Austria. This does not mean that there is not a large rhetoric present in the public sphere about what the Universities should do with regard to this issues (see the slogan "Universities, leave the ivory-tower!"), but it is not formulated in any more stringent way.

Although it is interesting to see whether or not such role assignments were defined in formal terms, it is even more revealing to investigate how they were interpreted and translated into reality within university life as well as to observe their transformation process over the recent years. Indeed one could say – and this was clearly the case for France – that while a general statement of the duty of the university to communicate with society existed very early on, it was not taken too seriously. Only in the more recent times this assignment to organise regular interactions with society at large has become much more urgent as a preoccupation both for scientists as well as for the university as institution. In the French case in particular, the dialogue with the cultural and social environment, thus the "mise-en-culture" of science was very much put to the fore.

The Swedish and the Belgian case yet hint at still another interpretation: "service to the community" was implicitly reinterpreted as "service to business". Thus much effort went into what I would call "stakeholder-PUS" or how it was labelled in the Swedish case "practical PUS". Such a focus on efforts in the domain of stakeholder-PUS could also be observed in the Austrian context. Increasingly Universities are expected to become motors for regional development in knowledge-societies and the role as communicators of knowledge and know-how is adapted and intensified accordingly.

What all universities apparently share in the field of PUS activities is their extensive participation in the national or regional science weeks and festivals. This was explicitly underlined in the Portuguese case with regard to the national "Ciêntia Viva" program, the Belgian universities even were to be the chief organisers of these events, and in the other countries universities would – due to their role as central research institutions – be key-players in these events. This participation is perceived as strategically important – partly also as this is a setting through which universities hope to attract potential students.

How do universities react on the institutional level to this new task as communicators?

In fact in many of the institutions special units or departments of science communication were created in order face these new tasks. These creations can be interpreted as a need perceived by the universities to professionalize this part of the institutions' activity and to put it in the hands of units that would have the special know-how as well as the resources available to do so.

Yet in the Belgian case the question of the impact of a too far-reaching professionalization of these communication initiatives was raised. Handing over the interaction of science with society to PR departments, technology transfer centres or didactic services could lead to a relationship of universities to their environment which is predominantly of promotional kind at the price of loosing a more open and critical approach to the relation between science and society. A too strong PR-orientation would not allow the construction of the necessary trust relationship between science and society which could also be maintained in a situation of crisis.

While Universities partly made major investments into these communication structures, scientists at the same time complained about the misbalance between the wide-ranging rhetoric on the importance of science/society interactions and the reality of the place attributed to this activity in the everyday life of University staff. Both in France and Austria, it was the apparent lack of consideration for such activities from the side of the institutions once the question of evaluating the quality of a person's or a research unit's is posed, that was underlined. In that sense one has, on the one hand, the lip service to provide the urgent need to communicate with wider segments of the public while, on the other hand, no real recognition was awarded for this work from the side of the university.

Target audiences: What stands behind the notion of "the public"?

Our final comparative observation refers to the audiences targeted by universities' PUS initiatives. For virtually all countries **families and school children** where mentioned as the more or less central target group. They constitute the pool of potential future students and are thus of vital importance. Girls are targeted in particular here (e.g. in the Austrian case) in order to make the technical domains more attractive to them.This focus however was rather caused by the constant worry about the future work conditions within Universities than by the necessity that was identified from a societal point of view. Thus there is a certain danger – as was stressed for the Belgian case – that the integration of adult people into the exchange activities between science and society is neglected.

Next to children the **school teachers** are a second important target group in some countries, as they have the position of multiplicators. Interaction with teachers and integrating science and society issues into teachers' education would thus be an important leverage for initiating change in the school system.

In the French case, **the Universities' own students** were explicitly identified as one of the central targets for PUS initiatives. Through this interaction and exchange one hoped to create spaces where students could get a more realistic appraisal of science beyond their own specialisation. They would be in a better position to understand the social world in which they are acting as future scientists and it could be an initiation for students to share values with regard to science and society. Following a similar logic of argumentation, PUS activities were also perceived as important means of exchange between **the researchers of different disciplines**. These communication activities could thus become places of interdisciplinary exchange, offering the possibilities to think beyond the limits of disciplinary boundaries and to get a better grasp of the overall development of science and technology.

Finally, as already underlined earlier, stakeholders and in particular industry has become an important audience for PUS initiatives. They are expected to start to perceive the University as an important partner for their own development. As much of the research carried out at Universities needs external funding, building such relationships has become a vital activity.

Research and teaching in the domain of PUS at universities

Linked to the role of PUS-activities for the University as an institution and for its own internal development, we would like to close with an observation on the presence of scientific research on questions related to public understanding of science as well as of teaching on these issues. One can definitely say that the UK has the broadest and most wide ranging tradition in this domain, which is mainly tied to the centres, were Science and Technology Studies (STS) units have been established. From the 1980's onwards a number of research programs started and later also teaching curricula were developed which are explicitly devoted to PUS or to science communication. Also France – while coming from different approaches and perspectives and having an extremely small established STS community – has, from early on, been highly active in

this domain. On the teaching side however this field is much less established. In the other countries investigated in this study there is research and teaching going on, however on a more marginalized and less institutionalised level.
In particular on the teaching side there is an enormous potential to be developed. Integrating also science and society courses in science curricula, where the contemporary aspects of science, technology and society are debated in detail could contribute to broaden the debate and sensitise young researchers already during the period of their formation.

Summing up one could say that in fact Universities do by far not use the communication potential they would have and they realise it in a rather conventional way. By that we mean that much of the communication still follows the deficit model (people need to be educated), the audiences are relatively restricted (mainly addressing schoolchildren and stakeholder), and the focus of what is communicated lies at the “back-end”, thus on facts and not so much on contexts in and practises through which scientific knowledge is produced. The challenge for the future lies in the creation of more open-ended communication contexts in which the public (defined as broadly as possible) can engage with the scientists about science and technological development.

Austrian research institutions as actors in science-public interaction

Ulrike Felt, Martina Erlemann

The following chapter describes and analyses the role of research institutions in structuring the interface between science and society within an Austrian context. These institutions play a fundamental role since they hold the monopoly as producers of scientific knowledge, while at the same time they need to position their concepts, theories and empirical findings within the societal sphere. It is thus their direct working environment that is at stake when they communicate with the general public about science. Although, this particular role singles out researchers and scientific institutions when compared to other actors in the field of science communication, they are at the same time confronted with the fact that in a world of increasing specialisation they have to live with a double-role: being experts in one field and being lay-person in all the others.

From all the different research institutions – universities, both public and private sector institutions – we will have to make a choice. We will mainly focus on universities, as they are institutions, which have a double task: they produce knowledge, while at the same time playing a key-role in the reproduction of trained personnel. However, we will also shortly describe the other research institutions in Austria and outline their role regarding science communication. This seems crucial as the self-definition of Austrian universities works strongly with demarcating themselves from other research and teaching institutions.

1. Austrian universities as actors at the science-society interface

For a long time the image of the ivory-tower that stood for the ideal of remoteness from society and the disinterestedness was used as the metaphor describing the relationship between science and wider society – and it was not regarded as being a negative description. On the contrary it stood for the universities' "necessary remoteness" from society, which would – and this was the belief – allow the creation of "objective" knowledge. However it is revealing to observe that over the last decades the context has changed dramatically and the *ivory-tower* has become the icon for the problems that are identified in the relationship between universities and society. This public institution is expected to open up towards societal needs (although it is often not very clear what concretely is meant by opening-up and who represents this society). It is thus expected to develop mechanisms and places where it interacts with different members of the public.

Universities, 19 public and 9 private exist in Austria, play a central role in the Austrian research and higher education system. For a long time they did not only hold a quasi-monopoly in according academic degrees, but they also were the key-players in the research domain. In recent years, this domination has changed for a number of reasons.

First the "*Fachhochschulen*" were founded and thus the third level education system became a binary system, as is the case for many European countries. Then a legal framework was created to allow for private universities to become integrated within the Austria educational system, so far nine of them have been established. Finally the non-university research sector began to develop, and in recent years has become much stronger. Today, it is a clear competitor with the university sector in many contexts.

To illustrate the contemporary situation of the universities it is worthwhile to have a look at the historical developments, throughout the 20th century, as they continue to influence today's universities.

Historical context

Already around the turn from the 19th to the 20th century[396] the universities felt increasingly threatened by the lack of support they received from government. On contrary to the general picture of an ideal academic life in Vienna, at the turn of last century, the situation was far from ideal. The buildings and laboratories were in a rather bad shape, technology for the labs was outdated and money was sparse to improve the situation. Scientists often complained that much more attention was spent for improving the external appearance than to the development inside the sciences. Apart from these circumstances the university was under the influence of strongly conservative and anti-semite forces. As a consequence researchers, which were seen as too "left" or were from Jewish origin, had little chance to get any of the university positions.

The university being an extremely elitist institution, which feared to loose further support from the government, thought that addressing a wider public would reinforce their position against the government. Series of public lectures were thus established and support was given by university teachers to the folk-universities that were very important during this period.

[396] For a in detailed study of science popularisation in Vienna from the turn of the 19th to the 20th century and the role of the universities see Felt, Ulrike (1997): Wissenschaft auf der Bühne der Öffentlichkeit. Alltägliche Popularisierung von Wissenschaft und Technik in Wien, 1900 - 1938 (Habilitationsschrift)

At the same time communication of science moved to the fore-ground, as they wanted to establish the scientific world-view as the dominant one in the public space. This seemed particularly important in those areas where folk-knowledge was still very present. Further the issue of accountability for public money spent in science can be traced back to this period.

After World War II the tradition of science communication had broken down completely. Science was in an extremely bad shape as most of the outstanding scientists had left Austria because of the political situation. In that sense there was no active public communication of science and also the universities as institutions did not spend any major effort in making their work visible to a larger public.

Contemporary university policy

The 1990's are characterised by a whole series of fundamental changes regarding the legal situation of the universities, which would also cause a process of societal repositioning of this institution. It began with the university reform of 1993[397] that was implemented during the latter part of the 1990's, its objective being a transformation of the universities into more autonomous bodies. While it is plausible to debate if this autonomy was actually realised and what it meant precisely, for our purpose it is interesting to underline that for the first time a more or less explicit demand to make the work accomplished within Austrian universities transparent, to disseminate their research findings to a wider public and to improve interaction with society at large. The phrase "Universities have to leave the ivory tower" stands as a rhetoric symbol for these discussions. This legal step will have and has partly had already clearly perceivable effects on the way issues around *Public Understanding of Science* gain importance.

University reform caused an additional number of changes, which touch on the public perception of the University as an institution and, thus, the perception of science and technology. In exchange for an increase in autonomy, until then completely absent, a system of accountability and evaluation of the Universities' work both in research and teaching was established. It is supposed to lead to the allocation of public resources in relation to the quality of the output produced. Departments were also asked to develop clearer profiles in their graduate programmes, in order to reassure the relevance of university education to "market"-demands, with industry being an important "public" addressed. And finally, to build up a public image of the Universities has suddenly become more important, as after severe budgetary cuts in the educational sector, the current level in research and teaching can only be sustained by acquiring money from

[397] Bundesgesetz über die Organisation der Universitäten (UOG 1993), BGBl.Nr. 805/1993

private sources, i.e. research money from private enterprises, the EU and other funding agencies.

This reform was however not the last one. The UG2002, which will be implemented during 2003, is a further step in the direction of so-called autonomy. Explicitly this means that the decision-making structures within universities are fundamentally changing. A large part of the strategic decision-making power will be in the hands of an external university board that will contain no representatives from Universities and only less than half of the members can be nominated by the Universities. Also Universities will have to negotiate a global budget for three-year periods on a contractual basis, in which the number of students and the research agenda will play a central role.

Universities and their PUS activities

The Austrian Universities differ in size, age, vocation and disciplinary structures. Different disciplines cope differently with these particular changes in the societal environment (market-organisation, entrepreneurial character of the university etc.). The social sciences and humanities, but also parts of the natural sciences have difficulties adapting to the situation. A reason for this disadvantage surely lies in the fact that their work is often not perceived as directly applicable to concrete contexts or as crucial to the economic development. Thus, these fields face severe difficulties and will need to develop rather innovative strategies to cope with the changing system –one way being to gain more visibility in the public arena.

The scope of universities present in Austria ranges from small, specialised universities, like the Montan-University in Leoben, to huge universities, like the University of Vienna, which covers virtually the whole spectrum of scientific disciplines. There are six universities in the classical sense: in Austria: Vienna, Linz, Klagenfurt, Graz, Innsbruck and Salzburg; three technical universities: in Vienna, Graz and Leoben; the Universities of Agriculture, of Economy and of Veterinary Medicine, all three in Vienna; six universities for arts and applied arts (they only recently obtained the label "universities"), three of them in Vienna, one each in Linz, Salzburg and Graz; privately funded Universities are the University for Health Informatics and Technology in Tyrol and the Katholic-Theological University in Linz as well as the Danube-University for Post-graduate Education in Krems[398]. Additionally, through the new law three medical Universities will be founded in Vienna, Innsbruck and Graz. The private Universities focus for the time being their communication activities mainly to attracting students and play virtually no role in the science communication field.

As the public universities were restructured under the 1993 law, it is interesting to look at the statements of objectives and aims (*Leitbild*). (For the changes to come under the

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[398] Listings see on http://www.portal.ac.at/

UG2002 it is too early to make any remarks.) Indeed most declarations express ambitious ideas of science-public relations. *"The University of Vienna therefore undertakes to inform the public of teaching and study opportunities, and of the possibilities and results of research"* is a kind of common statement shared by the majority of the universities[399]. The University of Vienna goes somewhat further and underlines that *"it will accept and examine suggestions, initiatives and application "from outside" and assess the results of its research with regard to their relevance"*[400], further the institution would offer a platform for a broad public debate on scientific standards[401]. The University for Agriculture (Universität für Bodenkultur) is also very explicit about the necessity of interaction with a wider public: *"The University of Agriculture is a competent and self-confident partner for the public. It combines the readiness to accept criticism with the obligation to take a positioning openly and precisely*[402]*."* Thus one could say that on the rhetoric level there is a clear shift towards more interaction and debate with the public. But how are these statements turned into actions? Have they managed to become more than necessary public rhetoric?

To start with we would like to ask the question:

Who communicates in the name of the universities with different publics?

"Of course individual scientists" – one could give as a first answer, however having to admit that this happens in average rather rarely. While some of them are quite active, giving public popular lectures, writing newspaper articles, speaking on TV or radio, participating in science weeks and contributing with other activities, the majority still do not see this as their central task.

Also, the institutes are important actors at the interface between science and the public sphere. Here one can perceive some activities in particular with regard to new internet presentations that have become increasingly more oriented to a wider public than was the case before.

Above all, however, the institutions have to built up both structures and know-how to ensure regular presentation to the outside world. Prior to the reforms units within Universities that dealt explicitly with science-public relations were the so-called *Außeninstitute* ("Units for relations to the outside"). They had all kinds of tasks to fulfil, namely taking care of the external relations (a rather broad variety of activities ranging from exchange of students and scientists), do some popularisation of the scientific

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[399] Cited from http://www.univie.ac.at/unileitbildengl.html. Similar formulations can be found on http://www.uibk.ac.at/c115/leitbild/#gesellschaft for the university of Innsbruck and http://www.jku.at/forschng/index.htm for the university of Linz

[400] Cited from http://www.univie.ac.at/unileitbildengl.html

[401] Similar claims are stated by the Danube-University of Krems http://www.donau-uni.ac.at/de/weiterbildung/mission.html

[402] http://www.ud.boku.ac.at/Infos/Werundwas.htm

outcomes and the preparation of press releases and build contacts with enterprises as potential collaborators or customers. Especially, the technical universities this latter task played an important role since their techno-scientific output opens more possibilities for application in industry than for other types Universities. Within this setting communication with a broader public was definitely not extremely high on the agenda.

Over the last five years a process of task differentiation could be observed within this part of the universities. Most of universities installed “PR-offices” whereas establishing relations and communication to the outside on the academic level (e.g. student and teacher exchange) remained in the responsibility of the former *Außeninstitute* (offices for external affairs). The “Centre for Research Funding, Third Party Funding and Public Relations”[403] of the University of Vienna is an exception insofar as it still combines both functions. Concerning the organisational structure, the offices are located centrally, directly linked to the rector’s office. The task to establish a contact with the public is therefore delegated by a centralised unit within the University structure.

Regular activities are, press releases, event calendars and some universities publish their magazine – the Universities in Salzburg and Innsbruck distribute it four times a year a University magazine through the local press. Several universities have established a research database, which should address potential users or research partners. Further the Universities run specific events some of which will be discussed below.

Who are the audiences they address?

Apart from a larger unspecified audience that universities hope to reach through media reports and other public events such as participating in the annual *Science Week*, in general there are four types of audiences: journalists and other multiplicators; stakeholders, who could become potential collaboration partners or financiers, school children and women, who could be attracted to study at universities.

To reach the not-yet-academic audience many University departments organise a "*Tag der offenen Tür*" (Open day), which aims at presenting themselves to the public. The main users of this possibility are future students seeking information about the various disciplines and decision-aid prior to entering the university.

The technical universities have recently started to focus through special programs and open days on school children, here in particular on girls in order to attract them for a study of specific scientific/technological disciplines such as physics, mathematics or

[403] http://www.univie.ac.at/public/

engineering. The events for girls are organised by an association specialised on attracting girls to enter techno-scientific formations[404].

The journalists are mostly informed on a regular basis through press releases as well as through special events organised for them. Also University magazines regularly address this clientele. Regarding the stakeholders the communication on the institutional level remains very general – through the university's magazine for example, the detailed work needs to be done on the level of the individual researchers.

What is communicated about science?

Without entering into any details three observations can be made.

First one can say that so far **most of the activities run along the line of classical PR-work** and are staged along a one-way communication model. Very little is invested into more interactive communication and controversial techno-scientific issues are often avoided. In summary it lacks an alignment to chosen target groups. In contrast to the presented approach (*Leitbild*) only the one-way diffusion of science is put into the foreground of PUS-activities, there seems to be no idea how participatory science-public models and a dialogue-based discourse about science could be realised. Instead the dissemination into public space is channelled via the media – at least formally as nobody could be inhibited in reading press-news of a university on the website. Correspondingly several PR-offices describe this part of their PR-work as supplying the press with press-news, articles and photos[405].

Second, apart from the target groups mentioned above about it still remains unclear how to communicate with wider segments of the public about scientific activities within the organisation but also about the development of the sciences and their impact on society. Often elements of information about scientific and university activities are taken out of the respective context and presented to a wider public regardless of the concrete potential consumer and of the context in which the information is consumed.

Finally, most of what is communicated about science is scientific results – facts – and very little time is invested into reporting on "science-in-the-making". Thus people get science presented in an unquestionable way, and consequently they will not grasp the complexities of the production procedures and thus it will become difficult to get a more fine-grained understanding of what is at stake in these institutions.

[404] Verein Sprungbrett: http://www.sprungbrett.or.at/sprhome.htm

[405] See for instance the website of the PR-office of the university of Linz: http://www.jku.at/rektor/index.htm

Is there any research and teaching in Austrian universities on Public Understanding of Science?

The only research institution in Austria specifically engaged in science studies in a traditional sense is the VIRUSSS[406] working group of the Department of Philosophy of Science and Social Studies of Science at the University of Vienna. One of the research focuses over the past 15 years was on science/society interactions both historically and contemporary. In the area of technology and policy studies there are several institutions, such as the Institute of Technology Assessment of the Austrian Academy of the Sciences, a research unit on Technology and Work in Graz or the Institute for Technology and Society at the Technical University of Vienna. In the two first mentioned institutions the topics of public perception of technological development investigated.

On the teaching side – to take the example of Vienna University – there are regular courses offered on PUS issues, open to students from all disciplines. In recent years one can see an increasing interest in such issues. In particular in the new curricula of the biological sciences, communication of science has become a module in order to allow students to be better prepared for their future tasks.

Special initiatives of university institutions (some examples)

As it is impossible to delve into detail in all the different activities, we would like to mention just a few of them.

- First, in the recent years a series of popular lectures are co-organised between the Viennese popular Universities and the local Universities. Following the ideal of popular education, which had its high in the early years of the 20th century, one wants to bring university teachers to the popular Universities where they should present their work to an interested lay-audience. The initiative runs under the title "University meets Public". While this kind of engagement of academics in science communication seems very valuable, we would nevertheless try to underline the fact that in such settings the idea of "educating" the public seems very dominant and the hierarchies and power-relationships between science and the public are reproduced. In fact public lecture series belongs to the most frequently used communication tool.
- Secondly, it is important to underline the engagement of University scientists in the so-called "science week" which is – since 2000 – held every year. More than half of the presentations (approx. 400) made at this occasion come from University scientists. This was over the last three years a major occasion to

[406] http://www.univie.ac.at/wissenschaftstheorie/virusss

present science outside the classical contexts, e.g. in shopping malls, on the streets, in public places etc.

- Science Cafés also belong to the spectrum of activities that are organised by members of the Universities in Innsbruck and Vienna, just to give two examples.
- Finally it is important to state that during the last years children have been identified as target-groups for Universities and there is a number of interesting activities organised for them. During the ScienceWeek 2002 the Technical University specialised in a co-operation with the children's museum ZOOM on a science programme, which was a great success. This year the University of Vienna will hold in July the first "KinderuniWien" (childrens' University Vienna).

2. Fachhochschulen

The so-called *Fachhochschulen* provide an alternative to traditional university studies in the sector of third level education, with a more professional- and market-orientation in their education. These institutions are relatively young in the Austrian system – the first graduates finished their studies in 1997. The thematic spectrum of studies covers a range from economics and management, industry and technology to building industry and telecommunication; the fields of study thereby are aligned to demands of the labour market. Because of their regional widespread distribution they function as a counter-balance against the centralising tendencies on bigger cities and in particular Vienna.

On science-public-relations there are virtually no activities to be found. On their web-pages they generally underline a role as more practically oriented institution, thus allowing for the definition of boundaries towards the older and far more established Universities. Nevertheless, these institutes are a model of academic research that is more oriented to public and economic needs in the way it is propagated by the *Fachhochschulen* implies a different research-public-relation – one could better speak of research-customer-relation instead. When they present themselves e.g. in the course of the Science Week it is also often linked to publicity in order to attract a sufficient amount of students.

3. Non-university research institutions

Apart from the universities, which play a central role among the knowledge-producing institution, one finds also a number of other public research institutions. From the perspective of juridical status, financing and purpose they cover a wide range. It seems to be a characteristic feature of the Austrian profile that the research institutions show rather heterogeneous features.

There are a number of governmental and non-governmental research institutions, which engage in informing/involving publics in several ways. The institutions and their activities that are portrayed in the following part should be seen as examples for different types of institutions.

The organisational status and financing influences/sets the pattern of Science-Public-Interaction of the institution. Several of the private-conducted societies present themselves not only as knowledge-producing but also as knowledge-mediating to the public in general. Others that have a more entrepreneurial character address specified target groups, mostly companies, as potential consumers of the provided knowledge.

The *Austrian Academy of Sciences*[407] is with 700 researchers the leading organisation for non-university academic research covering nearly all fields/faculties from science to humanities. Besides their role as knowledge producers they have in recent years increasingly occupied the terrain of science communication. Apart from offering regular discussions with the press, an event calendar and establishing a mailing-list for medial actors as part of usual public relation work they are organising a series of talks (Schödinger-lectures) in co-operation with the Municipal School Council (Stadtschulrat) where **leading scientists are invited to discuss about their work with school children** in order to “offer the possibility to come into contact with leading international scientists”[408]. The philosophy behind the project is that if young people were able to identify closer to science with scientists they could easily become more attracted to enter a research career. In that sense it is an effort to give science a more human touch and thus to make it less remote from everyday experience. It would be of interest to question such efforts from a gender-perspective: fields where men are statistically dominating will be represented by male leading scientists and thus it will offer little potential for identification for women. While the goals of such initiatives would be to overcome the distance between scientists and so-called lay people one could speculate that horizontal gender segregation of scientific fields would be nevertheless reproduced. Further the Academy of Sciences is planning to build a science exhibition area, which is tentatively carrying the title “Galerie der Köpfe” (Gallery of heads). It is meant on the one hand to promote the history of Austrian science and in particular of the outstanding scientists that played a major role and on the other hand more current and changing exhibitions should allow exchange on more recent trends and developments in science and technology.

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[407] http://www.oeaw.ac.at/

[408] translated from http://www.oeaw.ac.at/deutsch/aktuell/schroedingerl.html

The *Research Center Seibersdorf*[409], the "biggest application-oriented scientific enterprise"[410]. Their focus of activity lies mainly on contract-research and development (R&D) for companies. The organisation presents itself as answering national and social needs, "providing good services for the public". The rhetoric in the web-presentation stresses notions of citizens, responsibility for the population, and knowledge being needed for society. Following this logic news, event calendar and contact information are prominently positioned on the website. Much attention is given to media contacts.

The core set of their direct interactions with a wider public is the so-called "Science Talks" that are organised every two months. Austrian and international scientists discuss with citizens what is to be expected from science for the future. They are asked to present their work "clearly and in an easily understandable way" to "citizens", and talk about "how their findings change the world"[411]. While the notion wider public is used very often, it becomes quickly visible that such initiatives address a rather highly educated public.

Another locally financed type of research institution is the *Joanneum Research Ltd.*[412], an independent research enterprise belonging to the province of Styria. It is with its 340 employees the largest province-owned research enterprise in Austria. This R&D institution works on "key technologies" such as environment and energy, electronics and information technologies. From the point of view of science communication it is quite active. Besides more classical features such as an on-line service, where firms and institutions can explain their specific problems and will receive advice for practical and theoretical solutions, a large amount of brochures published to present the work done within the roughly 20 research departments, the centre is taking care of a science page in the magazine "Korso" as well as of a science column in the local journal "Grazer Woche". The latter activity should allow the institution to keep a clearly visible position in the region where it is active.

We would also like to mention the IIASA (*International Institute for Applied Systems Analysis*)[413], a non-governmental research institution sponsored by its national member organisations in North America, Europe and Asia and located in Laxenburg south of Vienna. Because of its non-governmental status, IIASA argues, it provides non-political and unbiased perspectives. It should "remain sensitive to changes in the needs of its customers without jeopardising the free-natured spirit of true science" it is stressed. The core research themes are Energy & Technology, Environment & Natural Resources, Population & Society. Its information office distributes world-wide information material on research findings, meetings or new publications to 1600

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409 http://www.arcs.ac.at
410 http://www.arcs.ac.at/. In the English website version it is called information enterprise.
411 All citations translated from http://www.arcs.ac.at/news/events/science-talk;internal&action=_setlanguage.action?LANGUAGE=en.
412 http://www.joanneum.ac.at
413 http://www.iiasa.ac.at/

journalists and editors from all kinds of media. It also arranges interviews with experts, organises press conferences or visits of individual journalists and addresses various "target groups" (like students, enterprises etc.) by distributing promotional material. These actions and offers are carried by the overall aim to "encourage public awareness"[414]. It is remarkable that the organisation uses the term of public awareness when addressing its activities.

The type of customer-ordered research does not exist only in the field of techno-sciences but also in the social sciences. Several institutions offer empirical sociological research projects by order, for instance opinion polls and market analyses. Their self-portrayal is subject roughly to the same conditions and demands of promoting their scientific competence and offering their research as a supply of services in order to attract potential customers.[415]

There are a couple of research institutions working in the fields of sociology, economics and humanities. Only the minority of them enters into direct contact with the public. The *International Research Centre for Cultural Studies*[416] supplies press releases and a press timer to arrange appointment dates which can be seen as an approach to the media in the first line. A lecture series organised by the *Institute for Human Sciences*[417] is targeted formally to the wider public and aims to disseminate their research work but it is to be assumed that the audience have a respective academic background. Beyond this serial panel discussions about recent issues of political developments take place. The last to be mentioned here is the *Institute for Science and Art*[418]. Their objective is to access scientific studies to the public within the framework of event managing and vice versa to stimulate life a professional scientific investigation of yet unsolved problems/issues which have not been studied in the established science system despite of their topicality for social life. These activities can be interpreted as efforts to establish a platform for mediating relevant research topics into the science machinery where the institute functions as a turntable between scientific institutions and public needs and interests.

Summary and general observations

- The **external pressure for accountability and legitimization** put on public research institutions has been increasing strongly over the last years. Further some research domains underline that they feel rising scepticism about the kind of

[414] http://www.iiasa.ac.at/docs/research

[415] See for example the *Centre for Social Innovation* (Zentrum für soziale Innovation): http://www.zsi.at/ and the *Interdisciplinary Centre for Comparative Research in the Social Sciences:* http://www.iccr.co.at

[416] http://www.ifk.ac.at/home.php

[417] http://www.univie.ac.at/iwm/

[418] http://homehobel.phl.univie.ac.at/~iwk/welcome.html

research (e.g. genetic engineering) carried out. Building up communication structures with wider societal segments is thus seen as a necessity. However, the new "Fachhochschulen" as well as the private universities do not fall into this pattern as they seem to restrict their communication to publicity for their own programmes, but have very little engagement in explicit science communication.

- The **non-university research institutions developed earlier activities** in the domain of science communication than the universities. However many institutions remain caught in a rather simplistic dissemination logic (produce brochures and make them available).
- The speed at which institutions of research and higher education seem to realise the changed boundary conditions and the need to better position the knowledge they produce in societal contexts varies enormously across Austria. It seems very much to depend on local engagement and constellations. Thus the **situation in Austria in this sector with regard to science communication is rather heterogeneous**.
- While the importance and value of increased interaction with society is recognised on the highest institutional level, **communication activities count still very little in the academic evaluation system**. Thus the time invested in this direction is always seen critically by the researchers themselves.
- Throughout the range of initiatives that can be observed within universities there is still a clear **domination of the classical model of dissemination** of scientific ideas (one-way communication, deficit model based). These structures clearly are meant to reinforce the authority claim of these institutions and they focus on the expert position. Much less is invested in more interactive processes between science and segments of society and universities only rather hesitatingly engage in new ways of communication. There is very little if no engagement in full-fledged public participation exercises.
- **Communication** on science is **"back-end oriented"** in the sense that little information and discussion is focused on the research process itself as well as on the choice of research topics and much on the presentation of out-comes and their potential applications.
- **Children** were "discovered" **as target group** as well as **women** due to the decreasing number of students in the sciences. Informing about science and communicating the attractiveness of research is seen as an important possibility to improve this situation.

The emerging role of universities as science communicators in Belgium

Gérard Valenduc, Patricia Vendramin

1. Background

Universities are emerging as key actors in the Public Understanding of Science and Technology landscape in Belgium. The several reasons for this development are as follows:

Belgian universities are being faced with the efforts of trying to attract more students into the science faculties, and to improve the image of the scientific curricula. Most universities in Belgium have for many years been confronted with depletion in the classical scientific curricula (i.e. maths, physics, chemistry, biology, geology etc.) and a decline in applied science curricula e.g. engineering and agronomics. As the public resources allocated to each university, is proportional to the amount of students in different disciplines, a decrease in student populations entails a decrease in research funds. In addition a shortage of scientific skills has been recently identified in the Belgian labour market

The “Third Assignment” of universities, which had been in existence since 1988 but only on paper, was reactivated by the regional governments of the last two legislatures in both of the main Regions and by the Walloon Council of Rectors. This assignment of “service to the local community” had been understood as “service to the business community” for a long time. As the tide turns however promotion of scientific knowledge and technological performances have become a key component of the communication strategy of universities, as well as dialogue with the social and cultural environment.

As a consequence, initiatives in the Public Understanding of Science and Technology area are now used as promotional arguments in the competition between universities to win potential students as well as the local socio-economic actors.

Several universities have recently created units or departments of science communication, which do not belong to the academic structure but to the public relations activities. These units often run their own science centre or science house, which are accessible to students of secondary schools, teachers and the general public. The regional governments allocate specific grants for these new activities both in Flanders and Walloon Region.

There is however a policy difference between the North and the South of the country. In Flanders, the government had in 1999 set up an annual “Action plan for scientific information”, in which although universities play an important part, it is within guidelines defined at policy level[419]. In Wallonia-Brussels, the government allows a wide autonomy to universities and high schools but keeps an eye on the co-ordination and synergies between decentralised initiatives (cf. OPUS paper on governmental initiatives).

Universities and the education system are also the main organisers of science festivals and science weeks for this reason OPUS-spaces papers on universities and science weeks are merged.

2. The new role of universities in PUST activities

The institutional and financial involvement of French-speaking universities started at the end of the 1990s:

The University of Namur (Facultés Universitaires Notre Dame de la Paix) was the first to organise a science festival aimed at attracting younger members of the public. An annual festival "Oser la science" commenced in 1998. One of the more specific objectives of this initiative was for several enterprises within the region to be associated in the groundwork and management of the event. Like universities, enterprises wanted to attract young people interested in science and technology. Voluntary associations set up to promote the popularisation of science were also associated with the event. A department "Espace sciences" was recently created in 2002 to give a permanent form to this partnership with the education system, Non Governmental Organisations and economic actors.

In March 2000 the University of Louvain-la-Neuve (UCL) organised the first edition of a festival entitled "Science infuse". The festival is based on the presentation of experimental projects developed by secondary school students and their teachers. During the festival, awards for different categories are given out and "open doors" are organised in university laboratories for visitors to view experiments in progress. The second edition of "Science Infuse" took place in March 2001. In addition, the UCL opened a new "House of sciences" in January 2001, managed by secondary school teachers, university researchers and students. This is a resource centre for schools and provides a basic infrastructure e.g. Laboratories, computers, instrumentation etc. for the implementation of experimental projects.

Both of the free universities of Brussels (the French ULB and the Flemish VUB) organised a joint bilingual event in October 2000: "Wetenschaps-FESTIVAL des sciences", with the same purposes as the UCL. The VUB also inaugurated a science centre named "Pavilion of sciences", as a joint initiative of the science faculty and the government of the Flemish Region.

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[419] Vlaamse regering, *Actieplan Wetenschapsinformatie en Innovatie* (actieplan 2001 + actieplan 2000). http://www.innovatie.vlaanderen.be

In 2002, the governments of the Walloon Region and the Wallonia-Brussels Community decided to allocate specific grants to the universities for their activities in the area of science communication and scientific culture (600 000 €/year). These newly allocated resources were to be used for two purposes:
To help set up a permanent structure for public relations in the area of science and technology in each university.
To co-ordinate the initiatives already undertaken by universities and to organise a joint yearly science festival “Le printemps des sciences” (Spring of sciences), associating universities, high schools, voluntary organisations of science popularisation and teachers’ associations. The first festival took place in March 2002, with Energy as its theme. The choice of the date March, instead of the date of the European science week in autumn concurs to the timetable of universities and high schools: In March, open information days are held by the universities and high schools. Most of the future students also select their curricula at this time.
French-speaking universities are already acknowledging positive results of their recent investment in communicating science to the youth: for the first time in 8 years, inscriptions of students in scientific curricula had an increase of fifteen percent in universities and ten percent in high schools between 2001-2002.
In the Flemish part of the country, the action plan for science information also entrusts universities with a leading role in the communication of science. The first target of the plan is to increase the stream in core and applied sciences in universities and high schools. Universities are also invited to concentrate the implementation of their “third assignment” on:
the improvement in the diffusion of information on science, technology and research;
building awareness on the relevance of science and technological innovation in the region;
responsibility for enlightening public authorities through the provision of expertise services and continued education;
promotion of the cultural changes that are likely to strengthen innovative culture.
Most importantly, the Action plan is of the opinion that universities should focus their Public Understanding of Science and Technology activities on two target audiences: teachers of the secondary school and students of the last two years of the secondary school.

3. Role of universities in science weeks and science festivals

There are a few differences between Flanders and Wallonia-Brussels. For many years in Flanders, there has been a centralised organisation of regional scientific events, in correspondence with the European science week, in autumn: the "Science feast" each even year (6th edition in 2000) and the "Science happening" each odd year (7th edition in 2001). Although there are differences in their practical organisation e.g. location and duration, both events have similar targets which are families and school kids. They also involve the same partners, among which universities have a leading role. A sample survey has been carried out after each event since 1999. The purpose of this is to analyse the attitude and expectations of the public, the changes induced in their perception of science and technology, and among the young people, the influence on their selection of future curricula[420]. The surveys are carried out in two sub-samples, participants and non-participants in order to achieve comparisons. Results of these surveys show a growing interest and awareness among the Flemish population, a growing interest for scientific curricula in higher education, and a more trust in the potential benefits of science and technology for society. As time goes on there are increasing differences between the samples of those who have participated in the events and those who have not.

In the French-speaking part of the country, the festival "Spring of sciences" is decoupled from the European science week, for the reasons indicated above. There is no parent organisation of the science week in Wallonia, only in Flanders. Nevertheless, Walloon science centres (Parc d'Aventures Scientifiques - PASS - (full name please) and Parentville) have developed specific activities during the science week, which are in co-operation with other institutions in France.

4. Research and training on Public Understanding of Science and Technology at the universities

Although Public Understanding of Science and Technology has become an increasing part of public relations activities of universities, there is no observable change in the place of Public Understanding of Science and Technology as a research topic.

There is no research unit explicitly devoted to Public Understanding of Science and Technology in any Belgian university or in the science faculties and this includes departments of science and society, where they exist nor are there any research units in the departments of communication sciences. Themes related to Public Understanding of Science and Technology are however dealt with in other research contexts, for instance:

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[420] Sofres-Dimarso, *Effectstudies wetenschapsfeesten en wetenschapshappeningen in Vlaanderen*, http://www.innovatie.vlaanderen.be

The Federal Research Plan on sustainable development supported a project on "science communication in the area of sustainable development", carried out by the universities of Brussels, Antwerp and Arlon. This study focused on the relationships between scientists, Decision Makers, stakeholders, Non Governmental Organisations and the general public. A general model of communication patterns was drawn and case studies were realised on sustainable food and sustainability indicators[421].

There is some existing research on the role of science and technology teaching in the schools, mainly carried out in departments of science didactics. Universities of Namur, Brussels and Ghent have a long-standing tradition in this aspect. Originally, the idea was for the Namur department to emphasise on the development sciences and society dimension in the science teaching curricula[422].

The development of the Public Understanding of Science and Technology activities are not directly united with the development of a research capacity on Public Understanding of Science and Technology in universities. For instance, the preparatory study of the Flemish action plan on science information was subcontracted to Price Waterhouse Coopers, and the evaluation studies are subcontracted to Taylor Nelson Sofres Dimarso: international business consultants are preferred to the local university potential.

There isn't a course focused particularly on Public Understanding of Science and Technology for science students, there are courses on science and society in most of the universities, but they cover a wider range of topics and do not focus on science communication. Education in science communication is organised rather on the model of vocational training for people who are already involved in related professions in the media, science centres, voluntary associations etc. For example:

The Flemish government has sponsored a training seminar for science communicators, since 2001. This comes in the form of a cycle of six one-day workshops, organised by the WeCom project (Flemish association of biologists), the University of Antwerp and the science centre Technopolis[423]. There are also seminars of specialised vocational training however the participation fees are relatively high (about 1000 €/person).

Since 2001, the WeCom project has also co-ordinated a course on science communication in all Flemish universities. This course consists of two modules: written communication and verbal communication, which take up 15 hours each. The target audience consists of PhD students, researchers, and public relations officers in universities. Universities of Antwerp and Brussels organise a specific course for PhD students. The teachers' backgrounds are the media (Flemish television and Flemish

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[421] Mormont M. & al., *La communication scientifique en matière de développement durable*, SSTC-DWTC, Brussels, May 2000.

[422] Cf. the various publications of G. Fourez and his team, for instance : Fourez & al., *Alphabétisation scientifique et technique*, De Boeck Université, 1994 ; Brinkerhoff R. & al., *Sciences, technologies et société au quotidien*, De Boeck Université, 1992.

[423] http://www.wecomproject.com

press) and the communication departments of universities. Yet again participation fees are not low. These can cost between 200 € and 375 € for each module, and the model corresponds rather to specialised vocational training than to university teaching.
In autumn 2000, a group of science journalists (from RTBF, RTL-TVi, and daily newspapers) and science faculty deans (from all French-speaking universities) decided to start a network of information exchange between journalists and researchers. The Regional Ministry for Research and Technology (DGTRE) finances specific training workshops for this network.

5. Public Understanding of Science and Technology and the school system

As also mentioned about science centres or the media, the young people are the main target for many Public Understanding of Science and Technology initiatives. Priority is given to the youth as a result of several severe statements about the lack of scientific culture and training among the Belgian children and students:
An international comparative survey, published in 1998 by the International Association for Scholar Evaluation, showed that the level of scientific knowledge of Belgian French-speaking pupils (14-15 years old) had a very low ranking, way under the international mean and the European mean. On the other hand, the level of Flemish pupils was rated rather high. The estimated gap between Wallonia and the international mean was 1.22 school year, while the estimated advance of Flanders was 0.96 school year [424].
The amount of hours allocated to science courses is lower in French-speaking Belgium than in most European countries, and science courses are introduced later in pupils' curricula. Science teaching seems particularly weak at primary school level.
According to a recent decision arrived at in Autumn 2000, an extra hour of science teaching will be introduced next year in the first degree of secondary school. However there is a general agreement that an improvement of basic scientific knowledge and motivation can no longer be considered an exclusive matter of school programmes and that it requires a synergy between the school system, the media and the science centres.
The PASS (see OPUS paper on science centres) and the DGTRE (Regional Ministry for Research and Technology) organised in October 2000 a conference entitled "La science, c'est pas sorcier", devoted to science teaching and scientific culture for children. The conference gathered teachers, children's books and review publishers, children's TV producers and people that conduct researches into science didactics and

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[424] Monseu C., Demeuse M., *L'enseignement des sciences, un réel défi pour notre système éducatif*, dans le Bulletin Athéna n° 142, Juin 1998.

science communication. The conclusions of the conference[425] emphasize three models of interactions between Public Understanding of Science initiatives and schools. The first has to be avoided and the others can be promoted.

In the first model, the school institution becomes a client of external cultural institutions and science centres. Although it could be profitable for the audience of science centres, this model is counter-productive, because it leads to a progressive abdication of the school system, which transfers the responsibility of teaching science to other actors.

In the second model, the school institution cooperates with science centres and the media. This cooperation however must be well balanced: the school system has to formulate a learning project in such a way that it can be understood and translated by the other partners.

The third model is the resource centre. Resources available to teachers and pupils must be diversified, extended and made easily accessible: books, magazines, videos, CD-ROMs, visits, experiments, etc. Science centres can play an important role as service providers and "information brokers" for teachers.

Moreover, as detailed in the OPUS-paper on Non Governmental Organisations, there are several voluntary associations aimed at developing information and awareness on science and technology among the young kids, for instance through the provision of "packages" to the primary school teachers.

7. Concluding remarks

About transferability: the third assignment of universities

Considering Public Understanding of Science and Technology as a part of the third assignment of universities is similar to the Swedish position and perhaps some other European countries. It is however worthwhile to mention that the third assignment does not have the same importance as the first two (teaching and research). It is not only a question of resources, but also an issue of scientific recognition of the tasks carried out by the people involved in science communication and interfaces between university and society.

The location of science communication units outside the academic structure for example in public relations departments, technology transfer centres or didactic services, has a perverse effect involvement in Public Understanding of Science and Technology becomes a generic support activity of the university, rather than a task for each research unit. Moreover, Public Understanding of Science and Technology activities are mainly designed to be promotional activities, geared towards the general public and industry. Reducing Public Understanding of Science and Technology to the

[425] Léonard J-L., *Le labo des mioches*, dans le Bulletin Athéna, n° 195, novembre 2000.

promotion of science and technology may lead to a loss of critical approach to the relations between science and society.

The third assignment does not only consist of communication *towards* society, but also of more interactive communication *between* university and society, and more widely of *services to society*. This latter aspect remains much less developed. Nevertheless, the reactivation of the third assignment has considerably improved the involvement of Belgian universities in their socio-economic environment.

About target publics: focus on the youth, too much?

Public Understanding of Science and Technology activities developed by the universities are acutely focused on the younger members of the public, as related to their main objective, which is to bridge the gap of scientific skills. Although this is very important in order to promote cultural changes in society, this focus on the youth may also have perverse effects to enhance proselytism, to favour spectacular or fashionable topics and to embellish the image of science and technology.

Excessive focus on the youth may also lead to neglect of the general public. Adults are often addressed as parents not as autonomous citizens. An external observer, arriving in Belgium in 2002 without knowing the whole history, might think “public understanding of science and technology” means “youth understanding of Science and Technology”.

Culture of knowledge: French universities and PUS

Andrée Bergeron[426]

As research institutions, do universities take part in PUS (Public Understanding of Science) actions? And, if they do, what kind of actions do they develop and for whom?

I addressed these questions in a report written in December 2000[427] for the Mission de la Culture et de l'Information Scientifiques et Techniques et des Musées, Ministry of Research. This work was based on answers to a questionnaire (completed by 75% of French universities) and on circa 100 interviews with actors from 18 universities (~ 20% of French universities). I will base my paper on these data.

Once again, it is worth mentioning that, in France, people usually speak of "culture scientifique et technique" [scientific and technical culture] rather than PUS and that these words have an influence on what scientists say on the topic. Furthermore, the survey concerned not only scientific universities (or universities with science departments) but all kinds of universities; we were also interested in PUS related to social science, or even art: indeed, our aim was to understand what (if anything !) was done in order to make the public aware of the knowledge developed in universities.

French university system: some generalities

There are approximately[428] 85 universities in France. Some date back to the Middle Ages, others are more recent; some are specialised in Sciences or in Arts, others are pluridisciplinary; some are very prestigious, and others less so.

After the troubles of 1968, which emerged partly from the universities, the Government decided to restructure them and particularly to split the largest universities established in major cities into smaller ones. The way the former faculties regrouped in order to

[426] Andrée Bergeron is Member of the Laboratoire Jean Perrin – Palais de la Découverte – Paris

[427] Andrée Bergeron, *La culture des savoirs*, rapport pour la Mission de l'information et de la culture scientifiques et techniques et des musées, Ministère de la Recherche, Paris, 90pp. +annexes.

[428] This "approximately" may sound strange to anyone who is not aware of the existence of *Grandes Écoles*. What we call *Grandes Écoles* are usually prestigious institutions (like *École Polytechnique* or *École Normale Supérieure*) that operate beside the usual university system. Since some of those *Grandes Écoles* have the same formal administrative status than 'ordinary' universities but definitely different conditions (strictly selected students, many teachers, different funding system) it is sometimes difficult to decide whether a given institution does belong or not to the category 'university'.

form the new universities adhered of course to scientific criteria and to affinities (and, at the time, particularly to political affinities) between academics. That explains to some extent the groupings of disciplinary specialities within the universities: while most of them are not surprising (e.g. Arts with Literature, Science with Medicine, etc.), some are unexpected (e.g. Law and Medicine, etc.) or irrational (one speciality split in two or more universities in the same town). The present configuration of universities in France is still influenced by this history.

For the last few decades, French universities have been undergoing an evolution. There were 1.2 million students between 1980 and 1981, today there are more than 2.1 million. This evolution, which has been aspired to by successive governments ("we want 80% of an age-group to get the *Baccalauréat*" is a very well-known sentence!) is a huge change for academics: while they used to teach to "heirs", they now face the mass university. To add to their perplexity, some disciplines – natural sciences in particular – are, at the same time, confronted with a decrease of student entries.

Another recent evolution worth mentioning is that since 1982 and the decentralisation laws, the territorial organisations have played an escalating role. Local organisations – such as the *Region* in particular – take part in the development of universities, for instance by means of funding projects considered useful to local development. Universities, "cultural" projects or projects linked to PUS may, for such reasons, be supported by territorial organisations.

PUS at the university: why such a concern and for whom?

To understand what academics mean when they speak of *culture scientifique et technique,* one should first identify the publics and the goals of such actions. PUS in the universities does not always imply an action toward the outside world. On the contrary, students on the one hand, and colleagues on the other, are two expected publics. In this respect, PUS actions may be either part of the teaching or the research device.

Towards students

According to the academics interviewed, PUS initiatives directed toward students are intended to give them tools that would favour a reflexive attitude on their future practice and transform them into something more than 'science technicians': "*The challenge is to open students' eyes so as to make it possible for them to see their science not only from inside, but also from outside, with a detached attitude, being able to change* *perspective, to think over… something they are ordinarily not expected to do!*".[429] In addition, it would help them to put their knowledge into context, to understand its evolution in order to better imagine its future: "*we need to position young citizens in the world they will live in, therefore they have to know what our elders' heritage is and where they can go (…). We need to give them an historical and prospective vision for their professional commitment*".[430] In that context some particular goals are worth mentioning. For instance, a University physician said that: PUS may be interesting because it is a way to "*enable students to consider the human being as a whole*", while present curricula stress on specialised knowledge at such a point that "*a medicine student knows when to prescribe antibiotics but doesn't know how to consider a human being as a whole, that's why he is afraid of illness and death*".[431] The same person saw another interesting point in PUS as addressed to students: through history of technology it may help to maintain a kind of technical inventiveness for students who always deal with high-tech equipment, particularly for students who will have to work in developing countries "*here they learned to work with very sophisticated technologies, but when they go home they have no such things. So they come back and ask for simpler techniques. Through history of technology, they may have more imagination and inventiveness so that, back home, they may be able to invent their own solution to do what they want to do*".

PUS actions seem thus to be used by some academics as a tool that allows them to cope with what they consider as deficiencies in the present state of universities and curricula. That is one of the reason why historical and epistemological aspects, as well as transdisciplinary aspects, which are usually absent from the science curricula in France are so often evoked when speaking about PUS. That is also why PUS or cultural actions are considered as a way to "*mix populations and age-groups, to integrate foreign students and to help new students to acculturate to university*"[432], a way to initiate students to "*share values*"[433] of (their) science: in short, a way to help students acculturation at the time of mass university.

Presently facing students' lack of interest for scientific careers, science institutions and scientists find a very good reason to develop PUS actions: "*it may pull youngsters into scientific domains, the Dean thinks so*"[434] ; "*in the physics department, we face the same problem maybe even more than other places: numbers are decreasing. We need to make high-school students more sensitive to physics and to chemistry*".[435] Those

[429] SC, Bordeaux. For each quotation two pieces of information are given: the speaker's university and his/her general speciality. SC = natural sciences; AL = art and humanities; HSS = human and social sciences; HE = health and medicine.
[430] SC, Marseille
[431] HE, Bordeaux
[432] AL, Rennes
[433] SC, Marseille
[434] SC-HSS, Marseille
[435] SC, Marseille

who have been involved in such actions for some time acknowledge this new interest but may be disillusioned by the feeling that convincing colleagues to adopt their roles in this task remains difficult!

Toward academics

Here also, PUS and cultural actions are often used as a way to palliate the dysfunctionnings of the university or to reaffirm what the university is or should be. In that sense, some academics insist in reaffirming what they consider as the true nature of the university: a place of culture and thus "*Scientific and technical culture is only a part of university global cultural problematics. Here we have, so to speak, an association of scientific intellectuals. Intellectuals are those who think for the world. Here, they are scientific intellectuals because they are working in science*".[436] PUS actions directed toward academics aim at introducing some reflexivity: "*to find the meaning of all that*"[437], they are a concrete tool against what someone called "*the narrowing of knowledge*"[438], a living way toward interdisciplinary which academics are decidedly in need of today since "*scientists are closed on their speciality, they only know what they are working at. This lack of curiosity induces a lack of culture and inevitably missed opportunities*".[439] For them, there are no doubts that such PUS actions directed toward scientists have epistemological implications.

Some actors in human and social sciences though these disciplines do not have a long tradition in PUS, seem to show a particular (though new) interest for the question. Indeed, they see a way to reaffirm that the university is a place of research: "*This policies that consists in making our research activity accessible to a larger public is volition from our Scientific Council*[440] *(…). We wanted to claim that the university is a place of education* <u>*and*</u> *of research*".[441] That sort of claim is addressed to an external public, and academics themselves since "*scientist's mean representation of university research potential is sometimes below what it really is*".[442] It is also a collective way to define university scientific policy, particularly because PUS actions, like science policy, often have a cross dimension: "*On all those aspects, we deal with transversality. It is not possible to separate this question* [PUS actions] *from university policy*". The fact that our survey was made when some universities were working on their *Maison des*

[436] SC, Lille
[437] SC, Marseille
[438] SC-AL, Bordeaux
[439] SC, Lille
[440] Universities are directed by 3 councils: Administration Council, Scientific Council and Council of Studies and University Life.
[441] AL-HSS, Rennes
[442] HSS, Strasbourg

Sciences de l'Homme [House of Human Sciences] project[443] probably made this aspect more acute.

PUS is useful to reaffirm the research dimension of universities, to have a collective reflection on cross aspects of research, and precisely for its ability to organise the confrontation science / public. What academics expect is twofold: first, new research tracks (and even funding) could come from this meeting between university and (local) society and, secondly, researchers could experience a sort of epistemological effect through their own exposure to the outside world: "*This question forces academics to think about what they do, how they are perceived outside and how they can intervene outside. This is a very important question, the question of exposure and representation of oneself. One is forced to confront others. A university needs this boldness*".[444]

What we see here is that, if some researchers in social sciences are convinced that PUS actions are important for the university, the main outcome is expected within the university itself.

Toward the general public

Of course, the general public is one of the targets. First, because the 1984 law stipulates four main assignments for universities, one of them being "the diffusion of culture and of scientific and technical information" [*la diffusion de la culture et de l'information scientifique et technique*]; thus, PUS becomes one of the academics' missions and some amongst them are aware of this. The sentence which then most often emerges is "*to enable people to understand their world*".[445] There, PUS actions are close to popularisation: what matters is "*the diffusion of knowledge and of technical progress to the general public*"[446], a dissemination which has to take place because of the law, but also because academics often have the feeling that they ought not to keep their knowledge to themselves: "*knowledge is not a scarce good one should keep for himself. The more you share it, the more enriching it is!*"[447]

In the times of mad cow disease, of climate changes, and of GM food there is no doubt that science will be at the centre of public debates. Scientists (and natural scientists) are aware of this and, for them, PUS actions may play a crucial part: "*Scientific and technical culture is also a process of opening knowledge to debate*"[448]. Some have a

[443] The *Maisons des Sciences de l'Homme* are conceived as transdisciplinary and trans-university places of research in Human and Social sciences. They are expected to form a network connected to the older of them: the *Maison des Sciences de l'Homme* in Paris.

[444] HSS, Strasbourg.

[445] It may be interesting to notice that natural scientists make a direct association (for them understanding science is understanding the world), while social scientists make it not so straightforward. For social scientists, science is a way to think the world and, as such, is a cultural fact; furthermore, science influences the way human being (in particular artists and intellectuals) constructs his relationship to the world: thus it is in order to understand human beings and their productions that science and techniques are to be understood.

[446] SC, Poitiers

[447] HSS, Marseille.

[448] SC, Rennes

slightly (though meaningful) different view and consider knowledge as a prerequisite to the debate: "*The mission of scientific and technical culture is(…) to allow people to understand their environment, to give them the minimum elements they need in order to make their own minds up on good grounds in all the debates that appear in our society."*[449]

PUS at university: some examples

General trends

In practice, what do universities do in the PUS domain[450]? Some activities could be considered as 'classical': conferences (opened to the general public or not), presentations in secondary schools, and dissemination of research by means of writings (this latter activity increasingly taking an electronic form). Another group could be called 'trendy': science bars, multimedia activities and curiously, all kind of activities related to exhibitions and heritage[451]: in June 1999, 10 universities had the project to build a museum and 8 more wanted to make their collections accessible to the general public.

The following table synthesises data collected in June 1999 from 66 universities.

Action, equipment	Existing	Project
Museums	7	**10**
Collections open to the general public	13	**8**
Collections open to scientists	22	4
Public conferences	**45**	3
Conferences for students and university staff	**44**	5
Planetarium	3	2
Science theatre	5	4
Science film-club open to the general public	5	3
Science film-club for students and university staff	5	3
Science shop	2	1
Science bar	14	2
Presentation in secondary schools	**33**	1
Magazine, editorial collection	**26**	4
Multimedia workshop	22	**9**
Web site	**42**	4

Two experiences of interest for different reasons will be described below in detail.

[449] SC Marseille

[450] Data obtained by means of questionnaire in June 1999. Questionnaire sent to 83 universities, 66 answers were collected (questionnaire sometimes partly filled in).

[451] This could be a result of the Ministry policy: different actions were conducted in order to raise the awareness of scientists in matters of preservation and valorisation of university collections.

Art and science programme

At Bordeaux 1 University, students and academics can take part in a programme called *Art et Science* that consists in a teaching unit (open to students during their first year at the university), a seminar (open to academics and willing students) and a yearly journal (*Cahiers Art et Science*). This programme combining research and educational dimensions has been in existence since 1990. It was created as a solution to the concerns of universities who wanted to develop the general students' culture.

The Art and Science teaching Unit allows students, a semester to attend (and take part in) the dialogues between an artist and a scientist; the artist and the scientist decide themselves at the beginning of the semester to confront one another according to their own wishes and affinities without any influence from the organisers. The only instruction they have to follow is to dialogue freely on their work, techniques, difficulties, etc. For students, it is often a discovery to listen to scientists (who may be their own teachers) speaking as researchers showing their doubts, excitements and insecurities.

The Art and Science Seminar brings together scientists and artists around a given theme (e.g. Traces; Margins and Borders; Meteorology; etc.). During the whole academic year, one talk follows another, alternatively given by an artist or a scientist each of them appropriating the theme in their own way. All papers are published in the yearly "*Cahiers Art et Science*".

The whole device (teaching, research, publication) works as a space advantaging pluridisciplinarity and reflexivity and a space where students have access to a view of science which is quite different from the one they are taught.

Science week in a neighbourhood

The Science Week is a national event but each university can organise its own participation. At the *Université de Haute-Bretagne* (Rennes 2), Science Week is organised with the residents of Villejean, the area where the university is located.

During regular meetings, citizens, associations, city representatives and secondary schools collaborate to plan the programme of the Science Week with scientists of the university. Co-jointly, they choose the main themes that are to be presented and they organise the programme. Doing this, Rennes 2 takes seriously the purpose of the Science Week and allows inhabitants to have an entry in university knowledge, not only one week a year, but throughout the months necessary for the preparation.

Benefits and obstacles

Although one may find numerous examples of PUS actions developed by universities, they are mostly due to some 'activists' convinced of the relevance of their initiatives. Obstacles are numerous and benefits are valued.

Obstacles

The main obstacle is probably the lack of consideration of such initiatives for the academics' careers. University teachers have the justified feeling that research is the only criterion that matters for their careers "*The problem is the acknowledgement of that sort of work. (…) In our status, we have a lot of things to do and we are only judged on research*"[452]. In France, this issue is all the more problematic since the comparison with the CNRS that bring together more than 11,000 persons whose only task is research, is quite tricky. For most University people, the fact that the law stipulates that academics should contribute to PUS but doesn't grant any kind of recognition for this investment is contradictory: "*One cannot wish that people take their part in PUS and neglect to take it into account in hiring and career management!*"[453]. And even if academics accept to contribute "for nothing", time itself remains a problem. Administrative tasks, teaching and research are enough to keep one busy. It seems to most academics[454] that, in order to translate good wishes into actions, the State should give some corresponding material help!

PUS and cultural actions are marginal tasks for the university, particularly when compared to its "*secular missions*": education and research. As a consequence PUS is seldom a priority when it is a matter of positions, nor is it for money or rooms. Each new action is usually a new battle. This marginality makes it difficult to persuade colleagues or students that they should find some interest in taking part in such actions, or even that these actions are worthy.

In addition, since PUS appears as a new assignment, it is sometimes difficult, even if people and the university are willing to initiate actions, to find the right administrative framework in which such actions could find their place. Last but not least, universities' lack of expertise and professionals to develop adapted actions can hinder PUS actions: opening a museum and building exhibitions are not part of the French universities traditional tasks.

Most of those difficulties simultaneously appear at two levels: a symbolic level and a practical one. Practical difficulties are real, but they are reinforced by the fact that those initiatives lack symbolic weight. Symmetrically, although the 1984 law on university did mention the "diffusion of culture and of scientific and technical information" as one amongst only four assignments (therefore giving a strong meaning to PUS), no practical provision accompanied this intention.

Benefits

Belonging to the university is a benefit in itself. Thanks to a large amount of valuable persons and to a lot of expertise brought together, the university is, for those who know

[452] SC, Marseille.
[453] SC-HSS, Poitiers
[454] Particularly in universities that are poor in teachers and in research credits.

how to use it, a facilitating context to develop actions. Furthermore, the fact that an action takes place within the university brings "*an organic connection with university*"[455] to it. That allows for some acknowledgement. Reforms may open new "*interstice where it is possible to slide themselves*".[456] It also seems that, bit by bit, minds are changing: "*When one was involved in PUS actions, before, they had fun. Now, they don't laugh that much. I think there are two explanations for this: the first is, the messages coming from high quarters (ministry and CNRS) and, the second is a change in mentalities*"[457]. But, maybe, the most valuable help comes from men and women themselves (strong personalities, people who do their part in the job: "*the small knot of persons who really want to do something*"[458]) and from their belief that "*it is good for something*"[459].

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[455] AL, Marseille
[456] SC, Bordeaux
[457] SC, Rennes
[458] AL, Montpellier
[459] SC, Bordeaux

Portuguese universities and PUS

Maria Eduarda Gonçalves, Paula Castro

1. Background

Before 1974

During the post-war period (the late ‘40s and ‘50s) the Estado Novo (1926-1974) Portuguese regimen maintained the university under strong control (see Rosas, 1998 [460]; Agudo, 1998 [461]; Gonçalves, 2000 [462]). The university served mainly the functions of elite reproduction and dissemination of the traditionalist and ruralist values of the Regimen (Rosas, 1998). During this period only about 0.04% of the population completed a university degree (ibidem).

Scientific and technological research in the areas of natural, earth and exact sciences remained outside the university,. In these areas, the research – however incipient – only had a place in the state laboratories, created by the State and directly dependent on it. There were no social sciences degrees until the 1974 revolution.

Some voices did of course try to defend the importance of scientific research and theoretical development for dealing with, for instance, the agricultural problems of the country (see Câmara, 1943 [463]) and some wrote about the importance of understanding science on the making as a product of conjectures, emerging from a community of scholars (Bento Caraça, 1946 [464]). The dissident voices had no place in the regimen however, and the 1947 “purge” drove a number of people that had spoken against the official ideology away from the academy (, a reputed mathematician called Bento Caraça among them).

The 1960s were not very different – even if the official rhetoric started indicating on the need to connect scientific research with the university, the fact remained that this connection was not systematically pursued and the university was not even reformed, as the primary and secondary degrees were (Rosas, 1998). It goes without saying that, in these circumstances, the universities lacked the basic conditions to engage in the

[460] Rosas, F. (1998). Estado novo, universidade e depuração política. Seara Nova, 62, 11-20
[461] Agudo, J.D. (1998). Ciência. In Portugal nas artes, nas letras e nas ideias. Lisboa: Centro Nacional de Cultura.
[462] Gonçalves, M.E. (2000). The importance of being European: the science and politics of BSE in Portugal. Science, technology and Human Values, 25, 417-448.
[463] Camara, A. (1943). Horizontes da estação agronómica nacional. Lisboa: Actas do 1º Congresso Nacional de Ciências Agrárias
[464] Caraça, B.J (1943/02). Conceitos fundamentais da matemática, Lisboa: Gradiva

diffusion of science in society: there was neither institutional or political support nor enough public backing.

After 1974

After the fall of the Regimen, in 1974, many dimensions of contestation, reform and revolution immediately emerged as banners that both the civil society and the political parties erected urgently. The issues of scientific culture, of more substantial financing for research and of the public dissemination of a reflection revolving around science, were not among the most visible of those banners.

This was perhaps because first there had to be an increase in the number of secondary and university students, the expansion of the university and the scientific community and the enlargement of the social sciences disciplines being taught in Portugal.

From the mid-80s on

Only towards the late ‘80s were these and other conditions consolidated enough for the scientific culture issues to emerge with stronger social visibility.

The figures in table 1 display how incipient both the University system and the scientific community were before 1974, and illustrate how the ‘70s, ‘80s and 90s were a period of major transformations.

Table 1

PhDs obtained in Portugal or abroad, accumulated values

	1970	1974	1980	1985	1990	1995	2001
PhDs obtained in Portugal	23	149	337	802	1791	3389	6761
PhDs obtained in other countries	38	201	550	927	1382	1969	3026
	61	350	887	1729	3173	5358	9787

Source: http://www.oct.mces.pt

As the Table shows, it was only during the ‘90s that the number of PhDs obtained in Portugal became higher than the number of PhDs obtained abroad.

It is also worth mentioning that while in 1973 there were 3, 400 university teachers (with and without PhDs), in 1991 there were already 11,000 (Mariano Gago, 1994).

Another example of change is the increase in the percentage of the population with university degrees - in 1997, 11% of the population aged between 25 and 64 had completed a degree (Firmino da Costa et al., 2000[465]).

[465] Firmino da Costa, A., Mautitti, R., Martins, S.C., Machado, F.L., & Almeida, J.F. (2000). Classes sociais na Europa. *Sociologia, Problemas e Práticas*, 34, 9-43.

And finally, the data displayed in Table 2illustrate some more of the changes that characterised the last two decades. Until the '80s, the university was predominantly male. The data show how the expansion of the recent decades was accompanied by a progressive integration of women. Although the category of full professors (where people are older in the profession) is in all areas still a category with a large majority of men, the two categories where people are younger already show a more balanced percentage of women.

Table 2
Percentage of men in the three categories of university teachers

	% teachers without PhD	% teachers with PhD	% full professors
Exact sciences	53	54	76
Biology and earth sciences	57	60	82
Health sciences	45	54	71
Engineering	64	69	96
Social sciences	53	56	80
Humanities	52	56	73

Source: OCT, 1999

Also in the area of investments in R&D, the '80s and the '90s was a period of change. However, although showing an upward trend since the mid-eighties, financial investments in R&D are currently still low by European standards. The GERD as a percentage of GDP rose from 0.43% in 1988, to 0.63% in 1992, and 0.77% in 1999 (http://www.oct.mces.pt).

This growth has been accompanied by a change in the relative position of universities and State laboratories. From 1982 to 1988, R&D units in the university sector increased by 88 %.

Universities have in recent years acquired a large degree of autonomy and have became the most important facilitators of R&D. in 1999 they represented, 44.2% of the human resources involved in R&D activities (ETIs) (http://www.oct.mces.pt).

By contrast, R&D units in the State sector diminished as a result of both the efforts to rationalise and concentrate R&D and of institutional rigidities, such as lack of scientific autonomy, financial constraints, and restrictions to new recruitment.

2. Activities in which universities are currently involved

2.1. Introduction

As investments in R&D increased, academic institutions intensified their teaching and research activities.

Several new courses began, including masters and PhD programmes.

The scientific community became engaged in research projects in a much more systematic way, and started integrating both national and EU research networks.
Such efforts left little or no opportunities and time for universities to develop other activities. The communication of Science to the public is currently only considered a part of the mission of universities by very few researchers, and this role is not considered in the laws governing the academy.

2.2. The Ciência Viva programme

In this context, the main push initiative in the area of PUS, and also the most visible one at a national level, is the Ciência Viva programme. The main objective of this programme, launched by the Ministry of Science and Technology created in 1995 within the Socialist government, has been to promote the diffusion of the sciences through cooperative projects involving the universities and secondary schools.[466] It is due to this programme that some level of involvement of the universities in PUS activities has been achieved, since 1996. The "Ciência Viva" programme encouraged the formation of permanent networks among schools, through its special twining programme, and gave rise to the establishment of "ciência viva" centres, conceived as interactive meeting places.
Every year, since 1997, a Science and Technology Week is organised by the Ministry. During this week, which includes "the national day of scientific culture", a series of events take place all over the country, including admission being granted to the public into some scientific institutions, films, conferences and seminars on different scientific topics. There is also an exibition of the projects developed by the students within the programme networks.

2.3. Research and training on PUS at the universities

In Portugal the studies on science (in its plural dimensions and carried by different disciplinary frames) are quite recent.
It was only in the '90s that an STS community started to emerge. It is now a small network of researchers working from different backgrounds - sociology, law, social psychology, education sciences, anthropology. This community has produced systematic studies on various issues, namely the scientific based public controversies, the scientific community's representations and practices, the relations between science and the industry and the economy, and the relationship of science with the political power and democracy.[467]

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[466] Under the Social-Democratic party government empowered in March 2002, the Ministry for Science and Technology was replaced by a Ministry for Science and Higher Education. At the moment, it is not clear how the policies for science and technology will evolve in the near future. On the Ciência Viva programme see below "Governmental initiatives".
[467] For example, J. C. Jesuíno et al. (1995), *A Comunidade Científica Portuguesa*. Oeiras: Celta; M. E. Gonçalves (ed.) (1996), Ciência e Democracia. Lisboa: Bertrand; M. E. Gonçalves (ed.) (2000), *Cultura Científica e Participação Pública*. Oeiras: Celta.

These books – together with journal issues, such as the "Revista Crítica de Ciências Sociais" ("Critical Review of Social Sciences") thematic number on "Science and Society" or the organization of some conferences – were important to create a dynamic network between a growing number of researchers. Moreover, these initiatives allowed this research area to gain considerable academic and public visibility. Another factor that contributed to the consolidation of the research area is the internationalisation process: the publication in international journals, the participation in international conferences, and the inclusion of Portuguese teams in European funded projects with other countries.

Today, the STS community interests and studies have reached a considerable differentiation degree; in the last few years there has been an emerging interest in the study of:

science teaching in elementary and secondary schools

the "laboratory studies"

the interaction between experts and lay people's conflicting rationalities in specific scenarios (like the EIA),

The mass media thematisation of science, and relationships between experts, politicians and journalists.

Concerning the study of the scientific and technological culture, and the study of the science's publics in particular, The Science and Technology Observatory (OCT) of the Ministry of Science and Technology have played an important role by funding studies and launching challenges for reflection concerning, in particular, the study of the scientific and technological culture and the publics of science.

Recently, the Centre for Research and Study in Sociology (CIES) of ISCTE created an Internet site (called "Scientific Culture and Knowledge Society": www.ccsc.iscte.pt) which organizes data on this research community and identifies the studies produced in this area.

Universities and Public Understanding of Science: The Swedish case

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

This text discusses the place of Swedish universities and colleges from the perspective of PUS. The Swedish universities function in a very specific national context. To understand how aspects concerning PUS are developed, it is first necessary to highlight the transformation of the historical situation, whereby just a few dominant universities existed, to the present situation of tension between the traditional universities and new and progressive colleges.

Universities and Colleges: then and now

Sweden has four large and traditional universities. Two of them lie in the Stockholm region (Stockholm University and Uppsala University). Another is situated in the west (Göteborg University), and the fourth is placed in the south (Lund University). In addition, one university was created in 1965 in the northern part of Sweden (Umeå University).

In addition to these traditional universities, there also exist a number of colleges that have grown incrementally and have subsequently been invited to assume the role of university; Karlstad, Växjö and Örebro have so far succeeded. Linköping University was given that status as early as 1975.

The number of students in colleges has grown rapidly during recent years. However, the present colleges are not as strong in research and research education as in undergraduate studies. Colleges do not have the right to award PhDs, hence candidates still have to be linked to a university supplying the necessary training.

As a consequence, the traditional social and political role of universities and colleges has been diverse. By and large the Swedish research system continues to be dominated by the old universities, which are marked by well-established disciplines.[468] The new colleges for their part are much more geared towards interdisciplinary institutional forms and also towards the crossing of boundaries between academia and the rest of society. Together with County Councils and Regional Districts (*landsting*) they often promote regional and local development policies to stimulate industry and the public domain. With these newer institutions a different style of scienctific information exists, more commercial in tone. While

[468] Wittrock, B & Elzinga, A, (eds.) 1985, *The university research system: The public policies of the home of scientists*. Stockholm: Almqvist & Wiksell International; Agrell, W, 1990, *Makten över forskningspolitiken.* Science and technology policy studies 1. Lund: Lund University Press; Thorpenberg, S, 2002, *The Changes of the Nordic Research Institute Sector – A Critique of the New Theories of Production of Knowledge.* Göteborg: Department of History of Ideas and Theory of Science.

the traditional universities highlight their international research links, the newcomers are more integrated into a local setting and motivated toward supporting regional growth. Seen in another way, the traditional universities have taken a national responsibility for PUS, but this task has never been very high on their priority list. The colleges, on the other hand, have taken a regional responsibility and this kind of interaction has from the very start been of great importance.

In this context, a new formulation of the “Third Assignment” (1997) is important. The original formulation appeared in the University Act of 1977, requiring researcher to inform the wider public of their work. This idea was linked to democratic ambitions: education of the people would increase their ability to act in a democratic society. The objective of the new formation of the “Third Assignment” was to foster a more intense interplay between the universities and society at large but in particular with industry. In the Ministry of Education’s directive it was apparent that universities and colleges were meant to increase the extent of their collaboration with industry, public administration, organisations, cultural life and popular education. In the most recent Science Bill, the objective is not only to disseminate research information to the public but it now explicitly states that industry must be a recipient in the dissemination process.[469] To make this easier, it is proposed that universities may create subsidiary companies, co-operating with industrial partners.[470] At the same time it is underlined that these collaborations should not be allowed to compromise the freedom of science.[471]

However, many now reinterpret the “Third Assignment” as a demand that universities and colleges should interplay more intensely particularly with industry.[472] This is in accordance with what can be called ‘practical PUS’, which has come to dominate in recent years. Higher education and research are increasingly seen as important motors for regional development. This argument has gain added weight since 1995 when Sweden entered the European Union. In this new trans-national context, the importance of strengthened regions has been accentuated. In a context where knowledge and quality are more significant for companies on the international arena, it becomes vital for regions to have strong centres of research and education supporting the work force and transmitting knowledge from research frontiers into business and industry. Whereas regional colleges already have this role, this shift into more practical and economical utilisation can be seen as a challenge to the traditional universities.

This situation has caused a long discussion on the governmental policy of decentralising university funds from the traditional universities to the new colleges during the past decade.[473] The proponents of this policy have suggested that the state give research resources to these areas so that the intellectual capacity in the surrounding region can be

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[469] *FoU och samverkan i innovationssystemet* (R&D and co-operation in the innovation system). Regeringens proposition 2001/02:2, p. 31.

[470] *FoU och samverkan i innovationssystemet* (R&D and co-operation in the innovation system). Regeringens proposition 2001/02:2, p. 44.

[471] *Forskning och samhälle.* Regeringens proposition 1996/97:5, s 60.

[472] Brulin, G, 1998, *Den tredje uppgiften: Högskola och omgivning i samverkan.* SNS Förlag och Arbetslivsinstitutet.

[473] 1994, *Tvärsnitt*, no 3-4.

stimulated. Opponents on the other hand maintain that Sweden is too small a country to disperse its research funding in this manner. In order to produce university departments of international excellence, they say, one has to focus resources on a few places in such a sparsely populated country.

Universities and colleges: present initiatives and the future

An interesting aspect of these recent changes is the influence of the “Third Assignment”. In the original formulation, the intent was to make research information available to the general public. It was also literally the third duty of university researchers: the priority of the “Third Assignment” was not as highly prioritised as the requirements of teaching and research. With the reformulation a different situation has emerged. The “Third Assignment” now also includes the notion of co-operation between academia and industry. As the scientific community is under economic pressure from the state, researchers can therefore solve two problems at once by establishing joint projects with local business: firstly, they fulfil the new “Third Assignment” directives by interacting with industry; secondly, these co-operative agreements will generate economic resources, which is important under the current financial climate.

This process of commercialisation has been a reality in colleges for same time, but has now started to influence universities too and may do so even further in the future. It is possible that a situation may arise where the changed requirements of the “Third Assignment” move up in the priority list and universities may subsequently focus their research efforts towards the needs of industry. Then we have a situation where the old democratic ideas of the “Third Assignment” have disappeared, but the new formulation - including the requirement of industry cooperation - will define the research (the “First Assignment”) pursued at the universities.

It is still too early to tell if this will be the reality of the future but is seems to be a fully possible development. However, looking at the specific initiatives of PUS at universities and colleges, the situation is still quite conventional. The traditional universities stress their credibility with rhetoric emphasising their extensive international research activity, of being on the research forefront and in this line bringing about initiatives in understanding of science. The traditional universities have an advantage of the larger number of initiatives in PUS compared with regional colleges and new universities. This is due to the fact that traditional universities also have established and large faculties of the humanities and social sciences.

An example of this is the so-called Humanistdagarna (Humanities days), where the humanities faculties at the traditional universities open their doors for the greater public. *Humanistdagarna* features popular lectures and opportunities to visit various departments of the faculties. Another example is the University of Göteborg’s involvement in and support of the International Science Festival in the city.

The regional colleges are more likely to promote a practical public understanding of science. This ties in with the strategic ambitions of regional and local development agencies towards industry and administration. Several of the regional colleges in Sweden are involved in networking ambitions aimed at joint actions of knowledge exchange between colleges throughout the country and local and regional administration and industry.[474] A common feature of both universities and colleges towards such aims is the existence of information units.

In addition to this, in the general discussions on the emerging 'knowledge society' ideas on PUS are reframed. Higher education and research are seen as important motors for regional development in the new EU-context, which is very much built on the idea of strong regions. In a context in which knowledge and quality are more important for companies competing on the international arena it becomes vital for regions to have strong centres of research and education, which can support the work force and transmit knowledge from research frontiers into business and industry.

A current tendency in PUS is the direction of knowledge mainly towards groups that can integrate research information and put it to work in their own professional walks of life in business and administration. However, there exists another important university trend in PUS, which can be described as a celebration of research, its cultures and its most prominent figures.

Due to the existence of the Nobel Prize in Sweden, the celebration of science is institutionalised and reoccurs every year. Many Swedish scientists are involved in the selection processes of the Nobel Prize and are targeted by the media when the winners are announced. A further boost of attention occurs at the tine of the prize ceremony in December. In addition, universities often arrange special events to celebrate important researchers and their findings. For instance, there was a conference dedicated to the 100th anniversary of the publication of the first article on the 'green house effect', written by Svante Arrhenius. This meeting was sponsored by the Royal Academy of Sciences and was aimed at researchers and journalists. This semi-popular event eventually led to various scientific publications.[475] Another semi-popular event focused on the 250th anniversary of the journey by Carl von Linné through the Southern part of Sweden taking inventory of its fauna. This made for a symposium hosted by the University of Lund aimed at schoolteachers. The proceedings from this event became a popular publication written by journalists. These two events are an example of how a semi-popular celebration can in its extension lead to an either popular or non-popular publication.

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[474] Talerud, B, 2000, Högskolans arbete med sin samverkansuppgift. (University initiatives to interaction) National Agency for Higher Education, 2000:2 AR, p 34-35.

[475] See Henning Rodhe & Robert Charlson (eds.) *The Legacy of Svante Arrhenius: Understanding the Greenhouse Effect*. Stockholm: Stockholm University and The Royal Swedish Academy of Sciences 1998; the symposium also led to a special issue of the journal *Ambio* (vol. 26 no. 1 1996).

PUS in British academia: Research, teaching and community outreach

Damian White, Josephine Anne Stein

Introduction

Universities play an important, albeit indirect role in PUS in the UK insofar as they seek to attract people to science courses and science-based careers. British universities play a more direct role through their involvement in mainstream PUS movement activities: hosting and contributing to science weeks/festivals, putting on public lectures and working with schools. However, Prof. Susan Greenfeld, Director of the Royal Institution, has argued that universities should do more to engage with the public to improve the public understanding of science. The extent to which universities can be considered 'institutional actors', as oppposed to the sites of initiatives by individual academics, specific departments, professional societies and the research councils, is often unclear.

The UK University sector is characterised by a fragmented organisational structure. Many universities have high degrees of autonomy from the state and state initiatives. Governing structures within universities (most obviously Oxford and Cambridge) are also marked by high degrees of autonomy for individual colleges. This can ensure that many Universities adopt a more indirect role to facilitating PUS ventures.

The Research Councils have instituted requirements for PUS to be incorporated into mainstream academic research activity (see section on Government initiatives). However, academics active in PUS have complained of feeling 'unsupported by their departments' and penalised for spending too much time on PUS activities which are regarded as extra to the real work of scientists. Concerns have been raised that the Research Assessment Exercise (the third of which was completed in 2001) actively discourages writing and other activities orientated to the general reader in favour of more specialised academic work (House of Lords, 2000)[476].

Contributions to National Science Week/Festivals

One of the major ways in which UK universities contribute to PUS is through contributing to and hosting science weeks and festivals. Boddington and Coe's

[476] See UK House of Lords Select Commitee on Science and Technology, „Science and Society“, HL Paper 38, The Stationery Office Ltd., London, 23 February 2000

evaluation of the 1998 Science Week notes that universities are indeed the 'mainstays' of this event. Almost 100 universities and colleges contributed to SET 98. Figures for 1998 suggest that the university sector contributed 39% of all events to Science Week and attract 26% of the audience. Boddington and Coe though note that these figures might actually underestimate the total contribution of higher education institutions 'as many institutions also support events in schools and elsewhere'. They argue that if these events were included, a reasonable estimate is that universities and colleges now support more than half of Science Week's events, attracting two thirds of the audience (Boddington and Coe, 1998).

Science Outreach Programmes

A number of universities run science outreach programmes. One example is provided by the science faculty of Royal Holloway College, which developed a programme with all its science departments to encourage school interest in science. A website gives details of forthcoming events, public lectures and student monitoring schemes. In addition and as part of 'National Science Week', Royal Holloway stages 'Exploring Science Open Day'.[477].

The Pupil Researcher Initiative is a multistrand outreach scheme run by the Engineering and Physical Sciences Research Council in conjunction with The Particle Physics and Astronomy Research Council. It has, *inter alia*, supported:

- The Researchers in Residence Scheme[478]

This scheme, run by the research councils and the Wellcome Trust, aimed to encourage Ph.D students to spend some time in secondary school (11-18) science departments to work with pupils and teachers. The scheme has been in place since 1995. The aim is to provide role models for students and also to break down stereotypes about science and scientists (PSCI –Com).

- 'Express Yourself Conferences'

These conferences offer the opportunity for pupils to give 10-15 minute presentations about a scientific investigation or project to a scientific conference attended by real scientists and engineers. (see EPSRC).

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477 www.rhul.ac.uk/Science-Outreach/Exploring-Science/Index.html
478 www.shu.ac.uk/rinr/

- Public Awareness Awards.

Launched in 1998, these awards committed £1.7 million funding to university projects that would raise public awareness about science, technology and engineering over a three year period. Examples include:

- The University of Cambridge's ‘Maths on the Underground’ – a series of posters displayed on the London Underground covering mathematical issue (inspired by similar developments on the Paris metro).
- The University of Strathclyde's travelling road show with poetry inspired by physics research
- The University of Manchester's electron microscope which the public could operate over the internet[479].

Similar outreach developments include the Teacher Scientist Network[480], a scheme that puts the scientific community of the Norwich research park into contact with science teachers in the local community. This programme supports and encourages teachers to deliver up to date and relevant science, to counteract stereotypes of the scientist and to encourage sciences to interact with women and children.
As teacher training institutions, university departments offer other types of outreach, such as the University of Leicester's website: SCIcentre[481], with information related to teacher training in primary school science education.

PUS in university curricula

British universities support PUS through academic courses in STS-related fields and through research on PUS itself. At undergraduate level, some examples of degree programmes are:

- University College London's Department of Science and Technology Studies[482], which offers four BSc courses.
- Birkbeck College, University of London runs a four year course in ‘Science for Society’[483], which provides a broad grounding in the physical, life and earth Sciences as well as providing an overview of the history and social aspects of science.

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479 www.epscr.ac.uk
480 www.tsn.org.uk
481 www.le.ac.uk/se/centres/sci/about.html
482 www.ucl.ac.uk/sts/
483 www.bbk.ac.uk

- The University of Newcastle runs two 'Science and Society' courses[484]. The Chemistry department provides the degree ‘Science in Modern Society’. Students learn about current scientific affairs and how to communicate science as well as studying individuals sciences. ‘Science and the Information Society’ run by the Physics department looks at how IT works (both in terms of its social and physical impacts).
- Innovation Studies at the University of East London combines practical instruction in ICTs with a critical socioeconomic analysis of this sector.
- The University of Stirling[485] offers a four year undergraduate degree in ‘Science and Society’, which requires that students train in both a scientific discipline as well as engage in a social scientific one.

Additionally, a large range of universities provide Humanities/arts degrees in the History and Philosophy of Science, Medical History (Manchester) and related areas which relate to the study of science and society. There are a very broad range of sociology departments in the UK who can offer specialist knowledge in the social studies of science, notably at the Universities of York, Edinburgh and Bath.

At the postgraduate level, MA courses are offered in Science Communication (Imperial College) and Media Science (Sheffield Hallam University); various MA courses on science policy and technology management (Sussex, Manchester) cover science/society issues.

The UK has three chairs in the public understanding of science. The evolutionary biologist Richard Dawkin became the first Professor of the Public Understanding of Science at Oxford University in 1995. John Durant was also awarded a chair in the Public Understanding of Science at Imperial College in 1995 (he has subsequently left this position and was replaced by Richard Russell). The University of Bristol recently established a Collier Chair in the Public Understanding of Science and Technology, held by three different people over a year.

Research on PUS

The UK has been a leader in academic research on PUS itself, largely under the sponsorship of the Economic and Social Research Council (ESRC). The first emphasis of British research into PUS has been to challenge the tenets of the PUS movement and to examine the basis of citizen engagement with science-based issues such as risk and the environment. For example, Wynne and Irwin developed critiques of the Deficit

[484] www.ncl.ac.uk
[485] www.prospectus.stir.ac.uk

Model and argued for valorising local, experiential or non-credentialled lay knowledge, while calling for greater reflexivity within the scientific community.

A number of researchers in the UK, many from the sociology of science, and from related fields and even outside academia, began to deconstruct what was meant by "public", "understanding" and "science"[486]. Papers began to appear and meetings were organised to discuss the constituencies and natures of various "publics", the meaning of "understanding", and even revisiting the more philosophical basis for defining genuine "science" amidst the frenzy of popularisation brought about by the PUS movement. Research on public understanding of science seemed to be spiralling inwards in some kind of STS whirlpool, with few practical results emerging. There were two main responses, both of which focused on policy implications of research on PUS.

The Economic and Social Research Council (ESRC) sponsored a research programme on Public Understanding of Science in 1998-1999, consisting primarily of a set of research fellowships in PUS and a set of meetings in which research results could be presented to practitioners in PUS and policymakers, and discussed. Organised by the Science Policy Support Group, and under the academic leadership of Alan Irwin, "users" were identified in the policy community, about a dozen discussion meetings were held with users and the research fellows.

The second initiative was not undertaken by universities directly, but by the House of Lords Select Committee on Science and Technology, which undertook its own inquiry into Science and Society. The Lords inquiry drew not only upon the results of the ESRC Programme but a great body of additional studies and PUS activities. The Lords took a comprehensive look at:

- Public attitudes and values
- Public understanding of science
- Communicating uncertainty and risk
- Engaging the public
- Science education in schools
- Science and the media

The Lords Committee heard or received written evidence from over 100 professional associations, S&T-based companies, agencies, research institutes, media companies, non-governmental organisations and individual experts. They were advised by John Durant, Professor of Public Understanding of Science at Imperial College and Brian Wynne, two of the UK's most prominent academic scholars in PUS. The Committee made visits to both the USA and Denmark, which is regarded as having some of the world's most sophisticated knowledge and experience of public understanding/public

[486] For example, "What Public? What Understanding? What Science?", meeting at the University of Leicester, 9 July 1998.

consultation related to science. The House of Lords' report, published on 23 February 2000, is an impressive overview of the state of PUS in the UK, both from the perspective of assessing the state of knowledge and in its analysis of the implications of this knowledge for policy.

The House of Lords' report recognised the existing crisis in public confidence in S&T and science advisory systems. It endorsed earlier calls for openness in the UK scientific advisory system, and while vigorously supporting the need for independent advice, encouraged scientists to be explicit about their sponsorships and affiliations. The Lords acknowledged and supported the PUS movement, although the report significantly finds that "the crisis of trust has produced a new mood for dialogue." The PUS movement in its traditional, promotional form, in other words, is no longer enough.

CHAPTER 3.5.

Public consultation and foresight exercises across six European countries: Similarities and differences

Gérard Valenduc, Patricia Vendramin

Consultation of the civil society is one the key objectives of the European action plan Science and Society, issued in 2001. The OPUS network has colleted and commented a series of realisations and experiments in the area of consultation practices and participatory foresight exercises. What can we learn from this inventory of significant practices? To what extent do they contribute to an improved citizens' insight on science and technology?

Consultation of civil society as an objective of European S&T policy

At the European level, two important policy documents emphasise the need for an improved consultation of civil society, particularly in the area of science and technology (S&T) and the development of a knowledge-based society.

The *White Paper on Governance*[487] promotes openness, participation, responsibility, effectiveness and coherence as political principles of good governance. In order to achieve these principles, a reinforced culture of consultation and dialogue is required in all policy areas, particularly in those where consultation and dialogue appear to lag behind: for instance, science and technology policy.

The *Action Plan Science and Society*[488] aims at developing stronger and more harmonious relations between science and society. Development of culture and awareness on science and technology is linked with citizenship and democracy.

Action 22 aims at stimulating exchange of information and best practices between countries and regions on the use of participatory procedures for science and technology policy at the national and regional level. The Commission intends to set up networks and regular workshops in order to implement these exchanges.

Action 23 emphasises the role of the Commission in the organisation of regular events enabling the participation of civil society, through public hearings, consensus

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[487] European Commission, *European Governance: a White paper*, COM(2001)428 final http://europa.eu.int/governance/white_paper/index_en.html

[488] European Commission, *Science and Society Action Plan*, COM(2001)714 final http://www.cordis.lu/rtd2002/science-society/home.html

conferences or interactive on-line forums. Such initiatives should be undertaken in concerted actions together with existing consultative bodies at the European level. Some topics are proposed in the document. Unsurprisingly, they confirm the relevance of a series of topics that are presented in the OPUS overview: biotechnology, environment, information technologies, health, innovation, etc.

Although the concern for an improved democratic consultation is a common background of these recent policy orientations, there is some ambiguity in the recurrent reference to “civil society”. Different interpretations of civil society are at stake[489].

Civil society may be understood as “a society of individual citizens”, in opposition to the State and its organisations, which are collective entities. This notion of civil or “civic” society refers to the political role of the citizens, whatever should be their role in economic activities, interest groups, scientific communities, etc.

Within this perspective, consultation or participation of civil society in science and technology will foster the involvement of individual lay citizens, through initiatives such as consensus conferences, citizens’ juries or panels, etc.

Civil society may also be understood as “the third sector”, i.e. an intermediate sector that neither belongs to the State nor to the market economy. In this interpretation, civil society covers all activities of the non-profit sector. Non-profit organisations are considered as spokesmen of those interests in society, which are not represented by the economic actors and the public authorities and institutions. Non-profit organisations are however not homogenous, they may even reflect divergent interests towards a particular question.

Within this perspective, consultation or participation of civil society in science and technology will foster the involvement of social groups and non-profit associations, through thematic forums, discourse structures, users committees, participatory exercises or “Etats-Généraux”.

There is a third approach to the civil society, often promoted by international institutions and conceptually closer to the second interpretation than to the first one. Rather than giving a comprehensive definition, these institutions try to draw an extensive list of who belongs or not to the civil society. At the European level, for instance, the Economic and Social Committee officially relates civil society to the following organisations:

- the social partners (trade unions and employers federations) and other organisations representing the social and economic actors, for example in the area of regional development, vocational training, etc.;
- non-governmental organisations which bring people together in a common cause, in areas such as environment, consumption, human rights, education, humanitarian assistance, North-South cooperation, etc.;

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[489] Bantien H. Jaspers M., Renner A., *Governance of the European Research Area: the role of civil society*, IFOK report for the European Commission, Brussels, May 2003, pp. 8-9. http://europa.eu.int/comm./research/science-society/

- community-based organisations, which pursue member-oriented objectives: youth or elderly organisations, neighbourhood associations, patients associations and all forms of associations through which citizens participate in local and municipal life;
- religious and secular organisations.

Within this perspective, consultation or participation of civil society in science and technology involves the above-mentioned structured organisations, often referred as “stakeholders groups”, either though institutionalised consultation channels or through more informal or innovative forms of consultation.

The OPUS overview of consultation practices and participatory foresight exercises includes examples of all categories, from lay citizens to more or less institutionalised stakeholders groups, in order to reflect the diversity of consultation and participation across Europe.

A wide variety of realisations and experiments

The six national reports describe and comment a wide variety of initiatives: consultative councils or committees; technology assessment; consensus conferences or citizens panels; local, regional or national forums; participatory foresight exercises; participatory risk assessment or environmental impact assessment.

Institutionalised *consultative bodies* are generally not considered anymore as the most efficient way to promote consultation and dialogue on science and technology issues, even in countries where social partners are systematically involved in consultation processes in many policy areas (Austria, Belgium, Sweden). The new generation of consultative committees on bioethics or food security, which escape from the traditional logic of the social partners, is more perceived as experts committees than as consultation processes. Consultative bodies suffer from several shortcomings: lack of reactivity or innovativeness; limited scope of consultation; weak impact in the media and on the general public. Nevertheless, as compared to more informal or punctual consultation forms, they present some advantages: institutional permanence and staff support; policy monitoring over longer time; official involvement in policy advising (although often with weak impacts).

The recent evolution of *parliamentary technology assessment (T.A.)* shows an important emphasis on the organisation of public debates on science and technology options. Institutions of parliamentary T.A. are present in several reported countries: Austria, Flanders (Belgium), France, UK. Methods of T.A. are used in various institutional settings in all six countries. Generally, T.A. institutions and projects have a twofold mission: policy advising and public debate. The second one has become the most visible, but too often reduced to the only organisation of consensus conferences.

Participatory methods of T.A. are however much more diverse and include various scales of involvement of citizens and stakeholders[490].

The design and implementation of *consensus conferences* is however not anymore the monopoly of T.A. institutions. The OPUS national reports describe several examples of consensus conferences organised on specific topics by research councils (Austria, UK), foundations or commissions for sustainable development (Austria, Belgium, France), science museums (France, UK). One of the key questions raised by the national reports is the policy impact of such consensus conferences, although they were successful communication events.

The organisation of *public forums on S&T-related issues* is somewhat different from consensus conferences, as they focus more on stakeholders than on lay citizens. Such forums can be organised at different levels and with various scopes. At a national level, the French practice of "Etats-Généraux" (on research policy, health policy and food policy), also used in the Walloon Region of Belgium (on innovation policy), aims at gathering all concerned stakeholders of a specific issue and at conciliating the different interests at stake. They benefit from policy support and media coverage, and they are designed to have a policy impact at short term. Other examples of public forums at the local level are described in Austria, France and Sweden.

The purposes of *participatory foresight exercises* are similar to those of the national public forums, but rather oriented to long-term policies. They include a forum dimension, together with other tools: Delphi studies, opinion surveys, scenario drawing, etc. In Austria, Belgium, Portugal, Sweden and UK, participatory foresight exercises were used in order to design and legitimate new orientations in technology and innovation policies, in a context of institutional changes: integration of Austria in the European innovation policies after its accession to EU, federalisation of S&T policies and institutions in Belgium, implementation of the Office of Science and Technology in UK, the future of the energy system in Sweden.

Finally, a lot of consultative and participatory experiences are related to *environmental impact assessment* or *risk assessment*. In France, the "Barnier law" specifies how and when public debates must be organised before and during the implementation phase of large-scale projects that might have significant impacts on the environment and the quality of life. A national "Commission for public debate" is instituted for monitoring this process. In Portugal, most of the consultation processes on science and technology are related to environmental issues, but there is an over-emphasis on information or passive consultation rather than active participation of citizens or stakeholders groups. In Sweden, public debates on the final storage of nuclear waste resulted in local referendums with an effective impact on decision-making.

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[490] Joss S., Bellucci S. (eds.), *Participatory technology assessment: European perspectives*, Report of the EUROPTA project, European Commission, 2002. http://www.tekno.dk

Some common trends across Europe

Despite the variety of reported national cases, some common trends may be distinguished in the evolution of consultative and participatory processes.
First of all, there is an evolution of thematic issues from general policy issues to specific questions, mostly related to quality of life: environment, health, food, land planning. General issues such as biotechnology are translated into specific problems: the use of GMOs in agriculture; genetic screening; the use of genomics in medical research. A similar trend is observable about energy policy. Bringing the policy debates closer to the citizens' concerns seems to boost consultation and participation. Nevertheless, this "particularisation" of the debates on science and technology displaces the centre of gravity of the controversies from design to applications, from science to technology.
The move towards flexible institutional forms is a second visible trend. Institutionalisation of consultation and participations is still perceived as necessary, provided it does not result in increasingly bureaucratic procedures. The observed diversity of realisations and experiments might be interpreted as a set of flexible responses to complex and unstable issues and problems.
A third trend is the growing importance of the local level. Local level not only means local consultation and participation processes, but also decentralisation and translation of national or European questions into debates and procedures at the local level. This is a quite paradoxical finding: on the one hand, there is an increasing globalisation of science and technology; on the other hand, the policy debates move to a smaller scale.

Participation and / or communication

A transversal question is raised by all national reports: have consultation and foresight a direct impact on the decision making process, through an effective influence on the decisions, or have they only an indirect impact, through better communication between the policy circles, the stakeholders and the citizens? In other terms: does consultation mean participation to decisions, or dialogue with the decision makers?
The reports provide several evidences of improved communication and dialogue between science and civil society. Consultation is one of the tools that bring scientists closer to the public. Consultation can also bridge other gaps, as for instance between the public and other policy circles: experts from public authorities, from industry or from international organisations.
Open consultation and direct participation may enter in conflict with a more classical approach to decision making: the role of scientific expertise as a support for political

decision. Consultation and participation can disclose and discuss the role of experts and the biases of scientific expertise, but there is no guarantee that, in last instance, the political decision will follow either the experts' advices or the conclusions of the public debate, if they are controversial.

Finally, the evaluation of the consultation and foresight processes depends on the goals to be achieved. If the goal is a better and wider public understanding of science and technology, most of the consultative or participatory experiments may be assessed as successful. If the goal is an in-depth democratisation of S&T policy, then there is still some way to go.

Public consultation and foresight initiatives in Austria: Late start and hesitant implementation[491]

Ulrike Felt, Maximilian Fochler, Annina Müller[492]

The debate about participatory methods of dealing with issues linked to science and technology and foresight exercises is a priority both on the European level (see the EU Action Plan on Science and Society), as well as at a national level. This is not only a topic in itself, but a large difference between national "cultures" in dealing with public participation becomes clearly visible. While some countries – such as Denmark – have a longstanding tradition in for example using the tool of consensus conferences, other countries have virtually no or very limited experiences in this domain. Austria belongs to this latter group, is in that sense a latecomer and such initiatives have remained, to date, a rare exception. Additionally the use of direct democratic constitutional mechanisms with regards to technoscientific issues has been rather rare (3 cases) in the Austrian context: a referendum in the 70ies on nuclear energy; and in the 80ies concerning a hydro-electric power plant as well as a public petition concerning genetic engineering in the 90ies.
Five cases that stretch over a period of nearly 10 years will be portrayed briefly in this chapter. We will ask the question of what is specific about the Austrian approach to this field, but also in how far one could detect changes in handling this "tool" of science-public interaction during this period. Four of them could be categorized as attempts to realise participatory technology assessment[493] in a broad sense, while the fifth was more oriented towards the creation of a possibility for a dialogue.[494]

Technology Delphi – A technology foresight exercise

Among the different initiatives to be discussed here, the *Technology Delphi* (1996-98) is the only example which was explicitly labelled as a Foresight Exercise. Initiated by the

[491] This chapter is based largely on information collected in a recent project; Felt Ulrike, Maximilian Fochler, Annina Müller: Sozial robuste Wissenspolitik, Analyse des Wandels von dialogisch orientierten Interaktionen zwischen Wissenschaft, Politik und Öffentlichkeit; Abschlussbericht Juli 2003.
[492] All authors are members of the Vienna interdisciplinary research unit for the study of (techno)science and society.
[493] For three of the case studies the information presented in this chapter are drawn from: Lars Klüver et al, "Europta (European Participatory Technology Assessment). Participatory Methods in Technology Assessment and Technology Decision-Making", The Danish Board of Technology, 2000, p. 46-50 and from Simon Joss and Serhio Bellucci (eds.): Participatory Technology Assessment: European Perspectives, University of Westminster 2002. For the citizen conference on "Genetic Data", which is carried out at this moment, one of the OPUS team members was involved in the preparation phase. www.dialog-gentechnik.at
[494] For the fifth case, the "Disourse-day on genetic diagnosis" the Austrian OPUS partner has carried out a qualitative evaluation: http://www.univie.ac.at/Wissenschaftstheorie/virusss

Ministry of Education, Science and Culture[495], it was intended to identify technological fields where Austria's economy could be developed successfully in order to reach international leadership within the 15 years to come. This was seen as central as until the mid-90ies Austria had not formulated an explicit technology policy (thus there had been neither conceptual nor strategic planning behind much of the initiatives undertaken in the 80ies) and this fact was identified as a major problem on the side of policy makers. Especially the contributions that science and technology could make to societal development as well as the necessary boundary conditions for them are being investigated. The driving force being this was: the will to identify existing market-niches for future development, and to assure and improve long-term competitiveness and economic positioning.

The method used was a combination of a decision Delphi-study and a bottom-up-approach[496]. Before starting the survey seven societal relevant thematic fields were identified by a Steering Committee. Among these topics were "Lifelong Learning", "Medical Technology and Supportive Technologies for the Elderly" and "Production and Processing of Organic Food". The main participatory element was to install panels for each of the seven fields identified who would be involved in designing the questionnaire for the actual Foresight study. These panels consisted of representatives from the consumer organizations, industry, as well as experts from the technical and social sciences. In that sense the participatory element was more oriented towards broad "expert participation" and not public participation in its larger meaning. Concerning the institutional level it was considered that the people involved should originate from different sectors, e.g. university, non-university research institutions, enterprises and potential user and interest groups. The result of *Technology Delphi Austria* was interpreted as a success for its network building capacity and by the fact that it managed to give a rather broadly carried input (all in all more than 1000 experts were involved at different stages) to the policy making process.

Lay-participation

Another type of a consulting participatory initiative was realised in the *Ozone Consensus Conference (1997)* on possible measures related to the issue of air pollution by tropospheric ozone, mainly caused by traffic emissions and high summer temperatures. Built initially on the Danish model of the consensus conference, the idea behind this conference was to find out how far regulations could go without meeting public resistance, and thus to broaden the usual negotiation mechanisms that take place between the

[495] See for a summary on http://144.65.2.1/start.asp?OID=4227&isllink=1&bereich=5&gwort=

[496] Georg Aichholzer, "Das ExpertInnen-Delphi: Methodische Grundlagen und Anwendungsfeld 'Technology Foresight'", ITA-Manuskript ITA-02-01, 2002.

corporatist “Sozialpartner” (institutions supposed to represent society; they take part in political decision making processes) and the government. It is also important to know that this consensus conference was initiated only by the three eastern provinces of Austria, as they were most heavily touched by the ozone problem and the government was hesitating to take any decision. A main reason for the initiative can thus also be seen in the attempt to put pressure on the national government in a federal power struggle. The conference was planned by the *Wiener Umweltanwaltschaft* (Vienna Environment Advocacy), which is a part of the Viennese administration, and supported by the three provinces. With major budgetary difficulties and given the political setting in which this conference took place, a number of quite “fatal adaptations” were made to the “Danish model”. The advisory board consisted of politicians from the provinces and not of external experts, the panel – for budgetary reasons – exclusively consisted of a group of young people (between 16 and 28 years old) and it was not selected in a representative way for the whole population. The experts’ hearings were rather shorter than usually and so was the concluding session. Reaching a consensus turned out to be difficult as trust neither in the experts and nor in the politicians could be established during the conference. One major reason for this mistrust was that the panellists felt that they were being pushed to make decisions and take responsibilities they expected to be made and taken by the political arena. As a consequence, this consensus conference can be seen as a failure.

The *Traffic Forum* held in Salzburg was more oriented to regional planning than to controversial scientific issues, however also touching science in some details[497]. The trigger for the discussion forum were permanent traffic problems in the city of Salzburg which was already present as an issue in all public spaces to that time. The applied concept was a mediated discussion forum consisting of an inner and an outer circle that came together in sessions periodically throughout one year. The inner circle represented all relevant interest groups, for instance car drivers, pedestrians, but also young people, students, and tourism-representatives, 20 citizens on the whole; the outer circle functioned as the representation platform of politicians, civil servants and experts. The main idea was that in the first line affected public interest groups should participate whereas the expert’s fractions were supposed to play only a marginal role. That means that participants from the outer circle could only contribute if an input was wanted or needed. The mediation process was designed to make it possible to expose the understandings of the different groups and thus avoid various kinds of misunderstandings. But during the sessions the moderation was not trusted as being neutral, the outer circle won influence and the designed concept seems not to have been realised in a well-structured way. The result was (rather) seen as having improved the discussion culture, but the outcome was so vaguely defined that the results could not be implemented practically.

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[497] A summary can be found on http://www.tekno.dk/europta/Cases/Salzburgweb.htm: Petra Grabner, “Traffic Forum Salzburg” 1999.

In the last few months two participation oriented initiatives have been started within the Austrian context, both in the field of the "life sciences/human genetics". This example clearly illustrates the urgent need that is felt, in this domain, to get away from the rather polarised debate toward a more finely tuned argumentative setting whereby adequate solutions could be negotiated.

The first example, which ran under the title "Discourse day: genetic diagnosis", was organised as an accompanying measure under the Austrian Genome research programme "Gen-Au" by the Austrian Federal Ministry for Education, Science and Culture in cooperation together with the communication platform Dialog<>Gentechnik. During one day three thematic focuses dealing with genetic diagnosis were discussed between a panel of experts, coming from different backgrounds, but also representatives of patient organisations and people who decided to participate. The aim was not to create a concluding statement, but to open a space where people could express their visions, could ask questions or raise doubts and fears about certain ways in which genetic diagnosis are handled in contemporary settings. As a follow up working groups were established, which could continue exchange and debate of certain topics. As a first effort of public communication on the issue it was generally judged as a success; however participants clearly doubted that it could have any further reaching political impact in the domain of regulations regarding human genetic issues.[498] As a one-time event it would not be able to produce any real participatory effect.

The second effort to be mentioned is a *citizen conference on genetic data* taking place at the time this report is written, namely in spring 2003. Financed by the Austrian Council for Research and Technology under its Raising Public Awareness Initiative, a communication agency with an advisory board of social scientists and communication experts in the domain of human genetics is carrying out this citizen conference. Building on the Danish Consensus Conference model a panel of citizens chosen representatively (gender, age, region, education etc.) has two preparatory meetings in which they first select their key-issues, and then elaborate on them with experts chosen by them. In their final meeting they should formulate a statement, which is then transmitted to the political level. It should be considered as a first experiment of that kind, as no explicit decision is on the political agenda with regard to the handling of genetic data in the near future. It will remain to be seen if the citizen conference will manage to become a starting point for a broader public debate in this rapidly developing field. Only the future will tell us the impact of this exercise.

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[498] For details see the hompage www.gen-au.at. The Austrian Ministry also financed an independent qualitative evaluation of the event. Felt, Ulrike, Maximilian Fochler, Michael Strassnig: Evaluierung des Diskurstages "Gendiagnostik" (Wien, 24.10.2002), Abschlussbericht eines Forschungsprojektes im Auftrag des bm:bwk, 2003; to be downloaded from www.univie.ac.at/wissenschaftstheorie/virusss;

General observations and summary

Public participation and foresight exercises are not very widely used tools in the Austrian context. One explanation could be the long-standing political tradition of negotiating with the “Sozialpartner”. This is largely regarded as a far-reaching and sufficient representation of society in the policy process. However, one could ask whether issues as complex as genetic testing or genetic data can be debated on this level that mainly involves traditional corporatist interest organizations, or whether it would not need broader forms of consensus building. In fact what remained often unclear was the question: **Who represents and in what form contemporary societies with regard decisions that are linked to science and technology?**

Most of the participatory exercises – if they are not like Delphi on the level of expert participation – have shown the problem of creating a trust relationship between the participants and the environment in which this deliberation should be validated. Thus transferring a well functioning method like the Danish consensus conferences does not mean that they will also be successful in their new context. It would be central to analyse these factors of success and be more sensitive in the process of adapting them to different political contexts. For example, the strong tradition of hierarchical decision making processes in the Austrian political culture have lead to suspicions that the political sphere is not really asking for participation, but rather pursuing some other “hidden agenda”, in most of the cases cited here.

These two observations made above lead to the question whether public participation in form of lay-participation can so far be seen as a model, which finds political acceptance in the Austrian context. In fact **only expert deliberation seems so far to have found acceptance on the political level**. However it would be interesting and worthwhile to investigate also in this case, **how these recommendations have led to policy measures** by now – e.g. five years after having run Delphi Austria. This would make it possible to understand why this kind of recommendation seems more adapted to the political system and how the interface between lay-participation and policy-making could be arranged in innovative ways in order to allow for new forms of participation. But one could also argue that it is not the procedures of public participation that are really at stake, but **the political field is challenged to turn participatory exercises into a legitimate tool** on which decisions are based.

On the level of **topics** there is a clear shift to the **“life sciences”** as central issues to be discussed both due to their economic potential, but also due to the wide-ranging impact they have on our living conditions.

Consultation and foresight in the Belgian context: first steps into public debates

Gérard Valenduc, Patricia Vendramin

The subject of this section is not so much science communication and scientific culture, the democratisation process of science and technology policy options. This process relies on manifold aspects:
Consultation of social groups and representative bodies.
Involvement of stakeholders.
Technology assessment and public debate.

1. Consultation of social groups and representative bodies

Belgium has a long-standing tradition of institutionalisation of consultation processes in many areas of policy making, including R&D. Consultative bodies usually involve the "social partners", i.e. employers' and workers' organisations. Some of these consultative bodies are recently been opened to other social groups, namely consumers' associations, environmental groups and other NGO's.

1.1 Consultation of social groups on R&D policy options

Consultation of social groups on R&D policy options may occur at two levels:
The R&D policy level; Each of the Federal States, the Flemish Region and the Walloon Region has set up its consultative council on science policy. These councils are composed of representatives from universities and high schools, public authorities, employers' federations and trade unions. They have an advisory role, on either their own initiative or when the government requires advice.
The R&D implementation level. Many federal and regional research programmes have a management structure that includes specialised "accompanying committees" for the different sub-programmes. For many years, the accompanying committees of programmes such as Applied Social Sciences, Information Society, Sustainable Development, Transport and Mobility, are open to so-called "users representatives", i.e. social groups that are directly concerned by the research topics. In some cases, these committees are also associated with the preparation of the calls for tender and the evaluation and selection of projects. There has been a recent policy decision to include

groups of concerned users in all the accompanying committees of federal research programmes.

The participation of social groups in R&D consultative bodies can meet several obstacles and be weakened by filtering and compromises. The pyramid of representation and delegation tends to filter out the “grass-root questions”. Consensus seeking between divergent interests is not very favourable to the emergence of new ideas, although occasionally the compromises may be on new ideas rather than established understandings.

1.2 Consultation of social groups in other fields

Official advisory committees exist in different relevant fields as regards the OPUS focus. These committees are not restricted to R&D questions. We can mention, for example, two of them that are active on current scientific issues, in human health and environment: the Belgian Federal Council for Sustainable Development and the Advisory Committee on Bioethics.

The Belgian Federal Council for Sustainable Development[499] is an advisory body that advises the Belgian federal authorities about the federal policy on sustainable development. The Council gives particular attention to the implementation of international commitments of Belgium (Agenda 21, framework convention on climate change, convention on biological diversity, etc.). In addition to its advisory duties, the Council acts as a forum to encourage sustainable development debate, for instance by means of organising symposia. Experts in the area, representatives of government and civil society, and a wider public have the opportunity to explain their point of view and to dialogue. The Council makes use of the results when formulating advice. The members of the Council represent various social organisations: environmental organisations, development organisations, consumers’ unions, trade unions, employers’ federations, energy producers and the world of science.

The Advisory Committee on Bioethics[500] is a joint creation of all the policy levels in Belgium (federal state, Regions, Communities). Its mission is to advice and to inform. It has to inform the public on bioethical questions and to advice public authorities, scientific institutions, health institutions, health high schools and ethical committees. It was been created in 1993. The Committee is composed of various members coming from different backgrounds and disciplines: scientific and medical worlds, philosophy, law and human sciences. The mission of advice and information concerns problems raised by R&D and its implications in various fields (biology, medicine, health) when these problems affect the human being, social groups or the whole society. The ethical,

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499 http://www.sstc.fgov.be/frdocfdd/

500 http://www.health.fgov.be/bioeth/

social and jurisdictional aspects of these problems are analysed. The committee treats questions or formulates advices on request or on its own initiative.

2. Involvement of stakeholders

Besides taking part in consultative bodies, there are some positive examples of deeper involvement of stakeholders in R&D policy debates.

2.1 Research meetings in the Walloon Region

Under the authority of successive governments and with the support of the regional administration (DGTRE), research and innovation policy has led to greater involvement of the players directly concerned: companies, research centres and universities, high schools, local development institutions. The organisation of consultations on R&D issues has become more usual, for instance through a series of Research Meetings (1996-1997) and the Prometheus programme (1999-2001). From June 1996 to November 1997, the Council for Science Policy (CPS) and the regional administration (DGTRE) organised a series of 10 one-day conferences-debates, open to the wider public. Each conference was organised on the same pattern: keynote speeches, including some made by foreign experts; round table discussions with representatives of concerned stakeholders; discussion with the attendants. The subjects of the debates were:

Research listening to the civil society.
Organisation of the research system.
Scope and means of R&D public financing in the Region.
Industrial cooperative research centres.
Sectoral and thematic orientations of regional public research.
Valorisation of research results.
Evaluation of the impacts of R&D on society.
Social and cultural conditions of innovation.
Internationalisation of R&D.
Role of the researcher in society.

About 900 participants attended at least one of the meetings. This number was composed of members from industry, universities, public agencies and administrations, government, education, trade unions and other social organisations. The CPS published a synthesis of the contributions and debates and issued key policy recommendations for the future of research and technological development in the Region[501]. The Prometheus project, carried out by the region within the European

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[501] Graitson D., *Les rencontres de la recherche*, dans le Bulletin Athéna, n° 136, décembre 1997

programme RITTS (Regional Innovation and Technology Transfer Systems) in 1999-2000, can be considered as one of the follow-up initiatives of this broad consultation and discussion process.

2.2 R&D, sustainable development and the civil society

Another example of the consultation process is the initiative started by the Federal Council for Sustainable Development (CFDD/FRDO) in 1999. This Council wanted to enlarge the participation of civil society through setting up various working groups on thematic issues related to R&D and sustainability. In order to launch its campaign, the Council organised a public conference entitled "Scientific research, sustainable development and organisations from the civil society" in October 1999. The emphasis of the conference was on the communication between scientists and the civil society.

As a support to the campaign of CFDD/FRDO, the Federal Science Policy Office implemented a research-action project on scientific communication in the area of sustainable development. Researchers from the universities of Brussels and Antwerp and from the University Foundation of Luxembourg carried out the project. It was based on structured interviews about the perception of scientific communication between two groups of actors: researchers and promoters of research projects on one hand and social actors and stakeholders on the other hand.[502]

Experiment of direct participation

Outside consultation bodies, direct participation of citizens in decision-making process on scientific and technological issues is not a regular occurrence in Belgium. We have however noticed some occasional experiments, conducted either on the initiative of NGOs or public authorities. Some examples of these are:

In 1998-1999, the federal Minister of economic affairs launched a set of workshops and conferences entitled "Agor@ 2000", the purpose of which was to develop a debate among the social and economic actors on the issues related to the information society. Eight workshops were organised with scientific experts, public decision makers, industrial managers and representatives of the civil society. Each of them resulted in a synthesis paper, which was used as basic input for a public conference. Eight half-day thematic conferences were then organised, in order to incorporate the views of a wider public.

The more structured consultation exercise is a citizens panel conducted in 2001 on the initiative of an environmental organisation, the "Fondation pour les Générations Futures" (Foundation for Future Generations). It was about sustainable development in a specific area of Belgium. It was a response to the public action in land planning. At

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[502] Mormont M., Zaccaï E., Loots I., *La communication scientifique en matière de développement durable*, SSTC/DWTC, 2001.

the end of the exercise the citizens' panel formulated proposals to the concerned authorities.
The Ministry of public health plans to organise a similar consultation exercise on the questions raised by GMOs in the food chain. The Ministry asked the same environmental organisation to organise a similar citizen's panel within the next months.

3. Technology assessment and public debate

There is an explicit interest of some research institutions and consultative bodies, as well in Flanders as in Wallonie, for participative methods of technology assessment, inspired by similar practices in Denmark, Germany and the Netherlands: consensus conferences, scenario workshops, citizens' reports, proposals debates, local technology forums, etc. However, in each Region, we find diverse experiences in this field.

3.1 Establishment of the Flemish TA-institute

On the 5th of July 2001, the Flemish Parliament decided to establish the *Vlaams Instituut voor Wetenschappelijk en Technologisch Aspectenonderzoek* VIWTA (Flemish Institute for Scientific and Technological Assessment). With this vote, almost ten years of societal and parliamentary debate came to fruition.[503] The Institute became operational in December 2001.
Compared to countries like the Netherlands, TA as a real scientific discipline is not very strongly established at the university level in Belgium. However this does not mean there is little TA research carried out. Most TA research is performed in particular contract research projects, or is carried out under another label (risk assessment, feasibility studies, etc.). Most TA-activities can be related to: analytical TA (risk assessment, Delphi-method) that have as result written reports; TA at the level of R&D itself. TA that directs itself to the general public is mostly information seeking (e.g. questionnaires), rather than interactive (e.g. consensus conference). Until recently, the majority of the projects that addressed the general public were based on inquiries and questionnaires. So one can say that there is very little experience with interactive or participative forms of TA that proactively encourages a structured public debate. This challenge is addressed to VIWTA.
The main goal of VIWTA is to proactively stimulate and sustain the social debate and the political decision-making process related to scientific-technological developments. This goal comprises of three equally important tasks:

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[503] Holemans D., *The long awaited birth of the Flemish TA-Institute*, in *TA-Datenbank-Nachrichten*, n° 3, 10. Jg., September 2001.

First of all there is the need for balanced, apprehensible documents on the social implications of new technological developments.
The second task implies the organisation of broad social debates in a well-structured way.
Last but not least the results of these debates will be of great importance for the Flemish Parliament.
In the motivation for the legal proposal for a parliamentary TA institute, two other important issues are mentioned: not only are there new developing technologies but there are also existing technological systems that no longer satisfy, or worse still, cause structural problems. There is also the problematic role of scientific experts in social and political debates.
Similar to some European examples, VIWTA is a parliamentary institute. It consists of a small group of experts. Being a knowledge institute rather than a research institute, the aim is not to conduct its own research. Necessary long-term research is subcontracted.

3.2 TA in the Walloon Region

In the Walloon Region, TA capacities are not so well-establish. In 1994, the Walloon Region decided to institutionalise a consultative TA mission in the Walloon Council for Science Policy (CPS). The CPS is a consultative body linked to the Economic and Social Council of the Walloon Region. The CPS advises the Walloon Government on science, research and technological development. It is composed of the social partners and representatives of various research groups (universities, high schools, public research centres etc) and the regional administration DGTRE. The TA mission consisted of two tasks: to prepare advice of the CPS on TA-related topics and to manage an experimental research programme, granted by DGTRE and subcontracted to universities and research centres, by way of calls for proposals. A small team for TA-coordination was set up under the authority of the CPS. Relatively limited resources were allocated for these TA activities, but this mission was intended to grow if the players in the CPS (social partners, universities and high schools) mobilise for its development. Until now, the technology assessment assignment given to CPS has not yet reached the visibility or impact that one might have expected from a regional body experienced in institutionalising technology assessment.
In the Walloon Region, EMERIT is an original long term TA experience. EMERIT is the acronym of “Expériences de Médiation et d’Evaluation dans la Recherche et l’Innovation Technologique” (Experiments of Mediation and Evaluation in Research and Technological Innovation). The project started in 1992. It consists of a mission entrusted by the Walloon Minister of Research and Technology to the Work & Technology Research Centre at the Fondation Travail-Université (FTU). The assignments given to EMERIT in 1992 were to promote awareness and to create a

favourable climate towards technology assessment (TA) in the Walloon Region, and to support initiatives of mediation between research and the civil society. These assignments resulted in a pluri-annual programme of activities: exploratory studies, publications, organisation of public events (conferences, workshops). FTU was selected as the host institution of EMERIT because of its experience in research on technology and society, and its close cooperation with social organisations.
In addition, during the last ten years, the region has significantly increased its promotional efforts in scientific and technical culture, focusing particularly on youth. However, although concern is still felt for a broader social discussion on the technological challenges, it is sometimes expressed more discreetly. As a result, the Walloon situation is paradoxical today because whilst expertise is growing in several research centres in the “technology and society” field, regional initiatives on TA-institutionalisation are more or less at a standstill.

Public consultation and foresight exercises in France: In search for hybrid fora

Philippe Chavot, Anne Masseran

In France, the first consultative structures were established in the Eighties. Originally, they were institutional organisations and were required to advise on proposals in matters of scientific ethics (more particularly in the medical field) and technological options. These organisations mainly included politicians as well as specialists in natural, human and social sciences. In the course of the 90s, a number of more diverse structures or venues became established at national and local scale. They allowed for the experience or advice of citizens and communities to be heard, giving rise to dialogues between them and together with institutional partners (experts, politicians, etc). In certain cases, like with the belated and still rare citizen conferences, the consultative exercise tends to privilege the "education" of citizens with regards to the challenges of scientific and technological developments, mainly in the context of a crisis or where the public does not accept an innovation (for example GMOs). In other cases, the aim is to try to provide some "hybrid space"[504] where manners of implementations may be discussed for certain innovations or technical developments taking into account the interests of the various actors and communities. These forums are mainly relevant at local level and in relation to health issues where associations exert considerable pressure. It should be mentioned that these "consultative forums", or at least those related to environmental issues, were encouraged with the establishment in 1995 of the new legal framework provided by the Barnier Law and a dedicated structure, the *Commission Nationale du Débat Public* (the national commission for public debates).

I. Consultative structures

1. Le Comité Consultatif National d'Ethique pour les sciences de la vie et de la santé (CCNE) - National Consultative Ethics Committee for Health and Life Sciences

The National Consultative Ethics Committee was established by decree on 23 February 1983. It acquired further legitimacy in the scope of the laws known as "the bioethical laws" following a vote in Parliament in July 1994. Although it is an

[504] We borrow the expression from CALLON M., LASCOUMES P., BARTHE Y., *Agir dans un monde incertain – essai sur la démocratie technique*, Seuil, Paris, 2001.

independent body, this committee is related to the ministries of Research and Health. Its mission is "to advise on ethical issues raised by progress made in fields such as biology, medicine or health and to publish recommendations"[505]. The CCNE is made up of 39 members belonging to the main spiritual groups, they include philosophers, individuals selected on the basis of their competence and their interest in ethical issues, and scientists. Despite such disparities, the scientific element often represents the majority, particularly when cases are put forward: indeed, the technical team in charge of this task is made of 12 members selected by the overall Committee of which 8 have a scientific background.

As an organisation, the CCNE is strictly consultative in nature: recommendations issued are mainly required by the government, assemblies and establishments involved in research and education. Recommendations expressed are not necessarily taken on board at decision-making level. Up to the present, the CCNE has expressed 75 recommendations and it has been particularly active as regards amendments made to the laws on bioethics[506].

It should be noted that specific ethics committees following the same pattern have been established within large institutions (INSERM, CNRS, some universities, hospitals…). Finally, a National AIDS Committee (CNS) has a similar role in the scope of decisions taken as regards this disease (see below).

2. L'Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques (OPECST) - Parliamentary office for the evaluation of scientific and technical options.

The *Office Parlementaire d'Evaluation des Choix Scientifiques et technologiques* was established in July 1983. It is an assessing structure whose purpose is to assist the French Parliament's decision-making process. As stated in the law, its mission is "to inform Parliament on scientific and technological consequences, particularly with a view to enlighten the decision-making process". To meet this end, the Office "gathers information, implements study programmes and undertakes evaluations"[507]. Half of its members are MPs and the other half are senators, as both parliamentary structures may require the services of the Office for a specific study. It is assisted by a scientific committee. In the space of its 20 years of activity, the OPECST has carried out about 75 studies related to technological options as well as to ethical, public health and environmental issues. In this respect, many reports have been written on the issue of nuclear energy. More recently, the Office turned to BSE and GMOs. Traditionally, the role of the Office was limited to undertaking assessments and giving public hearings.

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[505] Law reference n° 94-654 dated 29 July 1994, on the donation and use of elements and products from the human body, medically assisted reproduction and antenatal diagnostics, Art. 23.
[506] http://www.comite-ethique.fr/
[507] Law referenced 83-609 and dated 8 July 1983. Source, http://www.senat.fr/opecst/

However, since the end of the Nineties, it seems to have opened up to the public debate, as shown by the organisation of the citizen conference on GMOs[508] in 1998.

II- Participative structures

1 - La Commission Nationale du Débat Public (CNDP) - National Public Debate Commission

The National Public Debate Commission was established after the law referenced 95-101 and dated 2 February 1995 was passed. Known as "the Barnier law", it specifically relates to the protection of the environment (Barnier law). The law proposes that public debates should be organised between the various actors during the implementation phase of "the large-scale public development operations undertaken for national interest by the State, local authorities, public organisations or mixed economy companies presenting a high degree of social and economic consequences or having a significant impact on the environment"[509]. Furthermore, this law reasserts the importance of public enquiries in the scope of decisions involving the environment.

The objective set for the CNDP is therefore to facilitate the participation of all actors affected by large-scale operations that may have non-reversible effects on natural habitats and living environments. It is, in fact, a manner of framework allowing for counter-assessments. Originally, the CNDP was intended to be fully independent, however much negotiations led it to become a hybrid space including magistrates, elected representatives and associations. Therefore this commission could have played a determining role in public decisions in matters related to the environment. However, for the moment it does not seem to have much influence. Indeed, it is widely under-funded and the magnitude of its power lacks precise definition. Furthermore, it tends to give more importance to its information mission, at the expense of its two other missions, namely consultation and dialogue[510].

2. Les Commissions Locales d'Information et de Consultation du Public (CLI) – Local information and public consultation commissions

Local Information Commissions were established in 1981 as was passed the "plan indépendant énergétique" addressing the issue of electricity plants using, or not, nuclear energy. At the time, the objective was to promote shared responsibilities between local authorities, regions and State and to amend procedures for informing populations and electing representatives. The scope of the CLI competence was

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[508] Others consultative structures take part in the debates on technological orientations. Thus the *Agence Française de Sécurité Sanitaire des Aliments* (AFSSA) was established following the "mad-cow" crisis in 1999 and advises the government on issues relating to food safety.

[509] Law referenced 95-101 and dated 02 February 1995

[510] CALLON M., LASCOUMES P., BARTHE Y., op. cit

further enlarged when these consultative groups started to accompany several types of public action programmes at local level: construction and management of nuclear plants, research on radioactive waste management, local water management (the latter are called Commissions Locales de l'Eau (CLE) - Local water commissions).
The objective of these commissions is to disseminate information and organise a dialogue between the administration, experts, local elected representatives, associations and other stakeholders. Their action is also focused on local issues. However, they remain relatively unopened: indeed, CLI members are appointed and placed under the control of a regional prefect or local elected representative. They are therefore confronted with a double limitation: (1) it is impossible for them to open up on issues at hand and develop new knowledge and (2) it is extremely difficult for them to take into account the various identities' involvement[511].

III. Citizen conferences and *Etats généraux* (general meetings)

1. Citizen conferences

It was as late as 1998 that France, inspired by the model provided by the consensus conferences of Scandinavian countries, set up its first citizen conference which, on the occasion, was dealing with GMOs. However, the original model was, as we will see further, greatly modified[512].
The OPECST had been required by the State to organise this event following the reluctance of French people regarding the introduction of GMOs in food. The first conference was organised in record time (five months) because the president of the OPECST was determined to present the declarations voiced by citizens in his report to Parliament in July 1998. These declarations had very limited impact on the decision-making process. In reality, considering the way the conference was organised, one could wonder if, fundamentally, the idea was not to provide the 15 citizens taking part in the event with the means to understand scientific and technological innovations in the hope that this understanding may lead to an acceptance of GMOs. Indeed, prior to debating with experts, the citizens had to attend two weekend training sessions on:

- the evolution of agricultural production in the course of the last several years
- industrial techniques used in food-processing
- general principles on nutrition
- basic knowledge on genetics

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[511] CALLON M., LASCOUMES P., BARTHE Y., op. cit, p. 233
[512] Clearly, organisers rapidly decided that the title "consensus conference" would not be suitable to the French context where it would evoke, according to their opinion, a "half-hearted consensus" based on some ambiguous compromise. Furthermore, according to the organisers, the objective of this type of conference is not to reach a consensus but to force participants to compare their points of view. Finally, it seemed to them that the word "citizen" was particularly suited considering the participants' role as laymen. BOY D., DONNET-KAMEL D., ROQUEPLO P., "A report on the "citizen conference" on GMO's", http://loka.org/pages/Frenchgenefood.htm.

- improving plant species and transgenesis.

As may be observed, these themes are characterised by a strong emphasis on basic scientific knowledge and the absence of knowledge on agricultural alternatives. These training sessions aimed at providing citizens with a reference framework, allowing them to ask the "relevant questions". As analysed by Callon, Lascoumes and Barthe, the citizen conference aims at making [the political delegation] "more efficient, without addressing the gap between ordinary citizens and their representatives[513]". It may be added, having seen an analysis of the intentions of organisers and experts involved in the first conference, that it doesn't question the gap between science and society. The communication model used as reference is always that of a deficiency[514].

The second citizen conference, which dealt with climatic changes, differed from the first one in several respects. It was organised in 2002, just before the presidential elections. One of the objectives of the organisers was to exert a pressure on the future government to ensure that recommendations voiced by the French citizens would be represented the following September at the summit of Johannesburg on sustainable development. It was therefore important to draw the attention of politicians on this issues at a stage when it was still rarely discussed in France. Therefore, this event was not meant to make acceptable some publicly contested innovation. Second difference: this conference was not answering a public request. It was organised at the initiative of the *Commission Française pour le Développement Durable* (CFDD), the French commission for sustainable development, in a partnership with *La Cité des Sciences de la Villette*[515]. The various topics raised during training sessions included less scientific elements without, however, really achieving a genuine diversity in forms of competence.

It is of particular importance to mention the fact that in the case of the first and the second conference, citizens had to belong to no organisation or association holding interests in the fields under discussion. This assumed "neutrality" was supposed to allow for better "objectivity" and more independence. This element alone shows that this type of consultation is not intended to allow for the expression of identities but rather to stimulate an awareness of the importance science has in contemporary issues (particularly with regards to risks).

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[513] CALLON M., LASCOUMES P., BARTHE Y., op. cit, p. 243

[514] Sezin Topcu has carried out an interesting study on the perception that the experts present at the two conference had of the "laymen". See TOPCU S., *Experts' Perception of citizen in two French citizen conferences*, ESST MA, October 2002, Istanbul Technical University, Turkey/ Université Louis Pasteur, France.

[515] The CFDD is independent from the government but it is, however, reporting to the Ministry of the Environment to which it provides advice.

2. Etats généraux de la Santé (EGS) - General meetings on health

Implemented between October 1998 and May 1999, at the instigation of the Secretary of State, Bernard Kouchner, the *Etats généraux de la Santé* (EGS) attempt to conciliate local and national interests. Indeed, the *Etats généraux* were based on public surveys, conference-debates and regional citizen conferences. A number of 15 themes had been selected, each of them developed in a case and including the participation of national experts on health issues. Over a thousand meetings were held across France within this framework. Finally, a public meeting with a voting session finalised the process at national level.

As it is implemented, the overall operation aims at improving information provided on health policies to citizens as well as to inform health professionals and decision-makers on the various expectations emerging from the meetings. However, the objective of the *Etats généraux* was first and foremost to provide an opportunity for care system users, whether patients or other citizens, to voice their opinion. Indeed, one of the specific elements of these citizen conferences was the fact that, during their training sessions, the citizens/jury members had the opportunity to reword initial questions and choose the experts to be questioned. The latter were taking part in the final deliberation session during which they were to answer questions voiced by jury members. The process led to a set of political recommendations[516]. Certain themes[517] are particularly suited to this manner of proceeding in the sense that it highlights the variety of opinions: regional differences were brought to light, as were specific expectations and the expression of specific identities. On the other hand, it is still impossible to determine if the recommendations voiced at the EGS have really been taken into account at decision-making level.

3.Etats généraux de l'alimentation (EGA) - General meetings on food

The *Etats généraux de l'alimentation* were run from November to December 2000 at the instigation of the Ministry of Agriculture, the Secretary of State for Health and the Secretary for SMEs, Trade, Crafts and Consumer Affaires.

The EGA were aiming at:

- "clarifying the situation with regards to the expectations of the general public in matters of food safety and quality and, particularly, with regards to expectations in terms of information;

[516] CALLON M., LASCOUMES P., BARTHE Y., *op. cit,* pp. 248-249. See also: "*Bilan provisoire des États généraux de la santé*", in *Acteurs magazine*, (Special issue, supplement to the in-house magazine published by the State's administration on health and social issues), n° 36, June 1999, http://www.sante.gouv.fr/egs/8-nouveau/.

[517] Thus conferences organised around the theme of old age, for instance, have allowed for widening the debate and going beyond the initial interrogation of experts. In the case of some other themes, the debate remained extremely conventional, dominated by experts at the expense of the "laymen" who only had the passive role of an observer. See CALLON M., LASCOUMES P., BARTHE Y., op. cit, p. 249

- assisting the Government in taking a stand on these issues, answering the real expectations and concerns of the French people".[518]

Like the EGS, the EGA were implemented in several stages. First of all, more or less restricted pre-forums were organised. They were to be a preparatory ground to the actual forums which were held in five main French cities, partly chosen due to their gastronomical traditions (as was highlighted at length during the debates): Lyons, Lille, Nantes, Marseilles and Toulouse. Finally, the process was brought to a close with a conference held in Paris and inaugurated by Lionel Jospin, then prime minister.

The five regional forums brought together a wide audience and more institutionalised actors, invited due to their implication in food issues. They were mainly local elected representatives, scientific and medical experts (dieticians, etc). Hosted by a journalist, these forums were opened with the results of an IPSOS survey carried out in the beginning of October 2000 about the attitude of French people towards food. Right in the middle of the mad-cow disease crisis, debates rapidly revolved around a "mistrust" towards food processing.

Despite a open will to enter into a dialogue and concertation process, the EGA aimed first and foremost at fulfilling an educative and informative role. As stressed by the Minister for Agriculture in his opening speech, education mainly aims at facilitating the development of a risk-management culture which, it is believed, French people somewhat lack. "Through education and information, we will establish in France a culture of risk prevention which information is helping to put into perspective".[519] Finally, the declared objective of the EGA was to establish a trusting relationship between the various actors involved in the food industry (professionnals of food production and retailing, scientists, industrialists and … the "general public").[520]

IV - Hybrid forums: the specific case of AIDS

In France, the HIV forum represents the best example of a consultation arena allowing for various forms of knowledge to be confronted. The focal point of discussions is not only the way research on AIDS is developing, it also includes a political dimension which manifest itself in the diversity of represented identities. Finally, in the case of AIDS, we can genuinely consider that all the various demands, recommendations and

[518] Source : http://www.agriculture.gouv.fr/ega/

[519] Jean Glavany, *in Synthèse du colloque national des EGA*, downloadable document at http://www.agriculture.gouv.fr/ega/tables_rondes/colloque.htm, p. 4.

[520] The forums were to include about 500 persons per town, representing local actors involved in the field of food production, associations, elected representatives, health and education professionals, the general public and the media. The panel of contributors was made of pre-forums witnesses, regional experts involved in food production, local figures involved in health and education, consumers' associations, elected representatives, an "observer of our times" (sociologist, philosopher…), and "a prominent figure acting as witness giving an outside opinion". It should be noted that a Public Debate on Energy with a similar structure has been organised since March 2003.

expressions of identities are taken into account in the decision-making process. This forum represents the outcome of a long history[521] which can be considered as a genuine process of collective learning[522]. From the mid-Eighties, patients and persons close to them established associations – *Aides, Act-Up, Arcat-sida, Action-traitement, Positifs* – they claimed their commitment and expressed demands showing indeed much diversity but being always somewhat linked, one way or another, to scientific research. At times, these associations forced their way into the debates on clinical trials (methods, organisation, molecule efficiency criteria). The strength of this commitment facilitated, for the first time, the fact that a determining role could be granted to the patient (considered as a "social reformer" to quote Daniel Defert, president of *Aides*). As a consequence, the strict boundary between scientists and laymen was totally blurred : patients and persons close to them were taking part and expressing themselves, sometimes requiring actual training on research methods. A genuine debate involving all actors concerned on an equal footing could thus be established.

The second stage in the creation of a hybrid forum was in the opening of these associations towards the general public arena. The objective was to allow for these commitments to be socially acknowledged, to ensure identities are accepted, to make new forms of collaboration more visible. Within this framework, the media played a fundamental role. Not only could associations be acknowledged as genuine partners in their own right but, in addition, their diversity found a public place for their expression: it was no longer possible to believe that there is a typical patient and the idea that patients are people presenting as much diversity as non-patients had to be accepted. If such a feat could be achieved, it is mainly due to the wide variety to be found in the modes of action and commitment of associations involved. Through the means of spectacular ways to attract media attention,[523] some associations were fighting against discrimination, thus facilitating solidarity between HIV positive persons, patients and people not affected by the virus. These associations managed to politicise a debate which, without them, could have been dominated by medical knowledge alone. Furthermore, the legal field having been highly involved in the issue, certain rights have been established, particularly the right for all patients to have the benefit of the same treatments.

Investing in the institutional arena where decisions are made has also been a determining factor in the establishment of the forum. In this respect, the State played an important role in creating the CNS (*Comité National du sida* – National committee

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[521] See BARBOT J., DODIER N., ROSMAN S., Les espaces de mobilisation autour des essais thérapeutiques et de la mise à disposition de nouveaux traitements. Le cas de l'épidémie à VIH, CERMES, ANRS report, 1998 and CALLON M., LASCOUMES P., BARTHE Y. op. cit, op. Cit., pp. 251 sq.

[522] We borrow the expression to LASCOUMES P., La productivité sociale des controverses, talk delivered at the seminar on "Thinking sciences, techniques and expertise today", 25 January 2001, http://www.ehess.fr/centres/koyre/textes/lascoumes.htm

[523] Let us mention here the examples of the striking image provided by the giant-size condom placed over the Obelisk, place de la Concorde in Paris, or the red paint thrown at the ministers suspected of complicity in the scandal on contaminated blood …

for AIDS) which was to look after ethical issues following the model of the CCNE ; the AFLS (*Agence Française de Lutte contre le Sida* – French agency for fighting AIDS), mainly in charge of prevention and information; finally and above all, the ANRS (*Agence Française de Recherche sur le Sida* – French National Agency for AIDS) which rapidly became an arena for interaction. Within the framework provided by the ANRS associations created their own independent and recognised space supported by the authorities: the TRT5, where the various points of view can be discussed in such a manner that the community of associations may reach common proposals, particularly on issues relating to clinical trials. This space rapidly became a ground where the interests of all actors involved, scientists, patients and association representatives, were confronted.

This long process, raised by the associations and supported by the media, the authorities ad legislation allows for the emergence of a structure both consultative in nature and, above all, participative. Indeed, the point here is not to level differences but to allow them to confront each other. Furthermore, the influence of this operation over the decision-making process has proved to be extremely efficient.

The HIV forum should, however, be considered to be an exceptional case, a synthesis of forces both visible or in the process of becoming visible. Therefore, although a reflection on consultative processes could benefit from this model, it is impossible to turn it into a model that would work in all situations. However, this experience opens new avenues: one could legitimately wonder if participation processes are not all the more efficient when parties involved are determined to participate and, above all, decide on the format and location of their participation.

Public consultation and foresight exercises in Portugal

Maria Eduarda Gonçalves, Paula Castro

1. Background

In Portugal, efforts were made in recent years to involve the public in decision-making in various legislative areas. This efforts were particularly apparent in the field of environmental policy.

Public involvement, however, can take many forms and not all of them actually imply the same level of involvement (Lima, Pinto, Baptista & Castro, 2001[524]).

We can draw a first distinction between participation and information.

The former implies some form of integration into the final decision of the results of the public consultation. The latter is a unidirectional mechanism, usually flowing from the authorities or experts to the citizens, aiming at providing the latter with information, and very rarely incorporating evaluation procedures for assessing the impact or even the reception of the information.

Between these two extremes, two other forms of public involvement can be considered – awareness and consultation.

The former is a form of communication aimed at attitude change, taking the path of persuasion, and the latter implies the existence of mechanisms for acquiring knowledge of the public's attitudes, beliefs, suggestions and complaints – but an absence of explicit mechanisms for incorporating the information thus gathered into the decision making process. So, an ordering of these four forms of public involvement from more to less intense would be as follows participation, consultation, awareness and information.

2. Public involvement in environmental policy-making

An analysis of the Portuguese environmental legislation shows that there is an over-emphasis on information as a unidirectional process, and an impoverished understanding of participation (Lima, Pinto, Baptista & Castro, 2001).

[524] Lima, M.L., Pinto, A.M., Baptista, C. & Castro, P. (2001). *Participação, informação e responsabilização dos cidadãos no domínio da água*. Plano nacional da Água, INAG

For instance, in the case of Environmental Impact Assessment (EIA) processes, several commentators are unanimous in considering that EIA hearings are monopolised by participants with a scientific background Castro e Lima, 2000[525]; Castro & Lima, 2003[526]), who leave little space for public intervention. Besides, public consultation usually takes place during the decision phase, and very rarely during the phase when alternatives are being considered. In general, there is a low level of public involvement in these processes due to lack of information about timing and the details of the projects.

EIA public hearings have now diminished in percentage, as a result of a current interpretation of the new legislation (see Lima, Pinto, Baptista & Castro, 2001, for a comparison of the percentage of processes with public hearings for the period 1990-97 and for the year 2000; also Garcia et al., 1997 [527]). Instead, there has been a more intense investment in forms of individual information (face-to-face and written) mechanisms for citizens who wish to express doubts and concerns.

Debate thus seems to be loosing space, a trend that is seen favourably by both the technicians from the central administration and those involved in the EIA studies. According to Pott (1999 [528]), these technicians seem to defend a public involvement that goes no further than consultation, given the low levels of public knowledge and the reduced number of presences in the public hearings.

Another example are river committees – current legislation demands that these include representatives of local users and environmental NGOs. However, the process by which these representatives are chosen is far from transparent, the decisions taken are in most cases not easily accessible to citizens and there is a lack of mechanisms for direct claim by the citizens.

Still another example concerns the case of the environmental NGOs. These have increased in number – there were 42 environmental NGOs in 1987, and 188 in 1998. However, the fact that they are more of them, does not mean that they are making the process of public participation and consultation more intense - their work and contributions are considered only at the Consultation level. This means that there are no explicit mechanisms for integrating their suggestions into the decision making process.

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[525] Castro, Paula and Lima, Luísa (2000). A variabilidadedas concepções de ciência entre o público. In M. E. Gonçalves (ed.) *Cultura Científica e Participação Pública*. Oeiras: Celta, pp. 41-62.

[526] Castro, Paula and Lima, Luísa (2003). Discursos sobre a Ciência num Debate Ambiental. In M. E. Gonçalves (ed.), *Os Portugueses e a Ciência*. Lisboa: Publicações Dom Quixote, pp. 115-151.

[527] Garcia, J.L., Subtil, F. Pott, M. & Conceição, S. (1997). *Episódios de conflito e cidadania ambiental: relatório final de estudos de impacte ambiental*. Lisboa: Observa

[528] Pott, M. (1999). *Qualidade ambiental e justiça colectiva*. Lisboa: Observa

A recent EIA process illustrates what is being described as an impoverishment of debate and participation, accompanied by a strong reliance on technical expertise .
In the beginning of 2000, the Environment Minister, faced with strong public contestation to a project of co-incineration of toxic waste, decided that an Independent Scientific Committee (ISC) would study advantages and disadvantages of co-incineration in cement factories, and come up with a recommendation that the government would follow. Nevertheless, an even stronger public and parliamentaryopposition followed the ISC recommendation favouring co-incineration. Several interviews, both with the Minister and with public figures opposing co-incineration, took place. This concluded with the appointment of another Independent Committee, this time with public health specialists, being appointed (Gonçalves, 2002[529]).
Throughout this whole period there was an intense use by the Minister of the idea that science and scientific expertise can decide environmental matters via a direct transposition of its findings to public policy. Science was presented as an activity that was carried out by specialists in their offices and one that was able to come up with unproblematic answers. These unproblematic answers were to be used afterwards, as straightforward foundation for governmental decisions. Since local authorities and the public were not “illuminated” by science, but instead were “obscured” by local interests, their voices could not be taken into account for an informed governmental decision.
This version of scientifically informed policy echoed positively in large sectors of public opinion, and strengthened the Minister’s position in his party.
The co-incineration process also met with strong opposition, on one hand, from counter-experts from environmentalist associations, like QUERCUS. QUERCUS focused on the technical details of the procedure and on its comparison with alternative procedures for hazardous waste-management, such as reduction, regeneration or recycling of different types of waste, and on the other hand, from leading social scientists.
A citizens’ movement was organised in the bigger town near the planned site for the incineration, and these social scientists were very active in organising the protests and debates. Nevertheless, most of the *“against”* arguments marshalled by this movement explicitly relayed scientific considerations, namely facts and figures of public health issues

[529] Gonçalves, Maria Eduarda (2002), Implementation of EIA directives in Portugal: How changes in civic culture aer challenging political and administrative practice. *Environmental Impact Assessment Review*, 22/3, pp. 249-269.

3. Public involvement in science policy-making: the White Paper on Science and Technology Policy

Public consultation has no tradition in the field of science policy in Portugal. The formulation of this policy has been largely centralised by the government. Even the role of the scientific and business communities in these processes has been marginal.

From the mid-1980s until the mid-1990s, the main consultative body of the Secretariat of State for Science and Technology was the Higher Council for Science and Technology (*Conselho Superior de Ciência e Tecnologia*). The mechanisms for consultation of the scientific community provided for in the legislation that reorganised the Ministry of Science and Technology in 1996 (a National Scientific Council and disciplinary councils ("*colégios de especialidade*") have not been implemented.

The only significant exercise of public consultation in this area was undertaken in 1998. It was run by the Ministry of Science and Technology with the objective of elaborating the White Paper on Portuguese Scientific and Technological Development (1999-2006).[530]

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[530] Http://www.mces.pt/ForumCT/welcome2.html.

Public consultation and foresight exercises: The Swedish case

Jan Nolin, Fréderik Bragesjö, Dick Kasperovski

The following text discusses public consultation and foresight research in Sweden. It will concentrate on one particular but very important case: the referendum on Swedish nuclear power in 1980. The question was whether Sweden would keep, phase out or wait and see what to do with the nuclear power. In evaluating the dangers of nuclear power one must understand several very complicated scientific controversies, ranging from subjects like physics, chemistry, geology, as well as the social sciences. In the 1970s, this debate was, from a policy perspective, the most important vehicle for initiatives on public engagements in science.

The text focuses on the background and nature of the referendum, which included elements of both consultation and foresight. It will also follow the debate surrounding the referendum to the present time, in particular the debate surrounding the storage of nuclear waste material in the mid 1990s. Here are also elements of consultation and foresight present, and it is possible to observe a change over time when it comes to ambitions to involve the public in such matters in Sweden.

The Background

Firstly, an account of the background is needed to understand why a referendum was initiated in the first place. For the majority of the 20th century, strong Social Democratic governments ruled Sweden. After the Second World War, in which Sweden was not directly involved, a thorough welfare state was created. This meant large investments in the public sector. The distribution of science to citizens and the use of scientific findings in public administration were seen as important parts of democracy and rational governmental ruling.

Two policy reforms reflect this: firstly, the 'sectorial principle', introduced in the early 1970s, viewed the university as the main public repository for science which might solve problems within various societal sectors, be it housing, supply of energy, national transportation and local systems, environmental protection, health and welfare, etc.[531]

531 See Elzinga, A, 1980, "Science Policy in Sweden: Sectorisation and Adjustment to Crisis", *Research Policy,* vol 9, no 7, April, p 116-146; 1990. This means very little applied research is done in special government laboratories or institutions that fall under the direct authority of one or another ministry. Instead ministries support special research funding agencies that receive both unsolicited and solicited grant proposals from universities. These are sometimes called "sectoral research councils" to distinguish them form the more traditional basic research oriented councils which continue to allocate funds on the basis of

In the Swedish context it therefore became important to view research in the academic domain as open to public scrutiny and transparency. This meant that efforts must be made to inform a wider audience about the existence of this kind of research, making it accessible particularly to various *user* categories.

Secondly, a general and very important policy initiative is the requirement for researchers to disseminate their results.[532] In the University Act of 1977, a new task supplemented the earlier two officially proscribed responsibilities assigned to the universities, teaching and research, and it was thus called ”the Third Assignment” (*tredje uppgiften*). Disseminated research information (*forskningsinformation*) should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have come to modify the text; changing its intent somewhat. However, some core ideas are still present, which goes back to the fact that the universities are part of a unitary national system and publicly funded.

An important element of the “Third Assignment” is the emphasis on the democratic significance of research-based knowledge. Research as a resource for changing society produced two democratic problems from a political perspective.[533] One of them was that the citizens needed to increase their awareness and control over these changes. As knowledge increasingly became important for the possibility of citizens exercising their democratic rights, it also seemed increasingly problematic that dissemination processes traditionally were relatively marginal and skewed in favour of those in power, at the cost of the broader public.

The roots of this view are sometimes held to go back to the previous century when the Swedish democratic movement sought legitimisation by reference to contemporary scientific knowledge and scholarship. An important part of that argument was that education and not revolution is best for empowering people to change society and become democratic beings.[534]

The National Referendum of Nuclear Power (1980)

Swedish nuclear power plants were planed and built during the 1950s and 60s. During that time there was practically no debate on the dangers involved in producing energy

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a pure peer review process. The sectoral councils combine criteria of societal relevance and scientific excellence in their review procedures. In some cases the former dominate over the latter, in other cases the two-tier approach starts with scientific merit. Of course there has been a lot of debate around these procedures, they may be compared to the notion of "extended peer review".

532 Svensk författningssamling 1977:218.

533 Om forskning. (On research) Forskningsproposition 1986/87:80.

534 Se e. g. Gustavsson, Bernt, 1991, Bildningens väg: Tre bildningsideal i svensk arbetarrörelse 1880-*1930.* (”Bildningens” way: Three ideals of educative formation in the Swedish labour movement 1880–1930.) Stockholm: Wahlström & Widstrand; Wallerius, Bengt, 1988, *Vetenskapens vägar: om akademiker och folkbildningsarbete*. (The ways of science: On academics and popular education) Stockholm: Folkuniversitet.

of this kind or if it was desirably for Sweden to do so. It was not until the 1970s that nuclear power started to be conceived as a possible problem. After this it quickly became the most important political issue of that decade.

In 1974, the first political proposal of a referendum appeared, but it was not until the Social Democratic party thought a referendum was needed that it was realised. Further, in the 1976 government election campaign, *Centern* (The Middle Party) made the question of nuclear power to an important issue and two years later *Folkkampanjen mot kärnkraft* (The Peoples Campaign against Nuclear Power) was established. More than 100,000 people were involved in this movement between 1978 and 1980.[535] In this perspective, the referendum on nuclear power in 1980 was a result of the national commitment of engaging and educating citizens in scientific questions. The matter of consulting lay people became urgent after the nuclear accident in Harrisburg in March 1979. After the accident, attitude research showed that 48 % of the citizens were negative towards nuclear power while only 31 % were positive.

There was an officially perceived need to find means to systematise and channel efforts to popularise the issues at stake and give wider publics insight into the science-based controversies that kept emerging. A year after the Harrisburg accident, on the 23rd of March 1980, the referendum was held.[536]

In the late 1970s, a massive debate emerged with disagreements between different kinds of scientific experts. There were also political struggles between diverse parties, some promoting nuclear power and some criticising it. In addition, the media coverage was immense: Due to this debate, several of Sweden's larger daily newspapers established editorial staffs and feature pages on science. These phenomenon therefore was born in a context of linking science to environmental issues and risk society.

Preparatory to the referendum a host of study circles were organised to stimulate people to weigh expert arguments and the pros and cons of nuclear power. In 1979 *Forskningsrådsnämnden* (the Council for Planning and Co-ordination of Research (FRN)) was established in order to support, among other things, the "Third Assignment". The creation of FRN was in the first place stimulated by the debate on nuclear power and the growing awareness of linkages of science and democracy. Naturally, FRN got involved in the questions surrounding the referendum and it launched a publication series called "*Källa*" (Source).

This series particularly focused on areas where one finds differences amongst experts, i.e., controversies in and about science. A *Källa*-publication typically is structured

535 Rolf Lidskog (1998) "Bortom tid och rum: Svensk kärnkraftspolitik i historisk belysning" (Beyond time and space: Swedish nuclear power politics in historical light), in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 38f. 535 See Rolf Lidskog (1994) *Radioactive and Hazardous Waste Management in Sweden: Movements, Politics and Science*. Doctoral Dissertation. Uppsala: Acta Universitatis Upsaliensis, chapter 3.

536 See Rolf Lidskog (1998) "Bortom tid och rum: Svensk kärnkraftspolitik i historisk belysning" (Beyond time and space: Swedish nuclear power politics in historical light), in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 39.

around a dialogue between two researchers who differ in their views and understanding regarding a given question of considerable public interest. A third party, the mediator, comments on the propositions of the two antagonists, and try to find a middle ground of convergence as well as distinct lines of disagreement. The mediator for the most part plays the role of a pedagogical consultant rather than trying to promote convergence of views for the sake of some policy objective. The aim of these publications is "not to reach an indisputable truth" but to enlighten complex question of scientific character and to further an understanding of why experts differ in their opinions. As far as it is possible, the texts will leave the reader with facts as well as evaluations and matters of values.[537] The first eleven issues of *Källa* dealt with the problem of nuclear power. Central to these publication is a foresight focus, for example discussing the future problem of reactor safety and nuclear waste storage.[538]
There were three options in the referendum: the first stated that no more reactors would be built but that the existing ones only would be out-phased if the need of electricity could be granted; the second was similar to the first but had some supplements of ownership of the reactors and taxation of electricity; the third was more radical, proposing no more reactors would be started and that the existing would be decommissioned in ten years.[539]
In the referendum, 78 % of the entitled voted and the second alternative won close before the third. But in the Swedish legislation, a national referendum can only be consultative. The government is not obliged to follow the outcome: it is only a way for the regimes to obtain information of the public opinion in a specific question. However, the political parties stated that following this referendum the popular vote would decide future policy. Still, the winning option was more vague than the other two and actually did not determine policy on this issue. Twenty years later, there are still political debates whether or not to close reactors and if so, how fast to do it.

Local Referendum of Nuclear Waste Disposal

As sociologist Rolf Lidskog observes, since the national referendum the political debate of nuclear power has been transformed: No longer is it a broad debate, involving hundreds of thousand of people but the negotiation and decisions of the future of the

537 See *Källa 1: Kärnkraft och kärnvapen*. (Souce 1: Nuclear Power and Nuclear Weapon). Stockholm: Forskningsrådnämnden
538 Later ones have taken up issues like computerisation and its social impacts, forestry and acid rain, cancer research, the ozone depletion, violence in society, sports/steroids, and the most recent numbers are devoted to bio-technology.
539 Rolf Lidskog (1998) "Bortom tid och rum: Svensk kärnkraftspolitik i historisk belysning" (Beyond time and space: Swedish nuclear power politics in historical light), in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 38f

nuclear power plants is done by a small group of politicians.[540] However, during this time new questions in relation to nuclear power have emerged. As these primarily involved the matter of where to store the nuclear waste material, the debates moved from decisions in principle to decisions of a more particular nature, from the national level to local, from the "if" question to the "how" question.[541] In the studies pursued by *Svensk Kärnbränslehantering* (Swedish Nuclear Fuel Management [SKB]), almost all of Sweden was considered as possible places of terminal storage; only the northern mountain area, the island Gotland and the southern part of Sweden were excluded due to geological conditions.

Traditionally, the municipalities in Sweden have had great autonomy. The local government council in the cities does even have a right of veto, making it possible to decline national governmental decisions if it interferes with the local environment. However, in 1990 this right was narrowed, making it principally possible for the national government to overrule the local authorities if it was regarded of national importance.[542] It would therefore be legally feasible for the government to locate nuclear waste to municipalities it finds suitable. But it would nevertheless be practicable very difficult not to take into consideration the local wishes.

Today this latter path of decision-making seems to be the preferred one. In 1990, SKB asked all of the Swedish municipalities if they were interested in being object for feasibility studies of aptitude for nuclear waste storage. The study would observe both the environmental conditions and the nature of the social community. In 1998, five cities had approved of SKB executing feasibility studies.

An example is Storuman, a small city in northern Sweden with problem of depopulation and unemployment. SKB did a feasibility study there in 1993-94. In connection to this study, a local referendum was held in 1995. The outcome of it was clear: 71 % of the population in the city did not approve of further studies. As a direct consequence of this referendum, the local authorities declined SKB's further work in the municipality. The same process was repeated in Malå a couple of years later. In this city the outcome of the referendum was much closer, only 56 % were negative, but SKB did nevertheless finalised its engagement in the area.[543]

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540 See Rolf Lidskog (1998) "Bortom tid och rum: Svensk kärnkraftspolitik i historisk belysning" (Beyond time and space: Swedish nuclear power politics in historical light), in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 39 and p. 45f

541 See Rolf Lidskog (1994) *Radioactive and Hazardous Waste Management in Sweden: Movements, Politics and Science*. Doctoral Dissertation. Uppsala: Acta Universitatis Upsaliensis.

542 Ibid., chapter 3. Also see Rolf Lidskog (1998) "Bortom tid och rum: Svensk kärnkraftspolitik i historisk belysning" (Beyond time and space: Swedish nuclear power politics in historical light), in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 48.

543 See Partik Olofsson & Evert Vedung (1998) "Kärnkraftsavfall och lokalt beslutsfattande – fallen Storuman, Malå och Överkalix" [Nuclear waste and local decision-making – the cases of Storuman, Malå and Överkalix], in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 123-180. Also see Rolf Lidskog (1998) "Bortom tid och rum: Svensk kärnkraftspolitik i historisk belysning" (Beyond time and space: Swedish nuclear power politics in historical light), in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 49f.

Previous to these referendums, information campaigns towards the local population were initiated. The objective was to enlighten the lay public of the specific question. In Malå, this campaign began more than three years before the referendum. A study showed that 59 % of the population had come in contact with such information; that percentage had increased to 89 % one year before the voting. Despite these quite high numbers, many of the citizens felt that there had been too little information.[544]

Summary

Looking back over two decades of debate regarding nuclear power, it is possible to observe a change in the political role of citizens. In the spirit of democracy and the legislation of the "Third Assignment" in the 1970s with its idea of educating the lay people, a national referendum was held in 1980 regarding the future of nuclear power. In the process leading up to the referendum, large social movements appeared and information campaigns were launched. Here research with a foresight character was an important ingredient. While the referendum was only consultative, the political parties wowed to follow the decision from the citizens. As the winning alternative had a flexible character, the referendum actually served to close public engagement and give free hands to the policy makers. An important effect was, however, the creation of certain features of public debate, such as FRN and science sections in the newspapers. In addition, the public awareness of scientific knowledge as something important and controversial had been established among broad segments of the public.

Twenty years later after referendum, the debate had transformed from the national level to the local when discussing possible places for terminal storage of the radioactive waste material. The considered municipalities also used information campaigns, foresight studies and referendums in the decision processes. However, with the important difference that the local referendums in the 1990s were of a more executive nature than the national in 1980. A reason for that can nevertheless be that in these cases the vagueness from the national referendums second alternative is absent: the question for the municipalities is only yes or no.

If we are going to conceptualise this change, we can utilise the three degrees of public participation developed by Gene Rowe and Lynn J. Frewer. They make distinctions between a low degree of public involvement, such as the enhancement of (risk) information; a middle degree where views of the public is "solicited through such mechanisms as consultations exercises"[545]; and a high degree of involvement, where

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544 See Olle Findahl (1998) "Media som folkbildare: Malå och kärnavfallet" [Media as educator of lay people: Malå and nuclear waste], in Rolf Lidskog (ed.) *Kommunen och kärnavfallet* Stockholm: Carlssons Bokförlag, p. 237.

545 Gene Rowe & Lynn J. Frewer (2000) "Public Participation Methods: A Framework of Evalution", in *Science, Technology, and Human Values*, vol. 25(1), p 3.

the public may take part in “exercises that provide them with a degree of decision-making authority”.[546]

If we relate this to the discussed Swedish case of questions related to nuclear power, we find the first level, of targeting the public with information of risk etc, present as well in the national referendum in 1980 as in the local referendums in the 1990s. In 1980, there also was an ingredient of consultation (second-degree involvement). However, in the 1990s the role of the public seems to have moved from the middle level with its consultative exercises to the higher level, giving actual authority to lay people through local executive referendums.

As with most political processes, this is not an unambiguous development. Still there are traditional decision-making procedures where scientists have a conventional expert function, giving advice to governmental bodies. Recent examples of this are the question of radiation from cellular phones and the need to stop the cod fishing in the Baltic Sea.

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[546] Ibid., p. 3.

Making public consultation more "user-friendly" by turning "Technology Foresight" into just "Foresight": But who *are* the users? [547]

Josephine Anne Stein

Introduction

Public consultation on science policy began in the UK under the Conservative Government of Margaret Thatcher. Prior to that, science policymaking had largely been the arcane province of “boffins” within the Research Council system, advised by The Royal Society, other professional bodies, committees and co-opted individuals on an *ad hoc* basis. Policy for basic science was determined through traditional, elite Research Council structures, professional networks and practices; that for applied R&D focused on data and expert-driven processes[548]. Science and technology policymaking was a highly devolved, expert-led, and secretive process, operating under the strictures of the Official Secrets Act. The Cabinet did not ordinarily get involved, let alone the Prime Minister.

Thatcher changed all that. She regularly summoned scientists to No. 10 Downing Street to give her briefings on the latest scientific developments. According to one such scientist, a young physicist at Imperial College, politics did not enter into the discussion[549]. The Prime Minister, who prepared for these meetings in advance (and had a background in chemistry), subjected the scientists to her famous questioning and took an active interest in the substance of their research. These briefings were private; although the scientific community and the press were aware that they took place, there was no public interface -- just as was the case for the scientific advisory system. But that too was about to change.

In 1992, a new Office of Science and Technology (OST) was established within the Cabinet Office, headed by a minister with Cabinet rank (with the colourful title of Chancellor of the Duchy of Lancaster, who was also responsible for the Civil Service). William Waldegrave, the first to inhabit this post, launched a major, open public consultation on the future of science policy in the UK, inviting evidence from the

[547] Discussion of Technology Foresight and the UN National Consensus Conference on Biotechnology in this section is based largely on J.A. Stein’s chapters in P. den Hertog, J.A. Stein, J. Schot and D. Gritsalis (1996), *User involvement in generating and applying* Hertog *RTD: Concepts, practices and policy lessons*, project report to the European Commission (DG XII), TNO report STB/96/011, Apeldoorn, The Netherlands, April 1996, also published by the European Commission, DG XIII/D2, as a report of the Interfaces: Science - Technology - Society programme.

[548] J. Irvine and B.R. Martin (1984), *Foresight in Science: Picking the Winners* (Pinter, London).

[549] J. Hassard, personal communication.

scientific community and the public. Some 800 submissions were received from professional bodies, universities, associations and individuals. Not all of them were read.

The consultations fed into the development of the first major science policy document to emerge from Government in decades: *Realising Our Potential*[550], in 1993. This White Paper signalled the start of major reorganisations of the UK science base and policy shifts, amongst them a commitment to public understanding of science and to expanding expert consultation on science and technology policy.

This section examines six key consultations that took place in the decade following the publication of the White Paper: two foresight exercises (expert led and expert-dominated), two consensus conferences (with experts defining the scope and content for lay panel deliberations) and two more elaborate exercises in which the public had a more influential role in determining their own way of working and thus their own conclusions.

(Technology) Foresight

The first Technology Foresight exercise was initiated by OST in 1993 with the aim of identifying technologies likely to emerge by 2015 that would have a significant impact on wealth creation and the quality of life. It was, at the time, the largest and most complex exercise of this type ever undertaken in Europe, and it was accompanied by extensive commentary and some degree of controversy[551].

Technology Foresight was designed to marshal the intellectual resources of UK experts in research, technology and "exploitation", significantly broadening the range and degree of input by the expert community into innovation policymaking. As such, it was not intended to include, in a substantial way, consultation with end users or representatives of the general public. There was minor involvement of user groups and the public on an incidental or discretionary basis. However, the main thrust of Technology Foresight was an interactive process of eliciting expert opinion. It was based on a major "Delphi" survey, a set of regional workshops with invited participants, and a set of fifteen expert panels intended to cover most sectors of the British economy, under the leadership of a Steering Group.

The Steering Group selected about 60% of the members of the 15 sector panels using a co-nomination process that was also used to identify a wider expert pool that could

[550] Office of Science and Technology (1993), *Realising Our Potential: A Strategy for Science, Engineering and Technology*, (HMSO, London).

[551] P. den Hertog, J.A. Stein, J. Schot and D. Gritsalis (1996), User involvement in generating and applying Hertog RTD: Concepts, practices and policy lessons, project report to the European Commission (DG XII), TNO report STB/96/011, Apeldoorn, The Netherlands, April 1996, also published by the European Commission, DG XIII/D2, as a report of the Interfaces: Science - Technology - Society programme.

be consulted by the panels[552]. The remainder were identified more informally, on a discretionary basis, in order to achieve broader representation (for example, each of the sector panels typically had one or two women members, although none of the panels was chaired by a woman). Participation in Technology Foresight was dominated by well-established experts in technology and its exploitation (indeed, a "grading" system was used to select experts). A few representatives of consumer organisations and other non-governmental organisations were involved. For example, John Dawson of the Automobile Association was on the Steering Group, and members of Transport 2000, a voluntary organisation promoting public transport and the use of bicycles, took part in the Delphi survey. There was also some degree of wider participation in the regional workshops. Those involved in running the workshops said that invitations were easy to acquire, though only those close enough to the process to be aware of this were in a position to request an invitation.

It was a stated objective of the Technology Foresight exercise to bring together users and producers of R&D. However, in the parlance of OST, the term "user" was understood to refer to industry and other organisations (such as hospitals) which take up the results of R&D in order to produce goods and services for public consumption by end users. In other words, "users" took the role of intermediaries between knowledge producers and the public, who were conceptualised as consumers (as distinct from citizens).

The limitations of Technology Foresight to address the "crisis in competitiveness of British industry" through inadequate embedding of the process in the social context were recognised by critics and acknowledged even by those responsible for the design of the exercise (Loveridge, Georghiou and Nedeva, 1995). This led to a number of NGO initiatives which extended the consultation to, for example, young people (*e.g.* Visions of the Future, organised by the British Association for the Advancement of Science).

In the second round of UK Foresight, the word "technology" was dropped altogether, in an effort to broaden the discussion, and explicit efforts were undertaken to broaden "stakeholder" participation. Like the Technology Foresight exercise that preceded it, Foresight was constructed around a set of sector panels covering the range of economic activity in the UK. Unlike Technology Foresight, however, the second round was a much lower budget and generally lower-key exercise. Public involvement, as before, was left to the discretion of the panels, and according to one panel member familiar with the exercise as a whole[553], the degree of public consultation was not significantly greater in practice than had been the case for Technology Foresight.

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[552] D. Loveridge, L. Georghiou and M. Nedeva (1995), *United Kingdom Technology Foresight Programme: Delphi Survey*, report to the Office of Science and Technologyk, PREST, University of Manchester.
[553] S Hewer, personal communication.

The new Foresight exercise succeeded in broadening stakeholder participation in the panels to some extent, by including more representatives of NGOs such as consumer groups and environmental organisations, and representatives of the voluntary (charity) sector. However, the Foresight panels remained dominated by the more traditional expert communities that constituted almost all of the Technology Foresight panel memberships.

Not only was there greater fanfare surrounding the first Technology Foresight exercise, the policies that followed provided the means to implement the results. A “Foresight Challenge” fund for R&D conforming with the recommendations of the panels, accompanied by funding cuts more generally for the science base, ensured that Technology Foresight would be “successful” in steering British innovation processes. However, the general consensus of participants in Technology Foresight was that its importance lay less in the policies and changes in funding structure that followed than in its construction of new networks of knowledge producers and (predominantly) industrial “users”.

(Technology) Foresight was designed and implemented as an expert-led advisory process; public involvement was heavily circumscribed during the deliberative phase. The Delphi exercise was confined to co-nominated experts; the panel members were selected, and invitations were required to attend the workshops. It was only with the publication of the sector panel reports in both exercises that the discussion was effectively transferred to the public domain, by which time the outlines of policy initiatives deriving from the exercise were already in place.

Consensus conferences

The first of two national consensus conferences in the UK, on Plant Biotechnology, took place in London in November 1994. It was organised by the Science Museum and funded by the Biotechnology and Biological Sciences Research Council (BBSRC), largely at the instigation of Tom Blundell, the Chief Executive of the BBSRC. Modelled on the consensus conferences in Denmark organised by the Danish Board of Technology in the 1980s, this conference brought together research specialists, other experts and members of the lay public to engage in dialogue on scientific and policy aspects of plant biotechnology research.

The UK consensus conference was based on the questioning of experts in biotechnology and related areas by a panel of lay members of the public, selected to be broadly representative of the general public. However, in the UK (as in the case of Dutch consensus conferences) the primary purpose of the consensus conference was to stimulate debate and to inform the public about plant biotechnology and the issues surrounding its research and application. According to Blundell,

> *"We have a responsibility to communicate the new science in a way that is understandable to the public. Ultimately, it must be the public that makes decisions about biotechnology on the basis of its social, legal, economic and other repercussions for the future."*

Plant biotechnology was chosen as the topic of the conference as there was both great scientific and public interest in genetic manipulation. Animal biotechnology was ruled out as it is a highly contentious area in the UK: so much so that laboratories and individual scientists have come under attack by animal rights groups.

A Steering Committee was constituted to oversee the consensus conference, chaired by John Durant, the UK's first Professor of Public Understanding of Science, who holds a joint appointment by Imperial College and the Science Museum. Other members included the research director of a large biotechnology company, a journalist, an academic from a different scientific field, a senior official of the Consumers' Association and the Director of the Parliamentary Office of Science and Technology (serving in a personal rather than an official capacity), along with the conference project manager and the lay panel facilitator. Steering Committee meetings were also attended by a representative of the sponsoring BBSRC and the conference evaluator[554].

The independence of the panel was considered to be of paramount importance, which was why government policymakers either had indirect involvement, participated in a personal rather than in an official capacity, or appeared only at the conclusion of the process when the results were presented. Although scepticism abounded and it was initially difficult to persuade experts to participate, the exercise gathered momentum and in the end was felt that the experiment had been a success, although not without attendant risks. According to one lay panel member, who was elected as the chairman for drafting the report, "industry representatives present... breathed an audible sigh of relief," while "some environmental lobbyists were not so pleased with the lack of bit in some of our recommendations."[555]

A second consensus conference, on nuclear waste management was held in 1999, on a similar basis to the previous conference[556]. It followed, and made extensive reference to, the results of a recent inquiry by the House of Lords Select Committee on Science and Technology on the same topic. The government initially agreed to take the conclusions of the consensus conference into account in formulating a response to the

[554] S. Joss and J. Durant (1995), "The UK National Consensus Conference on Plant Biotechnology", *Public Understanding of Science*, Vol 4. pp 195-204.

[555] G. Lee, "A consensus conference from the point of view of a lay-panel member", in S. Joss and J. Durant, Eds. (1995) *Public participation in Science: The Role of Consensus Conferences in Europe* (Science Museum, London).

[556] UK Centre for Economic and Environmental Development (1999), *UK National Consensus Conference on Radioactive Waste Management*, Final report, (http://www.ukceed.org).

House of Lords report, but its response was written before the consensus conference was completed.

There were three basic elements of public involvement in the UK consensus conferences. First of all, the panels themselves were comprised of lay members selected to be broadly representative of the public at large. Secondly, the presentation of the panels' findings were conducted in well-publicised and well-attended public meetings at which there were also presentations by experts and stakeholders associated with the process, plus extensive opportunities for questions and discussion. Finally, members of the public were informed of the outcomes through a series of publications and press reports.

In the case of both consensus conferences, the topic under discussion had already been investigated by the House of Lords Select Committee on S&T. In both cases, the outcomes of the lay panels deliberations were not dissimilar from the conclusions reached by the Lords. This has prompted some critics to question the utility - and cost - of the consensus conference exercises (the first one had a budget of £86,000). According to the POST report[557], the results of the first consensus conference had "nowhere to go". As the government's response to the House of Lords' report on nuclear waste management was written before the second consensus conference was completed, and the outcome was not discussed in theParliamentary debate on the report, it would appear that the influence of consensus conferences on policy in the UK has been minimal.

Most commentators, both independent and associated with the consensus conferences, felt that the main value in the exercises was in raising quality, informed public debate and in building public confidence in the outcomes of public policymaking in these highly contentious areas.

Public consultation on the biosciences

John Battle, Minister for Science, launched the Public Consultation on the Biosciences in November 1997, on behalf of the Office of Science and Technology, which by then had been transferred from the Cabinet Office to the Department of Trade and Industry. The terms of reference and the methodologies to be employed were finalised by the new Minister, Lord Sainsbury, in the summer of 1998 with the support of an advisory group comprised of experts and stakeholders.

The consultation consisted of six citizens' juries and a larger survey involving 1,000 people from the Cabinet Office People's Panel (see section on Government Initiatives). While explicitly set up to seek the public's views and to promote informed debate,

[557] Parliamentary Office of Science and Technology, *OPEN CHANNELS: Public dialogue in science and technology*, Report No. 153, March 2001.

according to Lord Sainsbury the consultation also aimed to "encourage public confidence in the Government's use of scientific information."[558] Run by MORI, a major public opinion research company, the exercise exhibited characteristics of mainstream market research as well as the more consultative, interactive approach in the citizens' juries. According to Irwin (2001)[559], who observed some of the citizens' jury meetings, participants were seriously engaged in the process and the citizens were effective in shaping conclusions. However, the influence of their findings was limited. Irwin traces how the discourse shifted from the initial participatory formulation used by John Battle to the ultimate reception of the results by Lord Sainsbury, as clearly subordinate to the mainstream scientific advisory mechanisms informing government policy.

Citizen Foresight

Technology Foresight was heavily criticised by those who felt that the exercise was too remote from societal needs assessment to form the basis of democratic decision-making. One initiative organised by the University of East London and The Genetic Forum, on "The Future of Food and Agriculture", experimented with a different, citizen-led approach in which the lay panel was able to refine its own terms of reference in addition to contribute to the selection of expert participants.

The twelve members of the Citizens' Panel were randomly selected, in a constituency that had voted consistently in accordance to the UK as a whole in national elections for over 40 years. The panel met weekly in the function room of a local pub over a period of ten weeks. The process was overseen by a Stakeholder Panel comprised of representatives of key interest groups, in order to present the panel with an initial set of briefings that could be considered balanced, well-informed and fair. The panel considered evidence presented by a wide range experts and stakeholders, refining their own terms of reference as the exercise progressed, and requesting that the organisers provide additional information and invite additional, specific types of witnesses. With the help of a facilitator, the panel drew up a final report with a set of findings, most of which were by consensus. Where there was disagreement, the report used italic text and identified how many of the panellists were in agreement or disagreed.

The report of the Citizens' Panel was presented at a public event/press conference in Central London, at which the exercise was presented by the organisers and several panellists read out selected portions of their report (being unaccustomed to speaking in public). The final report of the Citizen Foresight exercise included background context,

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[558] T. Wakeford *et. al.* (1999), *Citizen Foresight: A tool to enhance democratic policy-making*, report of the London Centre for Governance Innovation and Science and The Genetics Forum, London.

[559] A. Irwin (2001), "Constructing the scientific citizen: science and democracy in the biosciences", Public Understanding of Science, Vol. 10, pp 1-18.

a description of the methodology, and short responses by members of the Stakeholder Panel in addition to the Citizens' Panel report itself. It was launched at a meeting in the Grand Committee Room of the Palace of Westminster, which was attended by Members of Parliament (both Houses of Commons and Lords), NGOs and the general public, as well as members of the Stakeholders Panel.

Interestingly, members of the Citizens' Panel chose not to attend the Westminster meeting. The report was instead presented as part of a more comprehensive document (Wakeford *et.al.*, 1999). Members of the Stakeholders Panel, who were more comfortable in speaking in public in such an imposing setting, were given the opportunity to present their responses to the citizens' findings. Nevertheless, serious points were raised by members of the public who were in attendance, and discussion took place that might not have been possible in any other context. For example, a member of an environmental organisation was able to ask a representative of an agricultural chemicals company why the company opposed a proposed European directive assigning liabilities to manufacturers, if use of their products posed no threat to human health. Members of Parliament mingled with scientists, journalists and citizen activists, and the debate was to a high standard.

Conclusion

This section focuses on three major types of citizen consultation: expert-led Foresight exercises, consensus conferences and more interactive, citizen-based examples of consultation. Of the six examples presented, it is Technology Foresight, in which the public was for the most part excluded, that had the clearest influence on British innovation policy.

The two consensus conferences, for which the terms of reference were tightly defined, broadly replicated the results of expert-led, House of Lords inquiries, which directly informed Parliamentary debate. The degree of influence these consensus conferences had on policy may have been limited[560], but they are likely to have played as much a role in building public confidence as in reinforcing the outcome of the more traditional Parliamentary science advisory process.

The influence of the public consultation on the biosciences is similarly difficult to assess; like the consensus conferences it may have played a dual role (communicating informed lay opinion to policymakers and to the public at large). Citizen Foresight, the most radically citizen-led example, was highly effective in bridging the gaps between Parliamentary, expert, corporate, scientific, civil society and ordinary public citizen to engage in interactive dialogue. While welcomed by all involved, the impact of the

[560] J Seargeant and J Steele (1998), *Consulting the Public: Guidelines and Good Practice*, (Policy Studies Institute, London).

specific findings on British agriculture is difficult to assess and Citizen Foresight may have been the least influential of all of the consultations described in this section. The main interest in Citizen Foresight appeared to focus rather on its approach to public consultation more generally. While considered an interesting experiment, the Citizen Foresight approach has not taken root in the UK. The traditional scientific advisory system serving Government, the Parliamentary Select Committee inquiries, expert-based public inquiries of other types, regulatory systems and special expert-led consultations are firmly embedded in public policymaking structures, while the more citizen-led consultations would appear to have limited scope for interaction with policymakers and even more limited influence on the democratic process.

One could raise the question of “why bother”? Why go to a great deal of trouble to assemble a citizens’ panel that is broadly representative of UK society to consider highly technical issues, when Parliament is itself constituted as a representative body and has the resources and responsibilities at its disposal to deliberate as well as to deliver? Why not seek to improve Parliamentary democracy itself? We do not propose an answer, but only to raise a more fundamental question about the capacity of any single representative body to responsibly engage with the full range of highly complex issues that face British society today.

In general, those who organise consultation exercises express satisfaction with the outcome; some have also expressed concern that future exercises remain under careful control to prevent their "capture" by special interests. Others express concern that they have already been captured -- by those who already control science and technology in the United Kingdom: industry, government and the research community.

CHAPTER 5.6.

Non-governmental initiatives in PUS: Overview and comparison

Philippe Chavot, Anne Masseran

I. The NGO arena

The OPUS network has chosen to consider NGOs as an arena showing diversity. It includes a whole variety of structures, which share two fundamental elements. First of all, NGOs have the benefit of being independent of governments and this places them in a position to work out their actions according to specific interests. Furthermore, these structures benefit from actions initiated in other arenas of the Public Understanding of Science (PUS) such as, for example, the media or museums.
Therefore, we will not limit our understanding to the sole work of "traditional" NGOs, like Greenpeace, but propose to extend our vision to structures defending the interests of consumers, patients or the environment. We will also take into account the actions of older structures such as the Royal Society in Britain, the Académies des Sciences in France and Austria and the Nobel Institution in Sweden. Structures originating from movements involved in popular education may also be considered as NGOs as their objective is to ensure the promotion of science and techniques. Finally, the independence – at least theoretical - of industries towards governments leads us to include them in our analysis.

If we are to consider that the NGO arena includes such a wide variety of actors and points of view, a whole array of positions towards the values attributed to science may then be perceived. For the sake of clarity, we will distinguish between two main groups. First of all, the actors looking into strengthening the role of science in society. These include "historical" groups playing a role in scientific education (academies, groups of professional scientists, popular education movements, etc) and their heirs (associations aimed at children, etc). In their case, the views adopted are rather universalist in nature and focused on science more than on society, the objective being to defend science. New actors have emerged since the 70s and they have become even more prominent since the mid-90s. These include: militant NGOs, associations of individuals touched by a specific problem or a cause (patients, consumers, the environment), independent counter-assessment centres. These groups of actors are focusing their action on the environment and on the individual, attempting to

demonstrate the impact, both positive and negative, that techno-sciences have on the environment, on people and on society. Science is thus less at the centre of this kind of debate or, at least, its importance is relative to other types of approach. In this case, the debate is of a political rather than scientific nature. Some of these actors are aiming at helping science regain, for example through educating children, a prominent place in democracy , some consider it as a form of knowledge among others and, finally, others try to mobilise science in counter-assessments. We can therefore see a renewed interest for the debate revolving around the social role that science should play. In this respect the NGO arena is far from being set in its ways and, on the contrary, it is made up of moving and dynamic interactions. Finally, all the various actors attempt to redefine the role that the citizen should play in a democracy and in all cases this redefinition involves the position of each individual towards science.
To understand the role played by NGOs in the evolution of the Public Understanding of Science, it is necessary to develop sufficient knowledge of the locations where they emerged, their purpose and their actual power. In this respect, disparities may be observed from one country to another. These are due to the types of actors involved, the influence of the scientific community as well as to the existing tradition in matters of public consultation or citizen debates (see chapter on Consultation and Foresight).

II. NGOs and national contexts

As highlighted previously, the NGO arena includes actors defending specific interests and pursuing many objectives.

- To federate groups of actors working on the promotion of science and technologies: this is the self-assigned role of academies and, to a certain extend, associations existing within the scientific community (in this case, the objective being also to promote scientific research and studies which nowadays suffer from a lack of interest).
- To promote scientific education: this task is mainly undertaken by associations aimed at young people and children, popular education movements aiming at both adults and children, etc.
- To defend the interests of citizens or communities: this is the objective of associations of consumers, patients and their relatives, etc.
- To defend the environment: associations and green movements politicised to various degrees as well as groups involved in awareness-raising actions focused on nature or animal life take on this cause.
- Independent control organisations attempt to promote counter-assessment in the scope of controversies involving safety, nuisances, wrong-doings, etc, related to techno-scientific developments.

- For some of the more "contesting" NGOs - politicised and militant movements, associations grouping "affected actors" - their aim may be to open up the decision-making process to citizens' participation.

A- Defending and promoting science

The main actors for the defence and promotion of science are academies, popular education movements and a certain number of more recently created groups whose work is exclusively concentrated on the promotion of science.

Since the 80s scientific academies, which are present in almost all countries under review[561], undertake promotional actions aimed at various publics. Beside traditional actions such as the publication of newsletters, the PUS activity seems to be intensifying. Thus, in France and Austria, children are a privileged target. Actions arising from a partnership with academies are undertaken in the scope of schoolwork, benefiting from a collaboration between school teachers and scientists, thus granting science a specific position in education. At another level, the Swedish Academy of Sciences, collaborating with the Nobel Foundation in Sweden, has recently contributed in the construction and development of the Nobel Museum. The participation of this type of institution in promoting and defending science leads to science benefiting from an image of trustworthiness based on criteria of "scientific excellence", prestige and historical heritage.

However, these initiatives for the promotion of science are not always followed up by - or based on - an analysis study. The Royal Society of Britain is the only organisation which undertakes an assessment activity of PUS actions and their consequences. Thus in partnership with the British Association for the Advancement of Science and the Royal Institution, it has founded COPUS (Committee on the Public Understanding of Science), which brings together the various institutional actors involved in the field of PUS (scientists, media, museums...). This committee assesses projects, grants awards and is involved in the development and promotion of rules of "good practice". However, although the COPUS is a mixed committee, it is led by a scientific institution. We can therefore legitimately wonder if these assessments are adequate to validate actions which offer various perspectives on techno-sciences or even raise a debate about science?

Broadly speaking, professional groups and movements involved in scientific education have formalised at least three issues which seems to be raised at transnational level in Europe. These three issues seem to be linked to the logic adopted by the actors of the promotion of science, namely: the public's knowledge is not sufficiently high in science;

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[561] Note however that Portugal has recently established institutions undertaking the same role: the Association of Science and Technology for Development (established in 1985) and the Portuguese Federation of Scientific Societies and Associations (established in 1990).

the number of students studying scientific subjects is constantly getting lower; society may not give sufficient value to science anymore.

- The low level of scientific knowledge reached by citizens seems to be confirmed by the results of Eurobarometer Surveys and successive national surveys. This problem is constantly brought back to the forefront of debates to justify various educational actions. In Britain, this assessment was brought to light by the Bodmer Report dated 1985, commissioned by the Royal Society. This assessment, based on wide-ranging surveys, drew a direct link between the scientific ignorance of the British subjects and their assumed inability to fully participate in democracy. COPUS, which goes beyond its assessment function and also acts for the promotion of science, has been established to remedy this situation. A similar assessment was run in France at the beginning of the 80s and it stimulated a number of structures for *Scientific and Technical Culture*, aiming at educating the public.
- We should, however, highlight the fact that surveys such as Eurobarometer are based on highly targeted questions, with academic format and aiming at obtaining measurable results which are, therefore, only quantitative by nature. As a consequence, these questions cannot come close to the knowledge individuals are actually using on a daily basis. Furthermore, these questions are essentially dealing with natural sciences as opposed to human sciences.
- The number of students studying natural sciences is decreasing. Politicians and scientists intend to remedy this "deficit" through an attractive and interesting presentation of science aimed at the younger public. Several associations, particularly in France and Belgium, have undertaken actions with the objective of attracting young people - particularly school children - to science. They organise, for example, meetings with scientists, facilitate a personal interest in scientific issues by the means of hands-on experiences, etc. These associations either operate at local level, (such as *Ose la science* (Daring science) and *Science infuse* (Inbred science), two associations directly linked to the universities of Namur and Louvain-la-Neuve) or form a network, like *Les petits débrouillards* (resourceful little ones) (an international network) or *La main à la pâte* (hands-on) (a French network) or *Les jeunesses scientifiques de Belgique* (Young scientists of Belgium). In Austria, this role is played by the Academy of Sciences, which organises conferences at which prominent scientists speak to school children. The objective is to attract children towards scientific careers by giving science a more human dimension.
- However the decreasing number of students studying natural sciences is only a problem for a certain category of actors (the scientists and politicians hoping that their country will have a position of leadership in science and

technology…). We can legitimately doubt that those who are primarily concerned by this situation, namely the potential students themselves, consider the decreasing number as a problem. Indeed, in most countries, the overall number of students does not significantly drop but it is their choice of career that seem to be changing: social sciences courses of studies as well as professional studies are always running to the full. Thus, considering the decreasing number of students choosing natural sciences as a "vital problem" shows an implicit hierarchy established between scientific studies and others. Natural sciences is always considered to be amongst the most prestigious courses of studies, particularly due to the fact that, in the various countries, scientific and technological developments appears to be a major factor for economic and social development.

- Third issue: it is thought that citizens do not value science sufficiently or, worse still, are questioning its legitimacy. It is mainly as controversies arise around scientific and technological developments that the image of science can be seen as tarnished: it is not automatically the reference system on which any policy should be based ; it is not necessarily a determining vector of progress and of well-being for humanity. For the actors of a "defence" and promotion of science, this phenomenon is interpreted through the model of a deficit in scientific knowledge: i.e. if the public is opposed to certain techno-scientific developments it is because both what is at stake and the benefits to be reaped are not understood. There again, education is often presented as a solution to "suspicion". Industries are particularly active in this field, particularly where their activity is controversial. Their intention is then to highlight to the public their degree of transparency. Cogema for example, whose activity is related to nuclear energy in France, offers information, explanations and annual reports to the general public via their internet site. These actions may, sometimes, be led by private research structures such as the IAASA (International Institute for Applied Systems Analysis) in Austria. Actions are aimed at journalists but sometimes also at students.

Through the emergence of these problems we clearly see that the NGO arena dedicated to the defence of science and technologies has a specific manner to raise issues. Indeed, most actors are professional scientists or, possibly, are trained to act as mediators between science and society (which, moreover, is an notable element of the current scientific and technical culture policy in France). As a consequence, their objectives are related to a "corporatist" interest: defending and promoting the institution, the profession and the values associated with science.

B – Science in perspective

Beside these areas dedicated to the defence and promotion of science, which are thoroughly integrated in the official fabric of organisations involved in the PUS, NGOs of a more "militant" nature are relatively recent actors in the debates surrounding science and techniques. Their influence is more or less significant, both as regards scientific and technical policies and PUS policies.

It is mainly when public controversies arise that these NGOs manage to be heard, at least partially, as they voice their interpretation of techno-sciences in the public arena. This has sometimes led governments to open new consultation areas following awareness-raising and pressure actions undertaken by these NGOs.

Two examples allow for the illustration of the influence that this type of structures can exert.

1. In Sweden, the creation in 1979 of the Council for Planning and Co-ordination of Research (FRN) - involved in the information and education campaigns that preceded the 1980 referendum on nuclear energy - appears to be the government's answer to the mobilisation against nuclear energy organised by a specific movement: The Peoples Campaign against Nuclear Power.
2. In France, the first citizen conference on GMOs organised by the *Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques* (OPECST - Parliamentary Office for the Assessment of Scientific and Technological Options), also appeared to be an answer to the joint pressure actions of NGOs and consumers' associations opposed to the cultivation of GMOs.

Even though these are specific examples, the manner in which these militant and independent structures establish their position in public negotiations involving techno-scientific developments allows us to perceive the forthcoming evolution of these contexts. We see the existence, beside official experts, of counter-assessing authorities. Also, techno-scientific innovations are not necessarily to be seen through a scientific distorting lens, whether or not it is popularised. In this respect, these "militant" NGOs could be a representation of what Ulrich Beck calls reflexive modernity[562].

As we stressed in our introduction, the action of militant NGOs can be directed in various ways: defending the interests of citizens or communities; defending the environment; providing counter-assessments; promoting actions allowing for a large proportion of citizen involvement in the decision-making process.

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[562] Ulrich Beck, *World Risk Society,* Cambridge, Polity Press, 1999.

Defending citizens' interests

Structures working for the defence of citizens' interests are relatively old but controversies arising around recent scientific and technological developments provide them with a new role and even with increased strength.
Thus, consumers associations are often deeply rooted structures, established for several decades and availing of far-reaching networks. Sometimes this places them in a position to influence national and European policies. In Austria and in France, the domain is structured in much the same way and two large associations deal with information, particularly with regards to food. These associations are relatively powerful actors in the scope of current controversies (ESB and GMOs) and they sometimes manage to impose their views in the decision-making process.
Public health is also a domain where actions are directed to the general public. Several types of actors are interacting around this theme: politicians, scientists, individuals affected and grouped in associations… According to contexts and depending on the past of each country, mediation in matters of health-related issues can take different forms. Whereas in Belgium mutual insurance companies raise the awareness of their members with regards to public health issues, in Britain it is mainly scientists who are at the forefront and disseminate popularised medical information. In France, the spread of AIDS, the tragic and complex case of the contaminated blood, together with a strong and militant association structure, have changed the course of this issue. As early as the late 1980s, associations of patients have turned to AIDS-related issues and have carried weight on the direction of research as well as on public health policies. Gradually, these means of acting have been used in the scope of other diseases. Generally, it seems that associations of patients are gaining increasing power in numerous countries, particularly due to the fact that they succeed in forming networks and, above all, develop their own research studies.

Defending the environment

As in the fields of consumer affairs and public health, organisations defending the environment follow two objectives. First of all, information actions aimed at various publics should lead to a daily awareness of the protection of the environment. These actions clearly aim at educating the public on simple actions, which can effectively contribute in protecting nature. In this domain, local structures are the main actors - particularly in France and Belgium - acting through the dissemination of information to citizens on ways to reduce energy consumption, avoid air pollution and recycle waste.
Furthermore and beside these local structures, politicised international networks aim at raising the citizens' awareness on environmental problems neglected by government policies at regional, national or European level. Thus Greenpeace has a presence in almost all countries (except Portugal). However, national branches avail of a certain freedom as to the choice of actions to be undertaken and the field of operations. There

again, contexts represent a determining factor. Whereas in Sweden and Britain, Greenpeace takes an active part in research studies to find alternatives to certain technological options, in other countries, like Austria, relationships with political green parties are somewhat stronger.

Furthermore, national or even local organisations are well established in some countries and virtually non-existent in others. Thus the Swedish Society for Nature Conservation (SSNC), which was established in 1909, exerts a strong influence on the decision-making process in environmental matters whilst also raising the awareness of young people with regards to the cause. In Austria, however, international NGOs such as Greenpeace and Global 2000 are the only genuinely visible organisations, at the expense of more local structures. In each country, actors are organised in a specific configuration and this may bring an element of explanation as to the way environmental issues are dealt with within the country.

Finally, with regards to the environment, independent counter-assessing structures have an important role to play, particularly in matters of environmental and health hazards related to technological equipment. Within the countries where they are established, these structures are important actors in the debate on science, technology and society. For example, this is the case in Austria where science shops are re-emerging and in France where the *Crii-rad* (*Commission de Recherche et d'Information Indépendante sur la Radioactivité* - Independent Commission for Research and Information on Radioactivity*)* and the *Crii-gen* (*Comité de Recherche et d'Information Indépendantes sur le Génie Génétique* - Committee for Independent Research and Information on Genetic Engineering) are established.

Widening citizens' participation

Finally, it should be highlighted that some of these NGOs are attempting to facilitate citizen participation. We can distinguish between two visions of participation : a participation in the reflection process, which resembles a manner of awareness-raising with regards to social challenges related to the introduction of techno-scientific innovations on a daily basis ; a participation in the decision-making process as such.

- Participation in the reflection: the development in a number of countries of "science cafés" represents one of the best examples of this type of action. The objective is to place science and technique in perspective with social and cultural concerns etc … We cannot fail to notice that even such locally based actions do not have the same meaning, or even are not based on the same philosophy, depending on their context. Thus in Britain, we can observe that prominent scientists are placed on a pedestal and, through conferences, they explain science to citizens. In this case, the scientific logic remains therefore central. In France, one banks on the interaction between scientists and other actors involved in a given field (such as professionals, associations and, obviously, citizens). The objective is to facilitate the emergence of a varied debate, not necessarily consensual. Adopting an extreme stance, some science cafés won't even accept the presence of scientists and prefer giving full latitude to the citizens' opinion. We should stress, however, that research institutions are increasingly using this space and organise their own cafés. In these cases, the model of a conference with science on its pedestal is much closer …

- Citizen participation in the decision-making process: this movement is much looser and mainly appears when controversies arise. Actors calling for a participation of the citizens in the decision-making process come from a variety of horizons and their representation is set in its context. Mention can be made in this category of professional unions or alternative organisations such as ATTAC. In these cases, techno-scientific issues are always linked to other issues, for example, political, social or economic. These movements are currently developing and one can legitimately wonder if their influence will go beyond specific cases and if they will indeed develop to become a genuine political power.

NGOs and non-governmental initiatives as PUS-actors in Austria: Heterogeneity and expansion

Ulrike Felt, Martina Erlemann, Maximilian Fochler

Using both the notion of NGOs (meaning classical Non Governmental Organisations) as well as non-governmental initiatives in the heading of this chapter, hints at the fact that we intend to cover a broad range of organised structures, which are actors in the domain of PUS-activities and are not under direct influence of the national government. In that sense we leave an approach, which would focus specifically on the highly visible big multinational actors such as Greenpeace or Global 2000, and will also take a look at the role played by smaller associations, self-help movements and private enterprises that are present in this domain. Needless to say we will not, of course, be able to cover all initiatives, but we will give a general impression of the different types of activities that structure this space.

How to organise a chapter on such a dispersed variety of activities and actors? We decided to divide the material in two major categories. On the one hand we will discuss those who could be regarded as bigger institutional socio-political actors, which carry out PUS activities mainly as annex activities to their political agenda. In this group organisations for consumer protection, the classical NGOs in the environmental domain as well as bigger organisations in the medical domain can be categorized. On the other hand we will regroup smaller initiatives and in particular those who took their start as citizens' engagement.

I. Institutionalized socio-political actors and their PUS-activities

Thus, we will discuss the bigger players in this part of the chapter. None of them are explicitly aiming at doing science communication, but do so as part of their pursued political agenda.

Organisations of consumer protection

Consumer protection in Austria is a fairly monopolised field, with mainly two institutions officially responsible, the Association for Consumer Information (VKI)[563], a non-profit organisation established in 1961, and the department for consumer policy of the

[563] http://www.konsument.at

Workers' Chamber (AK)[564]. Both institutions are politically identified with the left-wing party (social democrats). Although they can neither be classified as clear-cut PUS-initiators nor as institutions mainly concerned with issues of science and technology (a lot of their work is on rental, insurance and consumer law), they nevertheless play a role in transporting information about and conveying certain images of science and technology to Austrian publics. This role is particularly visible in public techno-scientific controversies, where they have to position themselves (e.g. "gene-food").

What is specific about the consumer protection institutions in Austria is primarily their direct contact with the people: The AK offers phone information/consultation as well as personal counselling; the VKI has a call-centre-like information service and also does personal consultation. Both publish a series of information brochures that are not only distributed locally, but also in contexts where information for special target groups is needed, like adult-education centres, schools etc. Secondly, they enter the stage when products (also when linked to scientific and technological developments) seem problematic for consumers. Constant fields of preoccupation are for example issues on food (GMOs, chemical and other food additives etc.) and information technologies, especially mobile communication (mainly marketing issues, but also the discussion over the risks of EM radiation).

The VKI, a more consumer and service-oriented organisation, focuses on individual counselling and works as an accredited product- and service-testing institute in co-operation with several laboratories on a national level, as well as internationally[565]. The AK, on the contrary, is more policy oriented, trying to enforce "improvements on the legal level for all consumers", and thus keeps close contact to the ministry in charge of consumer issues as well as to chambers and associations from industry and commerce.

"Classical" NGOs in the environmental domain

There are a whole range of interest groups and advocacy groups in Austria dealing with specific topics around science and technology, like the *Association of Hill Farmers* (40% of Austrian farming is mountain farming) which was and is fairly present in issues on GMOs and other technologies affecting agriculture; or the *Climate Association Austria* (Klimabündnis Österreich)[566], an NGO networking and lobbying internationally as well as regionally and locally against CO_2 emissions.

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[564] Bundesarbeitskammer (1995), 75 Jahre Kammern für Arbeiter und Angestellte, Verlag des Österreichischen Gewerkschaftsbundes; www.arbeiterkammer.at/;

[565] The VKI is member of the worldwide association Consumers International, member of the Bureau Européen des Unions de Consommateurs (BEUC) and International Consumer Research and Testing Ltd. (ICRT)

[566] www.klimabuendnis.at/root/start.asp

Constant (media) presence and general visibility across various topics however is maintained only by the two bigger environmental organisations, Greenpeace Austria[567] and Global 2000[568] (affiliated to Friends of the Earth International). They are the only two organisations, who, despite competing in a very small donation and membership market, on which they rely financially, can afford larger-scale campaigning activity in the environmental sector. In addition to the lobbying of politicians, they try to remain present in the public sphere by "revealing scandals" and sensitizing people for certain issues. This is important both for assuring their symbolic and financial survival, but also to push through and make their political agendas more forceful.

With regard to their "historically grown topics" like the concern about nuclear energy, the two organisations have also established themselves as centres of know-how and participants in powerful networks (media, politics). Other important topics are of course genetic engineering, climate, nature and animal preservation, and biological farming, which is very strong in Austria and lobbied respectively.

Additionally there is a wide range of organisations that, although not all of them can be presented here in detail, we would at least like to mention some. They all provide information for the interested or (potentially) affected public, with more or less political motivation. Firstly the *Bioclub*[569], which is an association of promoters and practitioners of biological farming in Austria, then the *Ökobüro*, the umbrella organisation of Austrian environmental organisations, and finally, the *Umweltberatung*[570], which is the association of Austrian environmental counselling services that work in most parts of Austria and are mainly concerned with consumer issues, currently GMOs and BSE.

The health sector

In the domain of health an important divide to be made is between the bigger and highly institutionalised organisations and the smaller and/or patient-driven initiatives. We will only deal with one example of such a bigger actor here, the self-help movements will be treated in the second part of this paper.

The player we want to take as an example is the Aidshilfe Österreich[571] (Aidshelp Austria). While its self—understanding is that of a self-help movement, it however has, due to its size and organisation (it is a network of independent Aids-help groups which work in the different *Bundesländer*), a different status and other functioning mechanisms than smaller patients'-organisations (see part II of this chapter). In their self-definition the Aidshilfe Österreich stresses that they want to position themselves as information-broker, they want to provide the scientific "knowledge, which leads to the

567 www.greenpeace.at
568 www.global2000.at/intro.htm
569 www.bioclub.at/
570 www.umweltberatung.at/
571 http://www.aidshilfe.at

right action in a given situation". Apart from targeting the segment of young people and those already affected, they in particular address so-called multiplicators, i.e. teachers, medical staff etc. The ways in which they organise their PUS activities cover a very broad range from lectures with discussions, over information platforms on the internet (with a particular segment for young people as a target group), projects with school children, "radio positive", which is broadcasted once a week and addresses affected people, to a newsletter, a journal as well as information brochures,

II. Smaller initiatives and associations organised by citizens

This second group of initiatives that do have a role regarding PUS-initiatives are much smaller in size and have a large diversity of organisational formats, aims and visions about the relation of scientific and technological development with regard to their aims. We will begin with a more extensive discussion of self-help groups and patients' associations, will briefly touch what is called *Bürgerinitiativen* (citizens initiatives) who are indirectly also active in communicating about science and technology, then we describe the implementation of the science shop movement in Austria. We will look at two examples of what could be called info-brokers in the domain of gene-technology, and end with a short description of yet another imported idea, namely that of science cafés.

To end this chapter we will add an observation that in fact with the growing importance of the PUS movement a new group of actors was born, namely those who do professional counselling on science communication.

The role of grass-root-organizations in the Austrian health sector: self-help-groups and patients' associations

The role of self-help-groups concerning the Public Understanding of Science in the health sector should not be underestimated. Besides fulfilling psycho-social functions these groups also play an important role as "translators" of medical knowledge as well as as fora where different forms of engagement of lay people with the medical world, different kinds of therapies or diagnosis can be discussed, compared and evaluated.

The Austrian landscape concerning grass-root self-help-groups cannot easily be described in depth, for social science research in this field is practically completely absent[572]. Considering the existing data from surveys and governmental institutions[573]

[572] Svoboda, Brigitte: Sebsthilfegruppen im Gesundheitssystem, in: Forster, R., Froschauer, U., Pelikan, J.M. (Hg.): Gesunde Projekte. Initiativen und Modelle im österreichischen System der Gesundheits-sicherung und Krankheitsbewältigung, Wien: Jugend und Volk

[573] For example the Self-Help-Group-Registry SIGIS of the Fonds Gesundes Oesterreich, www.fgoe.org

it seems possible to state that the number of self-help-groups in proportion to the total population[574] is far below levels in comparable countries, for example Germany[575].

The existing groups can be characterised as grass-root organizations in the sense that they show less formal organizational structures than the larger NGO's in the health sector, but not necessarily in the sense that they are initiated by citizens/patients in a bottom up-approach. Rather, it is not necessarily the exception that self-help-groups are initiated and sometimes even lead by doctors. It can be expected that the work of these groups concerning PUS, especially the critical comparison of different medical approaches, will differ from that of more independent self-help-groups.

The reasons for this situation may, on the one hand, be seen in the general development of the relations between science and society in Austria[576], and more specifically in the little financial and organizational assistance offered by the state.

Nevertheless, recent years have witnessed quite an increase in the activities of self-help groups and patient organizations. For example, the internet platform www.patients-online.at (see also the chapter on media and internet) offers medical information from patients for patients. Furthermore, several groups have started public campaigns to alter the public perception of their respective diseases, Multiple Sclerosis[577] being the most recent example. The maybe most noteworthy development concerning the discussion of issues concerning medical science and technology has been the institutionalisation of an alternative ethics commission[578] comprising of members of self-help-groups and disability-rights-organizations. The name of this commission "Ethics Commission for the Austrian Government" carries a deliberate notion of protest against the fact that the official Austrian ethics commission is comprised only of experts without a representation of the voices of affected people.

A new group of actors engaging in a different form of science communication than other actors in the field of health are associations of patients affected by orphan diseases[579], for example Debra Austria[580] or the Austrian Society for Muscular Research[581]. Often linked with similar groups in other countries, the goal of these groups is not only to improve the frequently suboptimal conditions for treating these diseases in the Austrian health care system, but also to raise money to fund specific research projects in order to find a cure for their disease. Since no public money is available for these groups (they are regarded as too small in number), they see the

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574 Hribernig, Karin (1998): Die quantitative und qualitative Dimensionierung des Nonprofit-Sektors in Österreich dargestellt an Selbsthilfegruppen und Selbsthilfeorganisationen im Gesundheitsbereich, Wien (Diplomarbeit)

575 Söllner, Wolfgang (1996): Selbsthilfegruppen und Selbsthilfeorganisationen im Gesundheitswesen, in: Uexküll, Thure von et.al. (Hg.), Psychosomatische Medizin, München: Urban und Schwarzenberg

576 See Chapter 4 for a detailed description;

577 http://www.ms-ges.or.at/

578 http://www.service4u.at/ethikkommission/

579 An orphan disease is a disease that statistically affects so few people that neither public nor commercial research is funded.

580 See www.debra-austria.org and www.schmetterlingskinder.at

581 See http://www.arcs.ac.at/news/events/science-talk/docs/muskelforschung_broschuere.pdf

need to communicate about their disease in order to raise funds. Interestingly for example Debra Austria has consciously chosen not to communicate the scientific content of their research projects, but to rely on describing the difficult living conditions caused by the disease that these projects are hoped to find a cure for. Besides the lacking a tradition of science communication in Austria that these initiatives could build on, a major reason for doing so is the fear that for example communicating projects involving medical genetics and gene therapy might be connected to the controversial topic of gene food.

Bürgerinitiativen (Citizens' initiatives)

Austria has a rather lively landscape of what is called *Bürgerinitiativen* (there are surely several hundreds such initiatives that are more or less closely linked to techno-scientific or medical issues). They are generally bottom-up organised initiatives varying largely in their degree of organisation, dealing with a broad spectrum of topics, among them also some, which touch on techno-scientific issues. These Citizens' initiatives generally rather work in local context, although some of them have managed to implement themselves on a national level.

One would find numerous examples in the domain of genetic engineering with regard to food, on electro smog, on environmental issues, anti-nuclear energy and many more. They provide people with web-sites, partly with the possibility to ask questions, produce information brochures, organise lectures on special topics and try to gain influence on the local or federal political agenda with regard to their topic. As the people working in these initiatives are rather engaged with their respective topics they are often ready to invest a considerable amount of time and their communication efforts are thus sometimes more powerful and appreciated than those organised in other settings.

Science Shops (Wissenschaftläden)

Science Shops are institutions aiming at linking groups of citizens, self-help groups or NGOs to those fields of science, which could help them solve their specific problems. The first science shop emerged in the Netherlands in 1974, where they are now obligatory part of every university. In 1991, the Vienna Science Shop[582] was founded, further such centres followed in 1993 in Graz, Linz and Innsbruck. The idea was to establish a rather active intermediary agency between the public sphere and university research. The activities included initiating masters and PhD theses on issues of public relevance, contacting experts in case somebody needs scientific or technological advice and carrying out literature surveys on certain areas of research of general

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[582] http://members.chello.at/wilawien/

interest. The services are free as long as the requests are non-profit oriented, of "practical nature" and "affecting a larger group of people".
Initially funded by the Federal Ministry for Science and Research, the situation became increasingly difficult for them due to the radically changing conditions in the science system in the 1990's. The Science Shops never managed to develop into a network of stable institutions of a similar kind in the four different places. On the contrary, after the support of the Ministry was cut, each Science Shop had to find an individual solution. In the case of Graz[583] it managed to be integrated in the University of Graz and work there as a platform mediating information and research between outside customers and research institutes, often in the form of Masters or PhD thesis. The Science Shop in Vienna does not have any formal ties to the universities and understands itself as an independent research institute in the cultural and social sciences. It still tries to initiate praxis-oriented research, in particular for NGOs and other non-profit oriented institutions; however this activity had to be restricted due to the financial short-comings. PUS-activities belong to their declared aim. In Linz[584] the Science Shop turned into a communication agency, which would among others also give support for initiatives in science communication. And finally in Innsbruck the former Science Shop is now attached to the *Institute für gesellschaftliche Forschung, Bildung und Information*[585] and is active in initiating masters and doctoral thesis on topics which are of relevance to users outside university. Newly founded was a structure similar to the Science Shops at the University Salzburg[586], which also aims at the transfer of knowledge from the university to the societal environment. It also uses the tool of initiating masters and doctoral thesis in areas interesting for larger societal groups.
In conclusion, one could say that the idea of the Science Shops could not really develop into strong actors and stabilise in the Austrian context. The situation was too dependent on local configuration and on the interest of the universities to get into co-operation with them. While this worked out in Graz, in Vienna such a co-operation never saw life. Thus the profiles of the different science shops had to adapt in order to survive and moved partly quite far away from the initial idea – thus this is an interesting case of how difficult it is to transfer a well working model from one context (and time; namely in the Netherlands and the 1970's) to another cultural context and another period in time. The Austrian science shops are however rather active in a number of networks funded under the 5th framework program, which try to analyse the potential of science shops and to develop new visions for the future.

[583] http://www-gewi.kfunigraz.ac.at/wila
[584] http://www.fabrikanten.at/
[585] http://info.uibk.ac.at/c115/c11508/
[586] http://www.sbg.ac.at/was

Information-brokering: The special case of genetic engineering

In particular in rather sensitive domains like the field of genetic engineering different actors appeared in recent years, who try to position themselves as “neutral” information brokers. The number of such actors is definitely growing, in particular since the internet offers a rather low-cost possibility. We will mention just two examples here.

The first, *Dialog Gentechnik*[587] (formally named Gentechnik & Wir), is an association created by a number of associations of scientists working in the field of genetics. They thought it to be crucial to create a common information platform, which would become a central player in preparing and diffusing information about the large variety of aspects linked to genetic engineering. Sponsored through concrete project work by all the Ministries that are engaged in this area as well as through projects funded by the EU, it tries to position itself as a central and independent actor (they underline the fact that they are not supported by the pharmaceutical industry on their web-page). However, as it is lead by scientists active in the field there is definitely the ambition to make the scientists’ position better understood and accepted in the public sphere.

Dialog Gentechnik is very active in many domains. They in particular address teachers and school children providing a broad variety of information materials, special actions, discussion forums, a kit for genetic experimenting for school classes and much more. Furthermore, they are involved in the science communication activities of the Austrian Genome research program (Gen-Au), they organized an exhibition on *pros* and *cons* of gene technology and were involved in many other initiatives such as the Discourse Day on Genetic Diagnosis or the Citizen Conference on genetic data (see chapter on Public Participation and foresight).

INFOGen[588] is the second, albeit much smaller initiative in this domain, which we would like to present briefly. It is a publicly funded service recently established by the Interuniversity Research Center for Technology, Work and Culture in Graz. This service formulates its aims as: informing, fostering interdisciplinary co-operation on this topic as well as allowing for a broad discussion on the societal consequences of gene technology. INFOGen in particular aims at addressing those people who work as teachers, in adult education, as health and nutrition counselors, and people who have to deal with these issues in the context of their profession, such as doctors and farmers. They provide information on their web-page, organize public conferences and do direct counseling work.

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587 http://www.dialoggentechnik.at

588 http://www.ifz.tu-graz.ac.at/infogen/frames.html

Science Cafés

Science Cafés are another example – after the science shops – of an "imported" (from France) science communication setting. In fact it is unclear whether these cafés would at all have their place under this heading of non-governmental initiatives, as in some cases they are simply organised by individuals or under the heading of universities like in Vienna (1. Wiener Philosophen Café) and Innsbruck (*Philosophisches Café*) and not by associations. In the Austrian case there is a small number of such cafés, which have so far not gained much visibility. In fact, the question to be asked is why, in a cultural context where the coffee-houses have always held a central role as a place for communication and exchange, the idea of the science cafés did not really work out – measured by the relative small number of participants who attend.

III. Counselling in the field of Science Communication as a new profession in Austria

Apart from these more concrete initiatives there are other developments, which merit our attention. Through the growing public discourse on the necessity of more and better communication of science, a number of initiatives were created which aim at offering know-how in organizing science communication initiatives. Thus the interface between science and society begins to be shaped by such in part more commercially oriented undertakings.

Let us briefly mention two such examples; one specialized in the biosciences, the field with the highest growth rate in science communication, the other with a broader focus.
We start with *DNA-Consult,* which in the beginning was an association of young natural scientists who for roughly a few years are engaged in planning and carrying out initiatives for the communication of science in public settings. Their projects and initiatives are financed both by public and private sponsors. Based on the idea that without being educated and informed people should not take part in decision-making, they are involved in preparing information campaigns and similar types of initiatives. Their philosophy has been self-described as aiming amongst others at "Sciencetainment". The latest example was the organization of a "Sperm Race", an initiative at the Ars Electronica, where men could hand in their sperm to be "tested for fitness" and women would be supplied with some information about the donor (color of hair, size, weight, what car he drives...) and could bet money on whose sperm is going to win. The event was thought to provoke discussion on prejudices present in the field of technologically assisted reproduction and heredity in general. More recently *DNA-Consult* was transformed into a private company doing PR or preparing PR concepts for all kinds of scientific institutions and helping to find sponsors for such initiatives.

The second case to mention would be "Brainbows- the information company"[589], which positions itself as consultant in strategic political communication as well as a content-provider in the sectors environment, energy, sustainable development, consumer protection and food.

It seems as if such institutions will begin to play an increasingly important role in the future as presenting science to the public has become an important element of the self-representation of scientific institutions. The impact they will have and the role they will play remains to be evaluated in the years to come.

Summary

- NGOs and non-governmental initiatives as PUS-actors play a central role in the Austrian system as in controversial situations people tend to trust them more than the official governmental experts.
- These institutions or associations understand themselves largely as an important counterbalance to the classical power relation between science and citizens.
- NGOs and non-governmental initiatives strongly rely on the internet to diffuse their information and the web-pages are often much more elaborate than comparative pages within the universities.
- The landscape of these institutions is rather diverse and not very clearly structured. There are only a few bigger actors, which are generally multinational, and besides that there is a bewildering diversity of smaller actors working in focused areas.
- The two "imported" communication settings – the science shops (The Netherlands) and the Science Cafés (France) – did both not manage to see the success they had in their original countries. This hints at the importance of adapting imported models in a way that they become suitable to the concrete cultural context (which could even be a local one in the strictest sense).
- All these institutions are highly fragile due to their difficult financial situation. This is even more the case for smaller local initiatives.
- The public they address is very diverse ranging from citizen groups, the school children, NGOs, people touched by a certain illness, … but overall one could say that generally social groups are rather addressed than individuals.

[589] In the domain of biotechnology and food, "Brainbows – the information company" has a rather rich web-site on genefood (http://www.genefood.at).

CHAPTER 3.6.

NGOs and non-profit associations in Belgium: between voluntarism and professionalism

Gérard Valenduc, Patricia Vendramin

1. Background

A large range of initiatives in the PUST area is initiated by NGOs, however their activities are developed within different frameworks. In order to understand the diversity of NGOs in this field, it is useful to point out some fundamental distinctions between these NGOs as regards PUST.

PUST activities within NGOs can be divided in two categories:

- Those for which PUST is a secondary activity, the main activity consisting of social or political intervention (consumers' organisations, environmental organisations, health organisations, trade unions, etc.).
- And those for which PUST is the core business for example many non-profit organisations such as "ose la science", "science4u", "les petits débrouillards", "science infuse", etc.

Within the latter different types of NGOs can be distinguished depending on their target groups, main orientation or institutional environment:

- Many NGOs target groups of young people in their PUST activities whereas others address the general public.
- While some NGOs focus on cultural development for example museums or cultural centres, others have education as their main purpose. These latter groups of NGOs address pupils and schools.
- Some NGOs have structural links with big institutions like universities and museums), others are independent non-profit organisations that sometimes network with other similar organisations in other countries an example of this is "les petits débrouillards".

2. PUST as a core activity

Several NGOs active in this area are independent non-profit organisations, created on a voluntary base and often involving unpaid work from teachers, animators or researchers. They often get subventions from the Regional authorities, either as youth organisations or as organisations for continued education. Some examples are as follows;

"Les petits débrouillards" (the small smarts)[590]; this is a non-profit association created in 1996 belonging to an international federation created in Canada in 1989. The goal of the association is to raise the interest of children from the ages of 7 to 12 years to science. They try to take science out of the labs by constructing their scientific experiments using objects from everyday life. Scientific work-groups are offered in schools as well as activities and visits during school holidays.

"Science4u" is a platform whose central mission is to support the gathering of citizens and science. In other words it is an interface between the citizens and the science world. The main goals of the organisation are to ask all actors within PUST field what kind of activities they offer to the public and to establish a contact with the public, informing them of activities on course, answering questions and offering advice. This organisation does not actually organise any specific activities rather it works as an interface between the general public and all the actors dealing with scientific and technological popularisation.

"Les Jeunesses scientifiques de Belgique" (Belgian scientific youth)[591]; is a long-standing organisation devoted to the promotion of science. Its twin purposes are to promote interest for science within youth without discrimination and to contribute to the training and the scientific culture of young people. The organisation proposes training courses, holiday activities, etc. Many scientific subjects are treated in connection with actuality and not just restricted to matters included in official school programmes.

"Jeugd en Wetenschap" (Youth and science) is a result of the merger in 1999 of two non-profit organisations, the Flemish part of the "Belgian scientific youth" and another Flemish organisation "Youth and cultural patrimony". It has the same purposes as its French-speaking counterpart plus additional purposes related to the conservation of the industrial and cultural patrimony in Flanders. The units of archaeology in universities of Leuven and Antwerp support the latter aspect.

Other NGOs are also closely linked to universities as a result of the emerging role of universities in PUST, cf. ad hoc paper and partially subsidised by them:

"Ose la science" (dare science)[592]; is an association for the promotion of the scientific activity for the youth within the university of Namur. The first concern of this association is to give young people a taste for search, encouraging team spirit, promoting tolerance and a respect for differences. The scientific activity is seen as a framework in which the young people can develop a new confidence in the future and become aware that they can conclude a project. The organisers are above all concerned with the following

590 http://www.lespetitsdebrouillards.be
591 http://www.jsb.be
592 http://oselascience.be.tf or http://www.sciences.be

significant aspect of education: to actively reconnect young people with the real word and help them locate themselves in a world dominated by technology.
"Science infuse"[593] is an organisation that has been created by the science faculty of the university of Louvain-la-Neuve. The purpose is to help discovery of science through the establishment of links between researchers, schools, general public and enterprises. The target groups are children from 5 to 18 years old, teachers in primary and secondary schools, families and holders of diplomas of science faculty. Their activities' main goals are: i) to develop an interest for sciences and for scientific methods through experimentations and work-groups; ii) to establish links between schools (both primary, secondary), universities and working world; and to reveal the importance of science in culture and economy. The organisation proposes a wide range of activities for the different target groups.

3. PUST as a secondary activity of socio-political NGOs

Most of "The socio-political" NGOs, in the areas of the environment, consumption, health and working conditions, devote a significant part of their activity to the diffusion of relevant scientific and technological information to their target public. Science communication is not a goal for them, but a tool that is used to improve the efficiency and arguments for their interventions.
Science and technology is not only an issue of communication but also an issue of capacity building of expertise and counter-expertise. The case of systematic use of counter-expertise by Greenpeace is a well-known example, but the need of scientific or technical expertise is not limited to conflicting situations. Several NGOs are also involved with consultative bodies and their technical committees, mainly in the areas of the environment, sustainable development, consumption and working conditions (cf. paper on consultation and foresight). They take part in advising the processes, where they must carry out peer-to-peer discussions with other experts coming from industry, consultancy, universities and public administrations.

a) Environment and sustainable development

A recent study carried out for SSTC-DWTC[594] identifies two main channels of communication between scientists and the general public in the area of environment and sustainability:
Public information offices or "counters": all three regions (Flanders, Brussels and Wallonie) have set up for more than 10 years a network of "energy counters" and

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[593] http://www.sc.ucl.ac.be/scienceinfuse/
[594] Mormont M. & al., *La communication scientifique en matière de développement durable*, SSTC-DWTC, Brussels, May 2000.

“environment counters”, where the general public can access technical and scientific information on rational use of energy in housing, hazardous substances, environmental regulation, etc. These offices, which are present in a lot of big and medium-size cities, also provide technical advice. The three regional federations of environmental associations (Inter-Environment Wallonie, Inter-Environment Bruxelles and Bond Beter Leefmilieu) who operate these counters are more engaged towards environmental action.

Targeted scientific and technical publications: organisations such as Greenpeace and the federations of environmental associations publish very well documented files for their members. As in other countries, every campaign of Greenpeace is supported by extended sources of information, including reports, bibliography, policy papers, etc.

b) Consumption

Information of consumers is another channel through which NGOs can diffuse scientific and technical information:

The most classical and well-known channel is the diffusion of comparative tests of technical products or devices, which are a very widespread source of technical information, related to everyday life for the general public. The quality of this information is much better than corresponding information in the “technical press”, for instance in the case of computer technology, where technical magazines are much less critical than consumers’ magazines. In Belgium, the audience of the consumers’ organisation “Test-Achats / Test Aankoop” is very broad. Its advisers are often called as experts in the media or in public debates.

In 1998 the national research centre of consumers’ organisations (CRIOC/OIVO) supported the creation of a “Network of responsible consumers”, of which activities are directly devoted to sustainable consumption[595]. This network involves researchers from several universities and publishes information files on GMOs and chemicals in the food chain, risks linked to domestic products, socially sustainable consumption, etc.

c) Health

As in other countries, patients’ associations are answering specific information needs linked to specific diseases (cancer, children diseases, rare diseases, etc.). More particular to Belgium is the role of mutual insurance organisations (“Mutuelles”) in developing awareness and prevention on health issues for their members, especially for the youth. Some of them also provide advisory services, in order to help understand complex medial matters.

[595] http://www.oivo-crioc.org

d) Working conditions

The most active organisations in this area are trade unions. Diffusion of information and knowledge related to S&T is obviously not their core business, but a useful tool at two levels:

General information for union members on hazardous substances, technological risks, health and safety at work, through their usual communication means: leaflets, trade union magazines, TV-programmes, etc.

Training of union delegates (shop stewards) and union negotiators in technical matters, for intervention at the enterprise level (within the committees for prevention and protection at work) and at the macro-level (consultative bodies on health and safety at work and on environmental protection).

In the area of work and environment, the RISE project (inter-union network for environmental awareness) is carried out by the two main Walloon trade unions and supported by the Regional Government[596]. This is an interesting example of capacity building for workers and social negotiators including a lot of scientific and technical aspects. RISE also establishes cooperation between workers' organisations and existing expertise in universities and research centres[597].

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596 http://www.rise.be

597 Valenduc G., *Trade unions as agents of environmental change : outcomes from the RISE project*, in Hidebrandt E., Lorentzen B., Schmidt E. (eds.), *Towards sustainable worklife*, Hans Böckler Stiftung, Sigma Verlag, Berlin, 2002.

Non-governmental PUS initiatives in France: The social authority of technoscience under controversy

Philippe Chavot, Anne Masseran

We propose, with the present chapter, to turn away from the traditional definition of Non Governmental Organisations (NGO), which would require us to solely consider organisations institutionally acknowledged as such, namely the French branches of transnational organisations involved in defending a specific cause, such as Greenpeace for instance. Indeed, we felt that it would be appropriate, as well as more fruitful, to extend the definition of "NGO" to all structures which are not directly under the control of the government. This explains the reason why we propose to deal with some associations involved in scientific culture, environmentalist and consumerist movements, CST initiatives (Culture Scientifique et Technique) addressed to the youth, associations of patients or relatives and, finally, actions aiming at disseminating knowledge undertaken by private businesses. From this perspective, the field open to NGOs initiatives is extremely wide and varied. We will have to limit ourselves to providing a few examples, arbitrarily classified in thematic groups.

I – Associations and locations specifically dedicated to scientific and technical culture

We intend to include in this sub-section all associations whose main objective is to establish links between sciences, technologies and citizens.

A – Association Science Technologie Société – ASTS (Science Technology and Society)

The ASTS is a non-profit making association established in 1981 by a group of engineers, managers, researchers, medical doctors and lawyers originating from a variety of backgrounds. From the outset, this association was based on unions and movements involved in popular education. The ASTS collaborates with some training organisations, communities and centres dedicated to cultural events (youth and cultural centres, centres for scientific, technical and industrial culture, etc). Rapidly, the ASTS established itself as a structure federating a large number of actions and initiatives related to CTS. The two main objectives of the ASTS may thus be summarised:

"facilitating a citizen command of the challenges facing society due to the evolution of sciences and technologies, particularly with the establishment of links between citizens and scientists involved in all scientific fields;
promoting the scientific and technical dimensions of culture in order to establish a manner of humanism for the 21st." [598]
Concretely, the ASTS supports a popularisation effort in favour of sciences and techniques through, for instance, the promotion of exhibitions dedicated to famous scientists (such as the current exhibition on Charles Darwin). For the last few years, the ASTS has chosen a direction which intends to be slightly more critically-minded: its objective is not only to disseminate knowledge but also to facilitate debates on sciences. This trend may be perceived through the targets that the ASTS intends to reach: indeed, gathering both scientists and CST actors, it now attempts to open up towards the various bodies confronted with science on a daily basis (professionals, consumers, etc). The ASTS publication, *Axiales*, is increasingly focussed on citizenship issues. Furthermore, the association regularly organises "reflection groups" aiming at establishing a link between scientists and citizens. Despite this strategic "new direction", which may be partly explained by the fact that recently there has been a increase in controversial situations in France involving scientific and technological developments, the philosophy openly adopted by the ASTS remains relatively traditional. The objective is to help science regain a place of choice in French people's general knowledge by the development of more interactive techniques such as discussions, dialogues, etc.
In January 2002, immediately prior to the presidential elections, the ASTS organised in Paris the *Assises de la Culture Scientifique et Technique* (Conferences for scientific and technical culture). This event, whose name was clearly a reminder of the *Assises de 1981* was intended to lead to General Meetings aiming at facilitating the promotion of CST at decision-making level (like the 1981 movement had led to decisions taken by the ministry headed by Chevènement[599]). The event gathered over a thousand people involved in CST (CSSTI, unions, popular education, scientists, representatives from the Ministry of Research, etc). The rhetoric developed in the wording of a "Call" highlights the "progressive" paradigm on which are based most CTS actions in France: "facilitating large scale debates; encouraging dialogue between all the actors for the development of sciences and technologies and mediation with fellow-citizens; mapping out ways of establishing long-lasting exchanges, all represent the best means to ensure the control of our shared future, to help science and individual progress together and to establish a new manner of humanism."[600]

[598] http://www.asts.asso.fr/
[599] See chp. Policy.
[600] http://assises.sciencecitoyen.org/

B – Young people's spaces

In France, numerous CST activities are directed towards younger people and more particularly towards children. This tendency may be explained by the fact that most of the institutions involved in these actions have hardly been affected by French centralism. The big confederations and popular education associations – such as the *Centre d'entraînement aux méthodes de l'éducation active* (CEMEA, Active education training centre) and the FRANCAS league – and the leisure structures such as the MJC have, from very early on, included in their programmes or supported activities for the scientific education of young people. Some of these big structures were created in the mid-19th century, in the move to the democratisation of education. Others were instituted during or a little after the Second World War. Since their creation, all these structures tried to concretise their democratic ideal through a promotion of the access to science.

L'Association nationale science technique jeunesse (ANSTJ, National Association science technique youth) was created in 1962, at the time when a need for the organisation of social leisure was felt. It is supported by great scientific and industrial organisations[601] and offers lot of scientific and experimental activities to young people. This Association includes 500 local clubs and proposes specific training for persons in charge of children during school holidays (the BAFA). Hence, the ANTSJ is a key organisation for the actions of CST directed towards young people.

Many collective institutions and associations directly involved in the CST for young people appeared during the 1980s, when the public debates on the authority of science became institutionalised[602]: that was the case, for the *Collectif inter-associatif pour la réalisation d'activités scientifiques et techniques* (CIRASTI, Inter-Association group for the promotion of Scientific and Technical activities), the *Clubs des petits débrouillards* (Clubs of small copers), *Exposciences*, and even for the international network *Mouvement international pour le loisir scientifique et technique* (MILSET, International movement for scientific and technical leisure). The activities of these groups carry the marks of a critical mind and a will to train "responsible citizens". In that sense, education to science should allow children to become open to the world, to better understand it and to be able to situate themselves within it. Also, in most of these activities, if science is considered to be an important element of the culture of the future citizens, it has to be linked to other elements. For instance, science may be a means to understand nature, but it is not the only one. This idea, together with the fact that most

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[601] Many institutions support the actions of the ANSTJ: The Ministries of Youth and Sports, of Education, of Research, of Culture and Communication, of the Environment, the CBES, the GIFAS, Matra, Météo France, SEP, Aérospatiale, ANVAR, ADEME, the *Palais de la Découverte*, the *Cité des Sciences et de l'Industrie*, the General and regional Councils, and numerous local institutions.

[602] Per comparison, the ANTSJ had been established when strong criticism movements existed within the scientific community.

activities target the very young – who are seen as curious about anything, open and imaginative – gives the diversified, playful, and explanatory forms to these spaces.

We propose the following assumption. We are wondering if the differences between the CST activities for child and for adult may not be linked with what is considered to be the attitudes of these two groups. It is as if the so-called curiosity – presumed to be general, directed towards any issue and with no limits – of the young leads the designers of CST activities not to define what should be exactly their interests. This situation contrasts – and maybe explains the difference – with the CST actions directed towards the general public: indeed one may quickly realise what are the presumed interests of the reader as regards to the CST when reading a magazine intended for women. In addition, the "level" and the cognition of a child is presumed to be evolving and adapting, whereas the level and cognition of an adult is presumed to be fixed and differentiated: that explains this tendency in CST activities intended for adults to search for the "lowest common denominator" (this bias is quite visible when comparing the two versions of the *Science et Vie* journal, one for adults, the other for children).

In what follows, we will only describe three significant initiatives among the CST actions intended for children: *Exposciences*, the *Clubs des petits débrouillards* (Clubs of Small Copers) and *La main à la Pâte* (The Hand to the Plough).

The exposciences

The activity *Exposcience* brings together every two years for several days, young people aged 5 to 25.[603] The young persons present a scientific or technical realisation or project in front of a large audience – including scientists, who act as experts. Hence, the philosophy of *Exposcience* is twofold: firstly, to make scientists, young persons and the general public challenge each other and, secondly, to enhance CST through direct involvement in scientific logics – the projects or achievements are decided and carried out by the young persons.

The *Exposciences* constitute to some extent the most visible and federative realisation of the associations gathered within CIRASTI.[604] It contributes to an active and experimental conception of CST directed towards young people. The policy of the CIRASTI could be summarised by this quote from Albert Jacquard "Understanding science is as important, for all of us, as love."[605] Hence, the CST is expected to put this philosophy into practice. Indeed, in that case, the CST is not understood as a mere transmission of science to some passive receptor but as an opportunity "to enhance

[603] The next *Exposcience* meeting will be held in Grenoble. An international formula also exists and is organised by the MILSET.

[604] Most of the member associations of the CIRASTI play an important role in CST. Among them we have the *Association Nationale des petits débrouillards* (ANPD, Association of small copers), *the Confédérations des MJC de France* (CMJCF, the Confederation of Youth and Culture clubs), the *Fédération Nationale Léo Lagrange*, FRANCAS…

[605] Source, CIRASTI web site: http://www.cirasti.org/exposciences.htm.

curiosity and to build up experiences by acting on the youngest possible persons."[606] Most people involved in these activities share the idea that an early and in-depth contact with CST may not only help children and young people to awaken to science and technology but also lead them to develop a responsible and curious attitude. This was confirmed by the interviews done in Strasbourg with local CST actors.

The National Association of Small Copers (Les petits débrouillards)

Established in the mid-1980s, the National Association of Small Copers is present in most French regions. It organises, during school and leisure times, weekly workshops at which children can meet each other to carry out scientific experiments and projects. This society also contributes to the organisation of "clubs" and training courses during school holidays and gets children involved in demonstrations such as the Science Days (*Fêtes de la science*). Teachers, educators, and scientists – who followed specific training – collaborate in the organisation of these activities. This action is headed by a multidisciplinary committee made up of renown scientists who ensure the necessary scientific rigour.[607]

The Association of Small Copers builds the interactive potentialities of the spaces it invests on a philosophy that encourages the curiosity of the youngest. While it proposes play activities, it strives toward a vocation of popular education (this society favours activities for a public who has few opportunities to gain access to culture). Thus, it is a matter of training, during childhood, a responsible and critical citizen. In this context, the CST represents a particular access to this role: "after the discovery, questioning and the joy of handling scientific objects and phenomena, the child learns how to build his knowledge, to call it into question, to interpret it, to overcome his/her difficulties and, finally, to express his/her own reading of the facts and to put new questions. This would, quite naturally, lead him/her to have a different perception of Nature and the World: a perception that would be both critical and constructive, a first step in the construction of his/her mind that would no longer be based on reflexes and automatism."[608]

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[606] Source, CIRASTI web site: http://www.cirasti.org/exposciences.htm.

[607] The members of this committee are: Pierre-Gilles DE GENNES (Nobel prize winner in Physics), Jean JACQUES (Chemist, Collège de France), Albert JACQUART (geneticist, INED), Yves COPPENS (anthropologist, Collège de France), Michel CROZON (physicist, CNRS), Sylvie VAUCLAIR (astrophysicist, Midi-Pyrénées Observatory), Hubert REEVES (astrophysicist), Pierre BOURDIEU (sociologist, Collège de France), Michel DEMAZURE (mathematician, director of the Cité des Sciences et de l'Industrie), Henry DE LUMLEY (anthropologist, director of the MNHN), Etienne GUYON (physicist, director of the Ecole Normale Supérieure), Jean-Marc LEVY-LEBLOND (physicist, CNRS), Olivier LAS VERGNAS (astrophysicist, director of the Cité des Métiers).

[608] Source, *Les petits débrouillards* web site: http://www.lespetitsdebrouillards.com/.

The Hand to the Plough (La main à la Pate).

The initiative *La main à la Pâte* (MAP) was launched in 1996 by the professor George Charpak, the 1992 Nobel Prize winner of physics, and the Academy of Science. The aim was to invest the primary school arena in order to promote a scientific approach. The MAP structures its activities on 10 principles, the sixth one specifies quite well its major objective: it should lead to "a progressive appropriation, by the pupils, of scientific concepts and procedures, accompanied by a reinforcement of written and oral expression."

Scientific guides (who should have studied for at least two years in a scientific university) help children carry out a scientific project suggested by the teacher. Confirmed scientists – "godfathers" – act as a link between the school and the MAP steering committee. Both guides and "godfathers" are volunteers and agree to follow a charter that guarantees the good functioning of the operation. Each year, the French Academy of Science gives awards for the best results. Hence, the MAP represents an institutionalised and very regulated space of experimentation of science and technology. In addition, it comes within the tenure of the "science and citizenship" movement, which developed in the 1990s in reaction to the various crises disrupting the relations between science and society. It is expected that through this early education the future citizens would recognise its reference points, and the rigorous and noble science constitutes one of these points.[609]

II – Citizens' initiatives

As opposed to initiatives focussing on a relatively traditional vision of CTS (more or less educational), citizens' initiatives are characterised by two elements. First, in these spaces science and technology are discussed outside the structures that are traditionally devoted to popularisation. In addition, the CST initiatives often come from citizens, most of them being grouped into associations. These initiatives can take several forms: criticism of scientific and technical choices, which is often accompanied by the establishment of counter-evaluations; the informing of citizens and consumers; the opening up to debate of science and technology issues. Let us mention, for example, the self-help associations that gather patients and their close relations. They manage to inform and sensitise the public to a particular pathology, to support patients and, sometimes, to set up counter-evaluations. In this context, the associations for the fight against AIDS were quite innovative[610]. They succeeded in forcing open the gates

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[609] See ERNST S., "La main à la pâte, qu'est-ce que c'est ?", INRP, Académie des sciences, 1997.

[610] See the chapter on "Consultation and foresight". Mention should be made of patients' associations such as the *Association Française contre les Myopathies* (AFM) - French Association against Myopathies - which manages to funds its own researchers with the proceeds of its yearly information campaign and calls for donations. See Rabeharisoa, V., Callon, M. (1999). Le Pouvoir des malades. L'Association

of the medical institution and so have started to play an important role in the fight against the disease: they participate in decisional choices, they give advice for prevention campaigns and have been able to bring about significant changes in the clinical protocols.[611] These activists have invented a new form of interaction with scientists and physicians, more egalitarian, and displayed an innovative capacity for the management and the appropriation of scientific information.

A – Critically-minded organisations

1 – Fondation Sciences Citoyennes (foundation for sciences in a citizen's perspective)

Fondation Sciences Citoyennes was established in 2002, following a conference entitled "What sciences, for what society". The *Fondation* intends to be a forum for discussions involving critically-minded scientific researchers – more particularly those belonging to independent organisations – and "laymen" taking up social, medical and/or environmental struggles. These "laymen" are therefore characterised by a daily environment where they encounter – or even contest – the dominating technoscience and official expertise. One of the major objectives is to implement a reflection and cross-action with an aim to "politicise" science and expertise. Therefore, the *Fondation* adopts a philosophy decisively critically-minded and attempts, not so much to ensure that science (re)gains a prominent position in French culture, but to place it in perspective, allowing the integration of various types of knowledge (scientific but also cultural, professional, etc).

Concretely, the *Fondation* tries to revive the *Boutiques des Sciences* (Science Shops) which disappeared from the French scene in 1984[612]. In the same perspective, it also supports independent organisations involved in assessments and counter-assessments. The idea is to "reallocate assessment and research capacities in the direction of citizens' movements[613]". Thus, the emergence of a "third scientific sector" should be encouraged, made up of partners (counter-assessment experts and citizens or experts from society) capable of taking into account and answering environmental and social problems. In this respect, this foundation, which includes members close to

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française contre les myopathies et la Recherche. Paris, Les Presses de l'Ecole des mines, Paris and Callon, Lascoumes, Barthes, 2001.

[611] For instance, members of *Act-Up France* are present in the clinical committee of the National Research Agency against AIDS (ANRS). Let us also mention the information activities of the Association *Aides*. They have established a whole network that permits to diffuse scientific information in the different regions. This information, once rewritten, not only reaches the patients but also their close relations and, in some extent, the general public. They succeeded also in bringing conviviality to their informative actions through the institution of *Caf'Aides*. These Cafés have been established as spaces in which guests could either have a drink, consults books and information booklets, but also receive advice or support from the members of the association.

[612] Some *Boutiques des Sciences* are still operating - like in Strasbourg - but they have lost their initial purpose as a place providing independent counter-assessments.

[613] http://www.sciencescitoyennes.org/

French STS analyses, intends to encourage public controversies and the establishment of hybrid forums.

2 – ATTAC – Association pour la Taxation des Transactions Financières pour l'Aide aux Citoyens (international movement for democratic control of financial markets and their institutions)

ATTAC was established in France in 1998, following an initiative taken by a critically-minded monthly publication: *Le Monde diplomatique*. Today, it is active in about 50 countries where branches have been established in their own rights. As an association dealing with a variety of themes, ATTAC is involved in the science/society debate on themes such as marketing health and life patentability. The organisation is presenting itself as a "popular university at the scale of the country" and it has attempted to federate around a shared axis (namely, to regain the grounds lost by democracy for the benefit of the financial spheres[614]) actors of different nature such as associations involved in popular education, organisations related to social movements, unions, media, etc. Its structure grants local branches with much autonomy, thus allowing for regional specificities to be strongly voiced. Assessments and counter-assessments may thus be developed both at national and regional scale (the intensive use of electronic networking ensures a certain overall cohesion). Concretely, ATTAC acts in the field of media, exposing the interrelations between technological developments and economic interests (particularly in the case of GMOs) in citizens forums and conferences. In this case, the scientific dimension of the issues raised is secondary compared to the political element.

B – The Science Cafés

The *Cafés* or *Bars* of sciences are initiatives strongly anchored in their local contexts. Various cities have by now established their own Science *Café*, but their format and mode of operation widely depend on the purpose of the initiative and on the academic status of their promoters.[615]

The first *Science Cafés* were established in 1997, under the impulse of scientific institutions, such as the French Society of Physics (the Paris *Café*) or the Club "Science and Citizens" of the CNRS (the Lyons *Café*). Other *Cafés* have been established as part of CCSTI's activities. For most of them, the goal was to open a "neutral area" in which general public and scientists may confront each other's point of view on specific issues. Each meeting focuses on a given topic, and it starts by talks given by scientists who are selected on the basis of their authority on this particular

[614] http://www.france.attac.org/

[615] 16 cities have established one or several Science Cafés: Angers, Annecy, Besançon, Caen, Clermont-Ferrand, Gentilly, Grenoble, Le Havre, Lyons, Marseilles, Montpellier, Nancy, Nantes, Nice, Paris, Strasbourg.

topic. Then, the general public may ask questions and the whole debate is moderated by a journalist. Let us underline the fact that these institutional initiatives aim primarily to promote science and technique through popularisation. Indeed, these *Cafés* are based on the master / student model of transmission of knowledge and they tend to answer public concerns with a dialogue that takes the shape of successive questions and answers.

Several other *Cafés* have been established since 1997: most of them follow the initial path; a few try to find new ways to establish a dialogue on science and technology issues.[616] Thus, the *Café* of Besançon (Doubs), created in 1998, does not invite scientists since they aim "to break with the constant reference to experts". Hence, this *Café* "is not a space dedicated to the transmission of knowledge but rather a place which allows the demystification of science and its *actors* "[617]. Nonetheless, the discussions are moderated by two persons: a mathematician and a philosopher. The main motive is to show how science and technology can lie and exert an influence. The Science *Café* of Strasbourg (Bas-Rhin) constitutes another example. The debates takes shape thanks to guests coming not only from natural or social sciences, but also from associations or local communities. The goal is to help the expression of the various points of view and opinions and, hence, to demonstrate that anyone can take part in the debates and reflections related to science and technology.

A new trend is emerging at the moment: the organisation by institutional scientists of *Café lycéens* addressed to students in secondary schools.

III – Consumers' movement – Acteurs non gouvernementaux de la consommation

The history of the consumerist movement started, in France, at the end of the 19th century. However, it was only shortly after the Second World War that consumers' associations became essential as counter-evaluation authorities. The main unions were created in the 1950s and 1960s: the *Union Fédérale des Consommateurs* (UFC, Federal Union of the Consumers) in 1951, and the *Comité National de la Consommation* (CNC, National Committee of Consumption) in 1960. In the mid-1960s a resource institution had been established: The *Institut National de la Consommation* (INC, National Institute of Consumption), which is defined as a "Technical Centre for Research, Information and Study". This is a public institute and as such it is partly funded by the State but its status authorises it to sell its products for a profit (mostly publications).

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[616] The French Society of Physics has tried to patent the name "Café ou Bar des sciences", in order to ensure a control on the content of the debates and on the persons authorised to speak before the public.

[617] Statements from the first national meeting of the *Cafés des Sciences* groups.

Throughout the 1960s and 1970s, groups for the defence of consumers multiplied at the local and the national levels, and they are by now gathered within 18 federations. Some of these associations and federations are directly related to trade unions (like the *Association Force ouvrière consommateurs*), while others are independent (like the *Union féminine civique* or the *Confédération de la Consommation, du logement et du cadre de vie*). All these associations work in a network and are deeply rooted in their regional contexts.

Most consumer groups prioritise three levels of action: the defence of consumers at local level, through offices in which members of associations listen and provide mutual help to the consumers; informing consumers via various media, either local or national; discussing issues, some of them related to the development of science and technology. We will comment only on the last two levels.

The public has become familiar with consumers associations because of their constant presence in the media. There are two major monthly consumers' journals: *Que Choisir?* (created by the UFC in 1961) and *60 millions de Consommateurs* (created in 1970 by the INC). Both journals publish specific files devoted to new products or to comparison. Here, scientific and technical information may be used either as a resource or as material subjected to criticism or scepticism (as, for instance, on issues related to mobile telephones, antibiotics, or organic food…).

These two magazines have gained in authority since they promoted large scale actions and their legitimacy has been widely acknowledged by the public. This encouraged the government to change its policy: for instance, they called, in 1976, for the boycott of food dyes ; in 1980 they protested against the use of hormones in calf breeding. The information disseminated through these two magazines is often recycled in a different format by other media. Indeed, consumers' associations also produce several TV programmes that can be broadcast either by the public channels (such as *Consomag*) or by the regional channels (when these programs are produced at the local level). There are also many local journals (for example, *Consommateur Alsacien*).

This significant use of the media makes it possible to inform the consumers about studies or counter-evaluations related to great consumer products that are undertaken by the associations. The local and national medias are also used as a public forum in which the consumers federations can express their opinions on current issues. For instance, many associations were at the forefront for criticising GM-foods and non-adapted rearing systems (which led to the mad cow crisis). This extensive use of media is complemented by the establishment of web sites and electronic forums.

IV – Green movements – Acteurs non gouvernementaux de l'environnement

Since a few years ago, environmental groups have, in France, an important influence in CST. But, the appearance of green movements in the public arena has been gradual, progressively integrating a positive vision of sciences and techniques.
In the late 1960s, several activists' journals were created to oppose scientific and technological developments, such as *La Gueule ouverte, Le Journal qui annonce la fin du monde* (The open mouth, the newspaper which announces the end of the world), published between 1972 and 1977 and *Le Sauvage* (The savage) published from 1973 to 1981. But, in the late 1970s, the green movements were losing credibility: they had not been convincing enough to stop the progression of nuclear power in France, and have been discredited by both the government and industrialists as "backward-looking movements".[618] Later on, they lost their independence as a critical authority, when the socialist government of the early 1980s managed to get them involved in local decisional committees, and in 1985, the heart of the green movement was tragically hit. Greenpeace France lost the Rainbow Warrior – a former French marine ship – and this event is described by the media and politicians as the failure of the whole movement. Greenpeace France stopped its activities during two years.

The green movements reappeared in France, in their diverse formats, in the mid-1990s. The Green party became an institutionalised political movement and succeeded in entering the government with Dominique Voynet as the Minister of the environment.[619] Other environmental groups try not to get involved in political life and propose alternative visions or even "counter-powers". In this context, numerous actions to provide education about the environment, which rely more or less on scientific information, are carried out. The federation *France Nature Environnement* (FNE) that gathers a great number of regional associations,[620] focuses its activities on targeted problems (acid rains, nuclear waste...) or on issues related to the local environment. The participating associations often play a counter-power function in the decision making process and thus engage themselves in a fight against the local authorities.[621] Hence, the information that may help to gain public support becomes a crucial issue. The information campaigns are generally done in informal ways, with actions in the streets of cities or villages and the distributions of leaflets. But these groups may also get more formal actions under way, through the organisation of public debates or even

[618] For a critical history of the French ecologist movements, see LASCOUMES P., *L'éco-pouvoir*, La Découverte, Paris, 1994.
[619] See the chapter on institutions in the present report.
[620] These associations function also in federative local networks, such as *Alsace Nature* or the *Societé d'Etude et de la Protection de la Nature en Bretagne*.
[621] The FNE aims also at exerting counter-evaluation for National or European decisions.

through the infiltration of governmental actions directed towards consumers (that was the case, for instance, for the *Etats Généraux de l'Alimentation*).[622]

The action of the French branch of Greenpeace represents another example of alternative discourse detached from institutional ecology. Greenpeace is very active on local and targeted issues, such as the problem of nuclear waste or the leukaemia risks related to the activities of the La Hague nuclear power plant. Independent from the State and from local authorities – as opposed to most associations that are forced to juggle with state and local funding -, Greenpeace is free to widen its activities. Its mission includes educating people about the environment and informing the local or general public on environmental risks. The media often comments on Greenpeace's capacity to offer counter-expertise and its authority has been largely reinforced since a few years ago on topics related to GMOs. Indeed, Greenpeace's expertise and opinions about GMOs led the media and then the government to take into account health risks related to these new organisms and apply the precautionary principle. This victory may be explained both by the success of the information campaign and the way the leader of the anti-GMO campaign of Greenpeace-France, Arnaud Apotheker, invests in the media scene. While Greenpeace-France uses the same information strategies than other environmental groups, it benefits from a greater public recognition thanks to its sharp actions and the efficiency of its counter-expertise.

The action of the *Commission de Recherche et d'Information Indépendante sur la Radioactivité* (CRII-RAD, Independent Commission of research and Information on Radioactivity) constitutes another example of the role played by independent groups. This association was created in 1986, in reaction to the information strategy followed by the institution, which claimed that the Chernobyl radioactive cloud stopped at the French borders. Since then, the CRII-RAD has engaged itself in two missions: to carry out radiation analysis within an independent institution certified by the Ministry of Health; to enhance public information on nuclear power and risks related to radiation[623]. More recently established and following a similar principle, the CRII-GEN (*Comité de Recherche et d'Information Indépendantes sur le Génie Génétique*), studies problems arising due to genetic engineering, particularly in the field of agriculture.

[622] See supra, the chapter related to the CST actions of INRA. To give a second example, during the fourth *Carrefour des Biotechnologies* held at Strasbourg in 2000, *Alsace Nature* was present to distribute leaflets informing the general public about the issues related to GMOs and on the way this public forum was organised. The *Carrefour des Biotechnologies* was organised by industrialists and scientists involved in that field, and aimed at promoting biotechnology economy within Alsace.

[623] http://www.criirad.com

V – Private institutions

We will not list all the private institutions involved in some way in CST. We will pick out two of them whose actions answer – among other things – current interrogations.

1 – The Pasteur Institute

The Pasteur institute (a private Foundation of "public utility" created in 1887) is involved in the CST in two ways. First, it popularises the work of Louis Pasteur through a museum, itinerant exhibitions, conferences, photographic and book libraries. Second, and since the identification of the HIV virus by the research group of Luc Montagnier in 1983 (and the fight for "paternity" during which he was opposed to Robert Gallo), the Pasteur Institute is regularly present in actions aiming at informing – or even educating – the general public on health issues.

All the activities that surround the Pasteur Museum try to make the life and the work of the "great man" known – even by extending the Pasteur myth – to a large public. The actions glorify both Pasteur and science. The Museum exhibits the thoughts of Pasteur that are emblematic of "French science", his contribution to the well-being of humankind and the utility of his work for the development of modern science.

The information and educational actions made by the Pasteur institute are of a different nature. In the 1980s and 1990s, Montagnier and its collaborators were often solicited to explain the nature of AIDS at many conferences and public debates. While the communication policy of the Pasteur Institute was not organised at the beginning of the pandemics – a weakness that led to inappropriate words[624] – it has, since then, been much improved. Like most French research institutions or agencies, the Pasteur institute has established its own communication service that connects researchers with journalists, and proposes scientific training for journalists. So, the institution made the choice of an internal regulation of scientific information, which may affect any action towards the public.

2 – The COGEMA

The various campaigns of antinuclear activists – and especially the " scandal of La Hague ", initiated by Greenpeace in the late 1990s – has placed the COGEMA in the following situation: either the company[625] that manages the French nuclear plants can keep a low profile (and thus invites criticism), or it can launch a communication policy

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[624] See the report to the French research agency for AIDS: MASSERAN A. & CHAVOT P., *Le sida des colloques aux journaux : construction et circulation de l'information*, Strasbourg, 1996.

[625] Despite most of its funding comes from public institutions, such as the *Commissariat à l'Energie Atomique*, the COGEMA works like a private institution.

to answer the charges put against it and restore public confidence. The COGEMA has chosen an intermediary strategy, a transparency policy as regards its activities and policies. It seems to us important to include this type of action in our national profile, because it is an information policy that tends to develop in several fields enduring a crisis in France (such as transplantation or agronomy). In that context, informing means to reassure the general public by calling on universal concepts like "transparency", "honesty", "humanity" and "science". Informing also means providing an answer for public concerns by privileging two axes: the integrity of the institution and scientific guarantees (for security for example). Since November 1999 the COGEMA has been communicating through mass media, such as television and national and regional newspapers, to inform on the activities of the La Hague plant. This campaign aimed to "make information accessible to all". In addition, a website makes it possible to visualise on line, 24 hours a day, activities within the plant. According to the COGEMA, the transparency actions were largely followed by the public: in one month, more than 4 000 contacts were established via phone calls to a free number and 40 000 connections were recorded on their web site. Finally, an opinion poll showed that this reassurance campaign was fruitful and demonstrated "the adequacy of this action to the public demands."[626]

The transparency policy has also taken more concrete form through real and virtual visits of the plant, as well as a consultation of inhabitants living close to the biggest plants managed by the COGEMA (La Hague and Tricastin). In a later stage of this survey we will investigate that sort of actions in order to clearly identify the strategies that are followed through informing publics on scientific, technical and institutional matters, and to assess whether these strategies succeed or not in bringing an answer to the public resistance to technological issues. Undoubtedly, it would be an interesting case study, especially in a national context where the massive installation of nuclear power plants has not, until now, been based on any consultation of the citizens.

[626] Source, Cogema, report for 1999, especially the chapter "Des hommes et des femmes responsables".

Non-governmental initiatives in PUS in Portugal

Maria Eduarda Gonçalves, Paula Castro

1. Background

In the past the popularisation of science by scientists, scientific institutions, scientific societies and scientific associations (some of whose origins date back to the 19th century), have been sporadic. Practical difficulties such as lack of funds, political and institutional conditions have not helped the process. Also insufficient motivation of scientists to engage in such activities (which are not taken into consideration for career progression purposes) and the lack of public interest have hampered the efforts of those few who have in the past taken the initiative to launch the popularisation of science activities.

The establishment of political democracy in the mid-1970s, and the accession of Portugal to the European Community in 1985 paved the way for the mobilisation of efforts by scientists designed to improve their communication with the general public.

2. The role of scientific associations

The "Associação de Ciência e Tecnologia para o Desenvolvimento" (ACTD - The Association of Science and Technology for Development), a non-governmental organisation established in 1985, provides the best illustration of this trend.

Apart from operating as a "lobby" of Portuguese scientists and technologists promoting higher status for scientists and better conditions for those undertaking research projects in Portugal, the ACTD organised a number of science exhibitions in various regions of the country in the late eighties and the beginning of the nineties.

These exhibitions involved the participation of a considerable number of members of the scientific community, and received financial support from the then Secretariat of State for Science and Technology.

The ACTD published a magazine, "CTS – Ciência, Tecnologia e Sociedade" (Science, Technology and Society). This was published three times a year, from 1987 to 1993 and played an important role in the diffusion of the international debates about science and society, as well as about science policy, and ethical implications of science and technology among other topics.

Once most of its "political" goals had been achieved (with the creation of a ministerial department for science and technology, and the greater relevance acquired by research and development at the governmental level), the ACTD was transformed, in 1995, into an association devoted exclusively to the diffusion of science. However the Association decided to close its doors in 2000, because of its inability to mobilise scientists to carry out its purposes.

Another association involving members of different scientific disciplines and Institutions, the Portuguese Federation of Scientific Societies and Associations (FEPASC) was created in 1990.

This non-governmental organisation has not been directly engaged in popularising science activities in its traditional sense, rather its activities centre on the promotion of public and academic debates about the social and political implications of science and technology.

FEPASC published a newspaper for a few years and organised conferences and colloquia about general themes such as science and politics, scientific culture and public participation as well as a number of debates on topics of actuality.

Since the mid-nineties, the involvement of scientific societies and associations in the popularisation of science has received a strong impulse from the "Ciência Viva" programme (see "governmental initiatives").

3. The role of private foundations and business associations

The more favourable climate surrounding science in the public sphere in recent years has encouraged other private institutions such as for the Calouste Gulbenkian Foundation to promote initiatives for the diffusion of science among the general public. Examples are the series of conferences on scientific topics organised, for very large audiences at the seat of the Foundation in Lisbon and a number of exhibitions for example, on scientific instrumentation on time and temporal scales, etc.

Some reference should also be made to the establishment to the Visionarium, an interactive science centre by the Industrial Association of Oporto in Northern Portugal.

Non-governmental PUS initiatives in Sweden

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

The following text highlights the role of non-governmental actors in Swedish PUS initiatives. The text will try to connect the different efforts to the Swedish social and political context. Some aspects have already been discussed under other headings, but the objective here is to give a general indication of the non-governmental role with regard to public understanding of science.

NGOs: a definition

In reality, there is not actually an equivalent to the notion of 'non-government organizations' (NGO) in the Swedish language. When talking of these kinds of political actors, the English acronym is often used. In the following text we will not try to define what this notion incorporates: a search in the literature shows a great variety of possible definitions. The following text simply regards NGOs as the opposite of government organizations. In consequence, everything but the latter will be included in the notion of NGOs.

Aspects of Non-Governmental PUS initiatives

For pedagogical reasons, the NGO initiatives with regard to public understanding of science are divided into two categories: 1) research oriented NGOs, 2) politically oriented NGOs. As with all groupings, these categories are of course contingent and only used for pragmatic reasons.

Research oriented

In this category, associations, societies and institutions whose main objective is to support different kinds of R&D are included. Perhaps the most influential of all these actors are so-called *Strategiska stiftelser* (Strategic Research Foundations). They are part of the transformation in recent years of the Swedish research funding structures. Their mandate is to fund long-term motivated research that can provide added value in an economically or socially beneficial sense. These foundations only support strategic research, i.e. basic research with long-term application. Arguably, these kinds of research ventures, due to the fact that they are aimed at certain socially relevant clusters of problems, are more geared toward extroverted activities than basic and applied research. Initially, their original economical resources were provided by the government of Sweden, but the Foundations are now totally independent: the capital is mostly invested in the stock market, which is supposed to generate a surplus to be distributed to researchers. In recent years however, economic turbulence in the stock market has caused the distributed capital to decrease.[627]

The Nobel Foundation is an important and influential actor in the Swedish context. The Nobel Foundation is an institution that has changed very little during its 100 years in existence. The activities of the Nobel Foundation can be described as somewhat circular; each year, every working procedure is implemented according to the same procedure in the preceding year, culminating in the Nobel festivities. Nearing its centennial celebrations in the year 2001, the foundation decided to do something radically different. It was decided to make Nobel more public. A Nobel museum would be erected to celebrate, science, literature and peace, as well as the prizewinners. There are already several other Nobel museums in the world, situated in places in which Alfred Nobel marked his presence. Sweden and Stockholm are thus rather late in joining the bandwagon.

Preparations for this museum have been ongoing for several years. The name Nobel conjures an association with excellence in several ways, so of course the museum itself has to excel and display exhibitions of the highest possible quality. The museum project has also attracted people with high competence and generous fund givers. The Nobel trademark is a strong one, and as such, many actors wish to be associated with it.

While most reactions to the Nobel initiative have been very positive, there has been some criticism regarding funding. The Nobel Foundation is obviously a very wealthy organisation. Still, the foundation has claimed that it cannot give funding to the museum from its own resources. It is claimed that the money in the foundation can only be used for the Nobel awards and the ceremony surrounding it, since that is what is stipulated in the testament of Alfred Nobel. This has meant that the municipality of Stockholm has agreed to finance the building, while the foundation is responsible for filling it with content of high quality. Thereafter, the foundation applied for funds from a large pool of Swedish fund givers and from various business sponsors. Most of these requests gained a positive outcome. However, there have been some complaints that if Nobel's testament had been interpreted differently, then the foundation would have been able to use some of its wealth for this project. Instead, money has been taken from fund givers which would otherwise have been awarded to research activity.

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[627] See http://www.stratresearch.se.

While this may be a valid complaint, those working with the museum have argued that the total amount of money being received, is, in perspective, so slight and taken from such a diverse amount of fund givers that it does not warrant heavy criticism. Moreover, the 'pro' of opening such a great public window for science in Sweden and an added profile for Swedish research outweighs the aforementioned 'con'. In addition, it can be said that this is a prime example of the "Third Assignment" actually being prioritised: why should only the first and second assignments receive funding?

The theme of the first exhibition in the museum is 'Creativity'. It is hoped that this would encourage common links between research, literature and peace work. The exhibition opened on April 1 2001 and was produced in three replicas. One of these will stay put in Stockholm while the others two will tour the world.

Interestingly enough, there is a bridging of the two cultures of humanities and the natural sciences involved in the project. The ideas put down by Alfred Nobel a hundred years ago make this connection necessary. Prizes are awarded both to natural science and to literature. The construction of the Nobel categories, formulated so long ago, places restrictions on how research can be treated in the museum. It also makes for an interesting juxtaposition and a rather exciting combination, something that would not likely be put together under different circumstances.

Another well established institution is *Kungliga vetenskapsakademien* (The Royal Swedish Academy of Sciences). The Academy is perhaps best known for awarding the Nobel prizes in physics and chemistry. But it also publishes a newsletter, *Akademin anser* (According to the academy), where prominent members of the academy discuss the scientific aspects of important societal problems. The academy has a long tradition (the oldest in Sweden, according to some) in PUS with a focus on the practical. By 1741, the *Grundregler* (Ground rules) already stated that as soon as a research result 'matured' it should be brought to the attention of the public.[628]

One more example of this type of actor deserves to be mentioned: *The Royal Swedish Academy of Engineering Science* which also publishes its own newsletter (*IVA-Aktuellt*). This advocates a practical public understanding with a focus on engineering and economics. *Ny teknik* (New Technology) is a journal owned by the associations of civil engineers and engineers. Its circulation (approx. 135,000) is spread very widely amongst professionals from varied fields but with an Engineering background.

Politically oriented

This category includes both politically traditional actors, such as labour unions, as well as more alternative organisation, such as social movements.

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[628] Kärnfelt, J, 2000, *Mellan nytta och nöje*. (Between utility and pleasure) Diss: Institutionen för idé- och lärdomshistoria, p 70.

If we start with the former, Labour unions have a strong standing in Swedish society. Almost every Swedish union has its own magazine where scientific results often in the form of a (practical) base for the profession are presented. A current example is the professionalization via science of teachers, and earlier examples are that of social workers and journalists.

Another important actor is *Arbetarnas Bildningsförbund* (The Adult Education Organisation of The Workers (ABF)).[629] Established in 1912, it is an organization close to the social democratic and labour movements, pursuing adult education in seminars and study circles. In 2001, ABF had more than 100,000 study circles with almost 1 million participants.[630] The subjects of study ranged from the humanities and arts to the natural sciences.

We also find a large group of actors with a focus on environmental problems. As in most western countries, Greenpeace is an important actor in the environmental debate. In addition, Greenpeace actively supports research aimed at finding alternative and better solutions to problems with less harmful environmental consequences.[631] There are however various other active organisations. With its 140,000 members, an organisations such as *Svenska Naturskyddsföreningen* (The Swedish Society for Nature Conservation (SSNC)) is very influential. The Society was established as early as 1909 and in the following near-century has grown to be the biggest nature conservation and environmental organisation in Sweden. Of the SSNC it is stated "[e]xperts carry out investigations and provide for actions that are used in work locally, regionally and nationally. Politicians and other decision-makers on a national level are lobbied in order to influence decisions for the benefit of the environment."[632]

SSNC have a youth organisation called *Fältbiologerna* (the Field Biologists), founded in 1947. The organisation has local, regional and national divisions and gathers young people "interested in studying the flora and fauna and/or work for the protection of the environment"[633]. The organization publishes books, has its own magazine and gives lectures in schools.

It is important to remember that Sweden utilises a broad conceptualisation of science, including also the human and social sciences. These means that organisations that work with other kinds of knowledge than the natural can also be seen and described as important actors.

An example of this is a group of feminist organisations, debating different kinds of gender theory. Such groupings play a vital part in both facilitating debate and ideas about science in society, and in Swedish culture generally. There is a certain logic in

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[629] See www.abf.se
[630] See *ABFs Verksamhetsberättelse* (The Annual rapport of ABF), ISBN 91-7994-097-8, p. 58 and p. 65. The rapport can be found at www.abf.se.
[631] See http://www.greenpeace.se/.
[632] See http://www.snf.se/english.cfm.
[633] See http://www.faltbiologerna.se/.

the idea that if science is seen as producing patriarchal knowledge and structures, then PUS consists of activities that serves to strengthen certain problems of inequality. An example is Fredrika-Bremer-Förbundet (*The Fredrika Bremer Society*), which is working towards equality of the sexes. In the principles of the Society, a vision of an equal education system is mentioned.[634] A magazine, *Hertha*, is also published; in a recent edition, the magazine discussed gender in relation to medical research.[635]

[634] See http://www.fredrika.org.
[635] See *Hertha* nr 1 2002; http://www.fredrika.org/hertha/index.htm

The "PUS Industry" in the UK: Who's supporting whom, what, how and why?

Damian White, Josephine Anne Stein

Introduction

Numerous non-governmental initiatives to develop the public understanding of science predate the emergence of the 'PUS industry' in the UK following the 1985 Bodmer Report, some by well over a century. The British Association for the Advancement of Science (BAAS, now just "the BA") is amongst the most prominent, well-established and active organisations in PUS promotionalism. The BA has become something of a focal point for the coordination and promotion of bottom-up "PUS movement" initiatives that have flourished, especially over the past 15 years. But NGOs involved in PUS have emerged from other quarters as well; Gregory and Miller note that 'in some ways, the public understanding of science movement has hitched a ride on the public's own efforts, as exemplified by the grassroots activities of hobby clubs and illness advocacy groups' (1998:220).
A very broad range of institutions in the UK, whether indirectly related to government or completely independent, contribute to PUS. They range from professional societies to charities and voluntary groups, to companies and industrial associations, pressure groups and community organisations. Given the plethora of activities that have gone on in this area, this section is necessarily selective. For more encyclopaedic accounts of this area Kass (2001) and the PSCI-COM database, have provided some of the most extensive pieces of information on this topic.

COPUS

Perhaps the premier non-governmental body promoting PUS in the UK is COPUS, the Committee on the Public Understanding of Science[636]. Formed by The Royal Society, The British Association for the Advancement of Science, and the Royal Institution of Great Britain, it draws its members from science, the media, museums, education, government and public life. Informed essentially by an 'expert led' version of PUS, it has been involved in a wide range of activities since its founding in 1986.

[636] http://www.copus.org.uk/

Over half of COPUS' annual budget is spent on the awarding of research grants for innovative projects in science communication. However, COPUS also provides bursaries to enable practising scientists to go on communication skills promotional courses. It is responsible for the Rhône-Phoulenc Prizes which seek to encourage the writing and publishing of popular science. (The prizes are worth up to $10,000 each on the popular science section).

More generally, COPUS also seeks to encourage the sharing of best practise of all those that are involved in PUS. The COPUS Forum for example brings together individuals involved in PUS to initiate dialogue and exchange ideas. COPUS also produces a series of guides which have provided case studies of research on the public understanding of science.

Critics of COPUS (e.g. Tudge, 2002) have argued that the organisation has been problematic since its founding due to its espousal of a deficit model of PUS. In the light of recent shifts in the PUS debate and growing expectations of dialogue between experts and the public, the three organisations that had founded COPUS undertook a review of the Committee's role. The outcome came as something of a surprise. On 9 December 2002, they issued a joint announcement:

> *"We have reached the conclusion that the top-down approach which Copus currently exemplifies is no longer appropriate to the wider agenda that the science communication community is now addressing. We believe it will be more effective to allow organisations to seek their own partnerships…….For this reason, we have decided not to appoint a new Chair for Copus and to stand down the Council as it is presently constituted…."*[637]

The three institutions pledged to continue their activities in promoting effective communication between scientists and the public. Copus itself continues as a "lame duck" organisation which will expire once its current commitments are discharged.

Professional Societies

A very significant contribution to PUS in the UK is made by the ever growing body of professional scientific societies, many of which organise public lectures and other PUS events. There are too many to mention in full here, but notable examples would include the following:

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[637] http://www.copus.org.uk/news_detail_091202.html

The British Association for the Advancement of Science (BA)

Founded in 1831, the BA is "dedicated to the communication and appreciation of science"[638]. The BA is a membership organisation responsible for running some of the major annual PUS activities in the UK from the annual Festival of Science to National Science Week. BA events generate extensive coverage for science stories during the week they are held in the national press (Gregory and Miller: 225). Additionally, the BA publishes the journal 'Science and Public Affairs' and it runs a number of science communication forums. At the formal level, it regularly hosts public lectures by leading research scientists. More informally, developments such as 'SciBar' have experimented with hosting discussions on science in a wine bar (Kass, 2001). This event has been so successful that from September 2002, the BA plans to expand its programme of sciBArs to encompass the whole country. It also runs a national network of science clubs and activities which are supported by 16 BA regional officers (www.the-ba.net).

The Royal Society

Having commissioned the Bodmer Report, and set up COPUS along with the BAAS and the Royal Institution, The Royal Society renewed its long-standing commitment to PUS in the 1980s. The Royal Society has long organised public lectures and open days where scientists exhibit and explain their research work to visitors. The Royal Society Michael Faraday Award is made annually to a prominent scientist "for the furtherance of public understanding of science." The Royal Society also hosts PUS-related conferences organised by outside bodies, such as "Science Communication, Education and the History of Science" (July 2000), organised by the British Association for the History of Science.

The Royal Institution

One of the most long-standing PUS events on the UK calendar are the Christmas Lectures organised by The Royal Institution, in which a distinguished scientist presents a special lecture for children which is broadcast on national television. These Christmas Lectures always feature visual spectacle as well as audience participation. For some British people, this annual event is as much a part of the festive season as the Queen's Christmas speech and the decorative lights of Regent Street; it best illustrates PUS as a cultural undertaking in the UK.

The Association for Women in Science and Engineering (AWiSE)

This national organisation seeks to advance the participation of women and girls in science, technology and engineering. Amongst other things AwiSE, does this through

[638] http://www.britassoc.org.uk/

providing open lectures, scientific and social meetings, workshops, visits and mentoring schemes which promote science, technology and engineering amongst girls and women.

The Engineering Council

This institution seeks to enhance the standing and contribution of the engineering profession. Concerning PUS, the Council runs a number of awards which seek to encourage public engagement with science and technology. Additionally, the Neighbourhood Engineering Scheme links engineers with local schools to provide direct support to teachers and students.

Independent Charities

Charities, particularly in the medical and health areas, have become important sponsors of PUS activities in the UK in addition to their main activities in supporting research.

The Wellcome Trust

The Wellcome Trust is the leading biomedical research charity in the UK and is one of the world's largest funders of biomedical research. It is investing £3 billion in research in the UK over the next five years (from 2001). PUS is a central concern of the Trust and public engagement has been adopted as one of its four key priorities. It presently carries out a wide variety of activities related to PUS and biomedical ethics. Examples of the Trust's work include survey work on public attitudes to science in Britain, and surveys of scientists own views of their future in public debate (Kass, 2002). The trust has also show interest though in launching more ambitious ventures.

In the spring of 1998, the Wellcome Trust embarked on a public consultation exercise on the topic of human cloning. The aim of the research was to 'provide input from members of the public who do not usually have a voice in such issues' ('Public Perspectives on Human Cloning' p.4) to the Human Genetics Advisory Committee. The resulting report, 'Public Perspectives on Human Cloning' was widely seen as providing a good example of how mainstream consultation is done in the UK. In contrast to deficit model approaches, it was found not only that participants could grasp the science (:47) but they were also able to ask pertinent questions which even well-briefed researchers found difficult to answer (:47); participants could grasp ethical issues quite quickly.

The survey found virtually no support for human cloning amongst participants. This was even the case amongst groups which might be expected to support it, such as infertile women, mothers who had lost children and lesbians. Only a handful of participants were more positive. A rather more sobering note for reflection on the state of PUS in Britain though is that the report also noted that participants in this project demonstrated 'very little confidence that any system of regulation could effectively control research'. It found that 'participants were unconvinced that public opinion would have any effect on what research was done.'

Cancer Research UK

Formed by the February 2002 merger of two major UK cancer research charities (the Cancer Research Campaign and the Imperial Cancer Research Fund), Cancer Research UK supports 3,000 scientists a year with an annual budget of £130 million. As the world's largest voluntary-supported cancer charity, its public interface is highly developed. It publicises the research it supports and provides detailed information on the state of knowledge in various areas of cancer-related medical science, both as a service to those affected by cancer and to enlist the support of volunteers and donors.[639] In addition to its prominence amongst the natural constituency of those affected by cancer, Cancer Research UK it is highly visible at local community level through its extensive network of high street shops selling donated goods to raise money for its work.

The Kings Fund

The Kings fund is a health care charity. The primary focus of the fund is to improve the provision of health and social care. However, it is attempting to extend activity related to public involvement related to science. Much of its activity here is related to experimenting with the extension of lay involvement in healthcare services (Kass, 2000).

Science Policy Research Group (SPSG)

SPSG is a charity whose aims are to promote the application of science, technology and innovation to policy, practise and management. In addition to undertaking PUS-related projects on behalf of other bodies, SPSG manages research programmes and networks of academics in a range of institutions, including the ESRC Programme on Public Understanding of Science between 1998-1999 (Kass, 2000). It presently convenes the Science and Society forum[640], which has run a number of PUS events. Most prestigious here would be a conference it co-hosted with OPUS in 2001 entitled Science, Society and Citizenship in the 21st Century.

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[639] http://www.icrf.org/
[640] www.spsg.org/science_society/forum.html

The Hansard Society

The Hansard Society[641] is an educational charity that brings together MPs, Peers, academics, parliamentary staff, journalists and others groups to promote parliamentary democracy. It is presently seeking to address increased public disaffection with politics through Internet-based initiatives such as the 'e-democracy' programme. It is also involved in a variety of PUS ventures. For example, it co-hosted an online discussion of Women in Science and engineering with POST[642] (Kass, 2001)

The Association for Science Education

This is an independent charity which promotes science education in the UK. The organisation hosts a range of meetings and conferences on science education. It also publishes a number of journals newsletters and publications which seek to discuss ways in which science related to people's lives.

The Nuffield Foundation,

The Nuffield Foundation is an independent charity, was established in 1943 by Lord Nuffield and William Morris. The Foundation strives to improve the quality of education particularly by the development of new teaching and learning methods together with the materials to support these methods. In relation to PUS, The Nuffield Council on Bioethics has been a particularly important body that has nurtured public debate on new developments in medicine and biology.

Civil Society

The public understanding of science in the UK has also been developing by a very large range of organisations in civil society run by volunteers. Once again, the variety of organisations, groups and initiatives are too numerous to log in full. However, some of the more pertinent examples would include:

Science Café

Café Scientifique is a venture where 'for the price of a cup of coffee or glass of wine, people gather to discuss new ideas and developments in science which are changing our lives' (House of Lords, 2000: 271) Developed by Duncan Dallas, head of a TV company that makes scientific and medical documentaries, it holds twice-monthly

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[641] www.hansardsociety.org.uk/
[642] www.parliament.uk/post/pn133.pdf

public lectures and events at cafés in Leeds and Nottingham. It has brought together a range of eminent experts (John Maddox, Oliver Sacks, Alan Sokal, Mary Midgeley) to discuss scientific issues that grab the public imagination.

The African Caribbean Network for Science and Technology

The African Caribbean Network for Science and Technology was established by Black professionals in 1995. The singular objective of this Manchester-based network is to advance the educational achievements and career aspirations of black people within science, engineering and technology. As such it is centrally committed to advancing the public understanding of science in the Black community in the UK.

The network fulfils this role by providing:

- career advice for students in science, engineering and technology
- mentoring using black professionals as positive role models
- 'In Service' training for teachers that seek to raise standards of black pupils in science, technology and maths
- Ishango Clubs: these currently operate in Liverpool and Manchester, providing after school and Saturday support in the natural sciences to students ages 9 to 19, weekend trips to places of scientific interest for club members, and information and advice to support parents.

The Governance and Science Group

This is a body of academics, writers and commentators that focus on recent efforts to open up technological innovation and its regulation to wider communities (Kass, 2001). The Group seeks to stimulate discussion between public interest groups, government, industry and research institutions on the direction and development of scientific innovation.

The Science, Technology, Engineering and Medicine Public Relations Association.

STEMPRA is an informal group, set up in 1993 to bring together people working in communication in scientific societies, research institutes and other non-commercial organisations in science, technology, engineering and medicine. (PSCI-COM)

Friends of the Earth and Greenpeace

Surveys suggest that accounts of scientific research produced by environmental pressure groups are seen by the British public as more trustworthily sources of scientific information than those of government or industry scientists[643]. Consequently, such groups have come to occupy an increasingly central role in PUS developments over the past 15 years in the UK.

It could be argued that the everyday campaigning activity of these groups directly contribute to PUS. More generally, both FOE and Greenpeace have begun to commission their own research providing counter-expertise to contest dominant positions on, for example, genetic modification or nuclear waste. FOE has also developed its PUS work on the internet providing web information about polluting factories on its homepage[644]. Such groups have also begun to run public lectures to generate public debate. Thus, Greenpeace UK have recently announced a seminar series on the Future of Science and Technology they are hosting in alliance with the New Scientist Magazine.

The Private Sector: Industry/Business/Consultancies

Industry and other commercial enterprises are a final area of non-governmental organisations that play a key role in providing scientific information to the public in the UK. Where industry-led PUS becomes corporate PR is a matter for considerable debate in the UK as elsewhere, a topic that was taken up by the OPUS/SPSG Conference in London in November 2001.

There is a long-standing tradition of industry in the UK hosting visits and open days for school children in the UK. The visit to the Dagenham Ford factory for example has probably been taken by most students in East London who have studied Sociology at school. Desires by both Conservative and New Labour regimes to extend public-private sector co-operation has seen industries supplying educational materials to schools in the natural sciences and courses with environmental components.

Companies have also intervened individually in debates on public controversies to inform the public in the UK. Notable examples would include Monsanto and Norvartis on the GM food issue.

Gregory and Miller argue rather than to initiate events or schemes 'the private sector appears to see its role as mainly as one of sponsoring the public understanding of science initiatives of others' (1998:228). An example provided here is the manner in which British Telecom supports Britain's 'Science Line', a telephone information service answering service that answers questions about science (1998:228). Other examples though might include the growth of corporate sponsorship. For example, both INTEL and Pfizer have sponsored Science Year in 2001-2002.

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[643] find MORI poll reference, Wellcome Trust

[644] http://www.foe.org/

More direct forms of industry PUS have emerged in the form of visitors centres. Sellafield Visitor's Centre, deserves mention as one of the most successful developments in this area. Opening in 1988, this visitors centre provides tours and information on the Sellafield Nuclear Power Station. The visitors centre attracts 200,000 visitors a year and is advertised on national television in the school holidays (Gregory and Miller, 1998).

Consultancies

A more recent development with the growth of the 'PUS industry' has been the growth of private consultancies offering advise on PUS or polling information. One of the most active consultants in this area is 'Evaluation Associates', a UK-based consultancy concerned with evaluating the effectiveness of public understanding of science activities. The agency has done evaluation reports on the following topics: Royal Society of Chemistry: Huddersfield experiment; ScienceLine; COPUS-Committee on the Public Understanding of Science, SETweek 1995-97, British Association Annual Festival, Wellcome Trust: The People Decide and Cracked, Pupil Researcher Initiative, ESRC funded survey of public understanding of science (Durant et al), Social Trends (Durant et al), Daily Telegraph, So did it work? (evaluation guidelines), K-Zone - an evaluation of a pilot exhibition designed to take science and health issues out to young people in youth clubs, bus stations. (PSCI-Com)

The consultancy *People Science & Policy* was set up in late 2000, to provide "support for science communication to improve relations between science and the public at local, national and international levels." *River Path Associates* also does business in the PUS industry, for example by running a cyberconference in 2000 that is described in the "Internet" section.

Conclusions

If PUS in the UK could be evaluated in terms of the number of independent organisations getting involved and the number of initiatives taking place, the PUS movement since Bodmer has been an outstanding success. A veritable "PUS industry" has developed in which NGOs play a key role (Stein, 2001); a significant number of people earn their living from coordinating, conducting and evaluating PUS activities.

In many cases, PUS has simply become a more prominent feature of what was already long under way in NGOs, in other cases PUS activities were added to, say, a medical charity's portfolio of pre-existing support mechanisms for research. But whatever the history or motives of its proponents, PUS has become a central feature of British culture via *e.g.* the BA, the cancer charities' high street shops and the vast number of surveys, events, Websites, activities, tours, and promotional materials in the media and in schools.

We believe that other aspects of the PUS movement, such as the impacts of PUS on public confidence in and support for science, need to be taken into account in assessing the true "success" of PUS in the UK. As a test bed for developing new democratic tools, interactive PUS in the UK is an interesting area for further research and evaluation. While not disputing the benefits of educational aspects of PUS, we would simply raise the question as to whether the "UK model" is a good one for European countries (including the UK itself) -- or for Europe as a whole.

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CHAPTER 3.7.

Governmental initiatives in PUS: Similarities and differences across Europe

Maria Eduarda Gonçalves

European governments now recognise that they have a role to play in the promotion of the public understanding of science and technology, as part of their policies for science and technology. The interest shown by political authorities concerning levels of knowledge, as well as attitudes of the general public towards science and technology may be explained by two main kinds of reasons: on the one hand, scientific and technological knowledge is nowadays generally accepted as a crucial basis of professional qualifications that enable the economic and social development of any country; on the other hand, governments are eager to obtain social support for their investments in research and development at a time when the public perception of risks derived from the applications of science and technology are challenging the traditional image of science in technologically advanced societies. Policy action in this new field can thus be regarded as a prerequisite for reducing the distance and tension between science and society.

The European Union (EU) has also been attentive to this requirement. Scientific literacy has been the object of the public opinion surveys carried out by the Eurobarometer since the late 1970s. Under its 5th Framework Programme, the EC launched a specific research line into issues of public awareness about science and the public understanding of science. In July 2002, a plan of action was adopted by the European Commission to stimulate and to support popularisation of science activities as such at the EU level.

However, notwithstanding the common recognition by governments of the importance to engage actively in the promotion of the public's scientific awareness, as well as social acceptance of scientific and technological developments, the guiding principles, institutional structures and tools that they have used to that end show a remarkable variation.

One could point out at the outset that, whereas in some European countries, such as Belgium, France, Sweden and the United Kingdom, science popularisation has a long history, going back to the Enlightenment, in others, such as Austria or Portugal, the diffusion of science has not been encouraged in a systematic manner until recent times. Whilst in the former countries, scientific institutions were in general supported by government, and benefited from a favourable educational and cultural climate, and a dynamic economy, in the latter, political and institutional, as well as economic conditions have kept science and the scientists in isolation from society for a long time.

Deliberate **governmental policies to facilitate or encourage the popularisation of science** appear, therefore, to be connected with particular political and ideological, as well as economic, social and cultural backgrounds.

It should be pointed out, however, that the contexts in which such concern was born and developed, and the underlying philosophies vary to a great extent: whereas in some cases, civic and cultural considerations have prevailed, in others, economic and industrial purposes predominate.

The United Kingdom is regarded as a pioneering and innovative country in both the theory and the practice of Public Understanding of Science. In this country, the objective of the initiatives put forward in this field from the 1980s onwards was twofold: improving people's capabilities as active professionals and informed citizens in an increasingly technological society, and securing the public's support for the state's investments in R&D. In contemporary France, efforts to carry out an explicit policy designed to further the penetration of science in society followed the options of the socialist government, which came to power in 1981. One of the outcomes of this policy was the establishment throughout the country of "centres de culture scientifique, technique et industrielle".

In Sweden, the relationships between culture and science have been credited as being of prime importance in the last two decades. The Council for Planning and Coordination of Research, established in 1979, has been the foremost actor to stimulate and support efforts to popularise science.

The decisive role of Belgian regional and local authorities in the promotion of awareness about science can be related to a somewhat similar aim: that of encouraging an innovative and industrial culture among students and entrepreneurs. Emphasis has been placed on the building up of a scientifically and technologically competent workforce, combined with initiatives to raise awareness about science among the general public. It should be recalled in this connection that in this country business expenditure amounts to 72% of total R&D expenditure. Besides, the ratio of researchers' vis-à-vis the active population is one of the highest in Europe.

A nexus can therefore be recognised between the levels of industrial development and investment in research and development, and the emphasis of public policies on 'technical' or 'technological', besides 'scientific' culture.

This hypothesis is reinforced if one considers the Portuguese case. In Portugal, industrial expenditure in R&D amount to only 20% of total expenditure. The explicit policy for scientific culture led by the Portuguese Ministry of Science and Technology from 1995 onwards has been guided the objective of countering the traditionally theoretical teaching of the sciences, by a methodology of teaching based on experimentation.

It was also in the 1990s that the Austrian government (firstly through the Ministry of Science and Transport and since 2001 through the Ministry of Education, Science and

Culture) acknowledged the need to invest in the promotion of the public's scientific culture.

Thus, highly industrialised countries, namely France and Belgium, have actively promoted the dissemination of science and technology in society as part of broader public policies, at the central or regional levels, aimed at furthering the synergy between science and technology, industrial growth and competition, on the one hand, and at raising awareness about science and bringing science into culture, on the other hand. These options account for the fact that the concept commonly used in political and social discourse be scientific, technological and industrial culture. In Sweden, a combination of the civic tradition that relates science to democracy, and a more practical, economically oriented tradition of industrial exploitation of science can be observed as well. The democratic argument played a major role in policies for the university and the public understanding of science.

In contrast, in Portugal, a country at an intermediate state of development, the new policy in this field was born out of a decisive struggle against Portuguese scientific backwardness. The concept most commonly used has been that of 'scientific culture'. This reflects both a cultural and a civic, but not so much a technological approach to the public understanding of science.

The establishment of **institutional structures at the governmental level** for co-ordinating the policy measures designed to further the scientific culture of citizens has proved to be a decisive factor of the policies' success. In France, a number of mechanisms have been created since the 1980s with specific informational functions, the most recent ones being the 'Mission de la Culture et de l'Information Scientifique', and the 'Conseil scientifique de la culture et de l'information scientifique et technique et des musées'. In Belgium, a specific department for scientific and technical communication at Walloon Regional Ministry for Research and Technology was established. Sweden's Nordic Forum for Research Information was set up to stimulate greater interest and enhance quality assurance of knowledge diffusion. In Portugal, the establishment of the Ministry for Science and Technology, in 1995, was followed by the establishment, in the late 1990s, of an Agency for Scientific Culture whose main responsibilities have been to run the 'Ciência Viva' programme and to manage the Knowledge Pavilion, an interactive science centre.

Public intervention for the communication of science to the public may also be characterised according to their more centralised or decentralised nature. The extent to which the political systems themselves are more or less centralised explains, to a certain extent, the differences in the degree and the nature of public bodies' involvement in science popularisation. The Belgium case provides a clear example of how regional and local authorities can be in a good position to strengthen science and technology's visibility in the public arena, and to promote the consultation of social and economic partners.

Policies in this field have, in general, featured a **wide variety of tools**. Countries that have a scientific tradition and experience in the field of public communication of science exhibit a broader spectrum of mechanisms and activities launched either by governmental or non-governmental agents, whereas countries with a more recent involvement in these activities usually resort to a smaller array of tools.

In Sweden, for example, the means used to raise the public understanding of science range from science festivals, magazines and newsletters, to the 'science theatre', and scientific documentaries. Public service TV and radio have also been instrumental in the diffusion of science in society.

In the United Kingdom, governmental institutions such as the Office of Science and Technology and the Research Councils support small initiatives organised by practicing scientists to communicate their work to the public. More recently, Web sites and the Internet have also been used by public entities as means to promote public debate about science. These communication means have been complemented, in the last decade, by more discursive tools, namely consensus conferences (the first one on plant biotechnology, organised by the science Museum, in 1994, and the second one on management of nuclear waste, held in 1999 under the sponsorship of the Centre for Economic and Environmental Development).

In Portugal and Austria, public authorities have been supportive of interactive museums and exhibitions, co-operative ventures between schools and universities and science weeks. The Portuguese 'Ciência Viva' programme encouraged the formation of permanent networks among schools, through its special twining programme, and gave rise to the establishment of decentralised centres, conceived as interactive meeting places. Every year, since 1997, a Science and Technology Week is organised by the Ministry.

The policy instruments resorted to in order to promote the science-society relationship may also be distinguished according to their unidirectional or bi-directional character. In the United Kingdom and France predominantly unidirectional approaches have been followed, whereby what is sought is mainly to inform or to educate people. In both countries, however, centralised activities combined with decentralised ones. In France, whilst the 'Cité des sciences et de l'industrie' ('Cité de La Villette'), was officially presented as "the biggest CST centre in the world", and strongly supported by the central state, as a source of national prestige, the 'centres de culture scientifique, technologique et industrielle' provide illustrations of local dynamism as regards scientific and technological developments.

In Sweden, the intertwining of central and regional initiatives can be remarked, with regional universities, in cooperation with regional and local administration and industry, more inclined towards practical understanding of science, and traditional universities in larger cities developing cultural and civic forms of science popularisation.

Governmental initiatives in *Public Understanding of Science* in Austria

Ulrike Felt, Martina Erlemann

In this chapter we will have a closer look at the activities of public sector institutions (with the exception of universities, museums etc. which we treated separately) in the domain of Public Understanding of Science. In part, these activities overlap with what we have already mentioned in Chapter 2, yet our focus here will be on the concrete realizations of what was expressed on the programmatic level. We will thus be able to observe how the often wide-ranging rhetoric fits with what is actually done. Furthermore this focus will give us some indication about the ways in which the publics, whom these initiatives want to engage with on technoscientific issues, are imagined and conceptualized.

We will start by presenting some of the main activities by the Ministries and other players on the federal level such as the Council for Research and Technology Development. In a second step we will have a brief glance at the level of the provinces, which partly have their own independent initiatives. In a third and last part we will look at the special audiences targeted by these initiatives.

1. Activities by ministries and other institutions on the federal level

Prior to describing the current role of the Federal Ministries regarding PUS initiatives, it is imperative to say that this field was, during the time of this project, in continuous transformation. The government has changed twice, both times resulting in a rearrangement of the ministerial tasks and of the persons in charge. Thus, the names and tasks of the Ministries changed, rendering it difficult to follow which activities disappeared and which eventually reappeared in a different Ministry under a similar or different heading.

Several ministries touch on science and technology, though in different perspectives. The first to be mentioned is the Ministry for Education, Science and Culture. Apart from supporting a number of projects in the field of PUS, such as the Science Week, the internet science channel of the Austrian Radio and Broadcasting company, Math.Space[645] – a new initiative that tries to popularize mathematics – and many

[645] This is a newly created setting in which issues concerning mathematics are discussed from many different perspectives through public lectures, courses for children and many other initiatives: http://Math.space.or.at

more, they have also themselves organized a one day event to publicly discuss issues of genetic diagnosis within their research program on Genomics (Gen-au) in co-operation with an association specialized in communication in the field of genetics. In parallel, the ministry is also giving some financial support for research in the PUS field, is engaged with improving the situation of women in science and technology (e.g. they run an internet-site on the history of female scientists[646]) and school curricula, where some issues of PUS are also present.

In an earlier version of its self-description, the Ministry of Transport, Innovation and Technology BMVIT explicitly stressed, the support of special public awareness-activities with the aim of supporting an increase in the openness of the population towards technological progress. On the new homepage that went online in mid-2002 this has disappeared and only a link called "Public Awareness", however rather "invisible"[647], remains. Thus one can say that less space is now given to this topic – at least concerning the presentation to the outside. Registered activities are the Science Week and several other information campaigns, on "Energy from Biomass"[648], innovative energy technologies[649] and sustainable product development[650]. The former is co-sponsored with the Ministry for Education, Science and Culture and addresses a broader public, while the rest are more-technology-oriented information sites directed to firms, enterprises and engineering-offices that deal professionally with these topics. One more recent activity was an open call for new ideas concerning a "Festival for Science and Technology" which should become an event similar to the Science Week or even replace it in future. However the realization is unclear at the time of writing this report.

The federal Ministry for Agriculture, Forestry, Environment and Water (BMLFUW), also called Lebensministerium (Life-ministry), maintains many databases and info-nets[651] on the areas of environment, water, landscape, forest and agriculture where a very broad variety of documents is collected: project reports, results of ordered studies, media articles, information documents about campaigns and hints for consumers, press releases, reports on public-relation works and also official statements about debated issues are collected. In these domains they also organize or are sponsors of events that could be counted as PUS-initiatives. An example of such an initiative could be this year's "aquarama 2003: Festival for Rivers", which is organized around the topic water. During four days there are exhibitions, demonstrations, games and other activities, all dealing with different problematic aspects concerning water quality and its sustainability.[652]

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[646] http://www.bmbwk.gv.at/womenscience/
[647] http://www.bmvit.gv.at
[648] http://www.bmvit.gv.at/biomasse
[649] http://www.energytech.at/
[650] http://www.ecodesign.at/ecodesign_eng/
[651] http://www.lebensministerium.at
[652] http://www.aquaramabregenz.at

The Ministry for Health and Women[653] (BMGF) is in fact quite active and houses a number of initiatives, which could be partially understood as falling into the category of creating public awareness – initiatives. One is explicitly focusing at women and ICT (Information and communication technologies), furthermore, the ministry provides a platform on genetic engineering exclusively established for this purpose[654]. Brochures and articles on medical and agricultural issues related to genetic engineering are offered, with a bias on the juridical aspects of gene-technology. The ministry sees it "as its task to inform about gene- and bio-technology in the most comprehensive way." It should "not be a campaign against or in favor of genetic engineering, instead it should provide an information platform with all corresponding opinions. The only form to inform objectively about genetic engineering is to confront divergent opinions"[655] It is also possible to order a regular email-service with current news on the topic.

Apart from the Ministries a new actor has entered the scene: the Austrian Council for Research and Technology Development, an institution meant to give policy guidance to the Ministries. On their homepage they explicitly announce the initiation of an "information and awareness campaign to improve the public understanding of science and technology" that started in autumn 2002. "The campaign comprises a wide range of activities addressing different target groups, such as a media campaign to create attention for the topic, citizen conferences to discuss topical issues such as genetic diagnostics ...."[656] The citizen conference on genetic data, which was sponsored by the council, has already been discussed in the chapter of public consultation initiatives, and will hence not be further treated here.

Yet, most of the funds available for the PUS-initiative by the Council have so far gone into a media campaign and an accompanying web-page which runs under the header "innovatives Österreich" (innovative Austria)[657]. The use of "innovation" as central notion already hints that the focus of the campaign is not so much science, but rather technology. The information campaign inscribed itself into a tradition of science and technology communication, which sets technological progress equal with social and economic progress and gives the impression of being largely uncritical towards the potential impact of science and technology on society. Accompanied by pictures of animals (a monkey, a rabbit, an eagle, a chick, a fox and a squirrel) short slogans are meant to convey a positive image for innovation. An example for the accompanying slogan would be: "Innovation is, if your cash is ok." (Innovation ist, wenn die Kassa stimmt.) or "Innovation is, if your child explains the computer to you." (Innovation ist, wenn ihnen ihr Kind den Computer erklärt.). The accompanying TV spot, which showed a monkey trying to open a glass containing a pear, had a spoken background

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[653] http://www.bmgf.gv.at/cms/site
[654] http://www.gentechnik.gv.at
[655] http://www.gentechnik.gv.at/gentechnik/set/G_ueberSeite_set.html
[656] http://www.rat-fte.at/en.php
[657] http://www.innovatives-oesterreich.at

text stressing the importance of a secure and well paid job, a fast car, a house on your own as well as of a big pension … all that would be reachable through Innovation.[658] A number of questions remain open when analyzing this campaign: What message arrives when people read or watch this campaign? What in the end are they told about the role of innovation, science and technology in society? Can this reduced and positivistic vision of the potential of science and technology in society actually contribute to building the trust relationship necessary in order to gain stable support by a wider public? Or will this on the contrary not reinforce certain suspicions that the aim is not dialogue with the public, but simply persuasion to accept what they are told to be the best way?

Apart from the Ministries and government agencies, Austria also has a few offices on the federal level that provide science-based information services for the population. The Zentralanstalt für Meteorologie und Geodynamik ZAMG (Central Institute of Meteorology and Geodynamics)[659] is one of them, working on themes related to science and environment.[660] Generally speaking these offices originated in the needs of providing current information about specific topics for the public that are related to science. The Geologische Bundesanstalt (Geological Federal Office) puts it as "providing geology in service of Austria". The ZAMG provides day-to-day information about climate changes, weather forecast and earthquake documentation. It is not primarily a research institution insofar as its purpose is not to produce scientific knowledge but to disseminate specific science-based information as a supply of services. Their work is characterized by strong orientation towards public requests. The process of information distribution has an enlightening impetus that appeals to the model of the "enlightened citizen". On the website one for example finds a text about earthquakes titled by "What you should know about earthquakes?" which explicitly refers to this notion.

2. The role of the regions in PUS activities

The role of the municipalities in fostering science communication activities is not very high, with a few exceptions. Of course they partly support initiatives but the regional governments often have no clear policy regarding science communication or PUS-activities. Some of them are financing initiatives like science shops, or special events

[658] For further examples of the newspaper and TV campaign see http://www.innovatives-oesterreich.at
[659] http://www.zamg.ac.at/
[660] Among others should be mentioned the *Umweltbundeaamt* (Federal Office of Environment) on http://www.ubavie.gv.at), the *Geologische Bundesanstalt* (Geological Federal Office) on http://www.geolba.ac.at/) and the *Bundesanstalt für Agrarbiologie* (Federal Office for Agrobiology) http://www.lwlnz.ages.at/

(like the "aquarama" mentioned above) linked to science communication, they support museums and other science exhibition activities, but most of it remains on a very selective level and is not integrated in a bigger strategy.

To give an example we have chosen to look at a more active region, namely Vienna, and the role played by the municipality in fostering PUS activities.

"Local" activities in the PUS-domain: the case of Vienna

Several regular events structure the public "life" of science in the city of Vienna. The first initiative to mention are the so-called "Wiener Vorlesungen"[661], a series of lectures which has existed since 1987 and where well-known scientists from Austria but also from the international community participate. So far more than 1000 such lectures were held in the city-hall of Vienna. They remain in the rather classical format of a lecture – as the title indicates – with the possibility to discuss afterwards. However, given the level of the talks and the setting in which they take place, these lectures address already highly educated people and not a broader public.

The regional government has also been involved in organizing the ozone consensus conference in 1997, which has already been described in the corresponding chapter. Furthermore the city of Vienna supports initiatives in the domain of PUS financially, examples being the Math.space mentioned above, but also many other smaller initiatives.

Many of the PUS-activities of the city are in the domain of the humanities, such as the history or archeology of the region, but also on issues of democracy (e.g. Dialogue.Discussion.Democracy).

For more than two years the *Wissenschaftskompass*[662] (Science-Compass) exists and registers events, mainly courses and lectures, concerning science, humanities and social sciences that are directed either to the public in general – like courses of the adult evening classes – or aim at an interdisciplinary academic audience – as for instance lectures held in academic research institutes. All events are covered in a calendar in printed and online version each quarter of the year. Initiated by the city of Vienna and *TuWas,* an association for extension studies located at the Technical University of Vienna, the intention of the *Wissenschaftskompass* is to ensure both the intellectual significance and economic position of the city. In the introducing statements where the originators formulate their approach, the purpose is strongly referred to the city of Vienna and its cultural history and tradition. It is claimed that the critical reflection of cultural and intellectual heritage of the city should be continued and thus fostered. Vienna is portrayed as an intellectual city where it came to "impressing merits of science and arts". Scientific life is described as being carried by qualified personalities

[661] http://www.magwien.gv.at/ma07/vorlesungen
[662] http://www.wissenschaftskompass.at/

and teams as well as by the mediation of results to professional colleagues and also to a wider public. This should be realized by calling the public's attention to the copious presentations of scientific outputs and thereby opening an intellectual, reflective and discursive space where "presentation, documentation, valuation and criticism are the 'humus' of creativity, fantasy and intellectuality" in order to kick-off "critical reflection of societal developments from the past to the future". Through regular and widespread announcements concerning scientific events, the wider public would be more aware of Vienna as a "colorful city of science".[663]

3. Targeted special audiences

If one chooses to look at the audiences targeted by programmes that are organised by the regions or on the federal level, three such groups can be identified. The first could be summarized as adult-education that tries to motivate people to continue engaging with science and technology beyond the end of their formal education. The second would be children, who have been "discovered" as a central target group for such initiatives. And finally women are high on the agenda in particular in connection with technological developments.

Adult education

It is interesting to stress that a co-operation between the University of Vienna and the Vienna Association for Adult Education is trying to revive a long-forgotten tradition, namely the performance of science courses given by university teachers at the popular universities in the first part of the 20th century. The project *University meets Public*[664] started in 1998 and is mainly funded by the Austrian Broadcasting Corporation and the City of Vienna[665]. In the first two years, 300 public events took place that attracted 4000 visitors. The low entrance fee was possible due to using the adult education infrastructure throughout the town. These events usually have the form of talks or series of talks around certain fields of interest, e.g., dealing with "Europe", issues of medical science or science fiction. They are held by university teachers from various fields in a rather classical format of lectures with the possibility to ask questions afterwards.

Children

Given the fact that the number of students in the classical core fields of the natural science is decreasing, children have been identified as an important target group. They

[663] http://www.wissenschaftskompass.at/; statement by the Major of Vienna
[664] http://vwv.at/InitiativenUmp.do
[665] http://www.magwien.gv.at/

should be addressed more explicitly and in particular governmental initiatives rather often underline this aspect. This overlaps with what we have seen in other spaces, like museums, where children have become a central target group. School children are nearly the only age-sensitive target groups of PUS initiatives: university departments organize special open days for school children to attract them for science or technological studies. Several museums offer special programs for (school) children. A closer look at the recent debates on the reform of school curricula in the scientific disciplines would be interesting[666]. The plans include in first line, apart from the instruction and explanation of scientific knowledge, also the mediation of "scientific thinking" and "typical scientific working methods". An additional aim is formulated as raising the awareness of the "cultural and economic meaning of science for society and environment". With the "better orientation in the environment" that is aspired within the scientific education, an ability of responsible agency is to be achieved. In fact the discussion so far rather seems to be guided by an enlightenment philosophy. Educated citizens are supposed not to develop negative attitudes towards science and technology, as these are mainly due to lack of knowledge about them.

Women in science

Another target group that is important on the political level are women. As the proportion of women teaching in the university was only 31% on the level of assistant professors dropping to 7% on the level of professors in 2001[667] how to realize gender equality in the science and technology sector has also become a political issue.

The marginalization of women in the scientific community finds nearly no repercussion in PUS initiatives. However with respect to science and technology as fields of university studies women have become *the* new target group of initiatives. These have been organized due to the decrease in the number of students starting scientific or technical studies, in order to motivate the potential academic offspring, especially female school leavers.

Corresponding to the governmental science-policy paper *Grünbuch* (the Green Book) the situation of women in science and university has been analyzed in the so-called *Weißbuch* (the White Book) where initiatives to support women are described programmatically. Concerning the technology-sector an initiative to be mentioned is *FemTech*[668], a series of events aiming at increasing the percentage of women in technology, especially concerning proposals for project funding as well as the proportion of women in high-status-positions, and motivating young women for technology. This initiative was initiated by the Ministry of Transport, Innovation and Technology. Also the Ministry for Education, Research and Culture is now running a

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[666] Curricula see on http://www.bmbwk.gv.at

[667] The most recent numbers are from 2001. See "Frauenbericht 2002", Ministry for Education, Science and Culture.

[668] http://www.bmv.gv.at/femtech/bmvinternet.htm

programme called FFORTE (bringing women into science and technology). Further plans include mentoring and networking for female engineers. But it should be noted that the target group of this actions are predominantly women who are already settled down in technical fields. New programs addressing the younger generation are under preparation.

Summary remarks

- There is quite an important discrepancy to be observed between the rhetoric developed with regard to the necessity of PUS and its realization. There is no bottom-up research and development program for PUS of a larger scale, which would allow for trying out different ways of improving communication.
- The more concrete programs initiated from the top have –with a few exceptions – a clear tendency to remain in a one-way communication model – “experts tell people what they should know and think about science”. Little space is given to more interactive settings or to citizen participation although this is all too often underlined as *the* important element in the policy discourse.
- Furthermore, it should be stressed that in the majority of these programs the notion of *Wissenschaft* is used in its very restricted sense, concretely referring to natural sciences and often technology/innovation. Too little attention is given to the crucial role of the social sciences and the humanities for societal innovations – this holds in particular for the recent “innovation” campaign by the Austrian Council for Research and Technology Development.
- What has to be underlined as rather positive are the more recent efforts aiming at improving the situation of women in the scientific and technical domains. Here a number of rather concrete measures are taken, parts of them also linked to PUS activities. However, there is still little awareness that science communication as such is in many cases already imbued by gender values and thus might not lower but reinforce the existing disparity.

Belgian governmental initiatives, boosted by federalisation

Gérard Valenduc, Patricia Vendramin

Background

Since the federalisation of the State, several governments can take initiatives and decisions in the area of Public Understanding of Science and Technology; the federal government, the Flemish government (one single government for the Flemish Region and the Flemish Community) and the Walloon and Brussels governments (Walloon government, Brussels government and French Community Wallonie-Brussels government).

Governmental initiatives in Flanders and Wallonie-Bruxelles reveal quite different policies. Since 1995, the Flemish government has set up a yearly action plan for science information, which aims at coordinating initiatives coming from public authorities, universities and schools, science centres and associations in the area of science information and scientific culture. External consultants evaluate each yearly action plan and prepare a report for the regional government and parliament. In Wallonie-Brussels there is no such coordinated policy. There is however a cell for science dissemination in the regional administration for science policy, which supports and grants decentralised initiatives. At the federal level, the well-known European "principle of subsidiary" guides governmental actions: federal authorities do not make decisions that can be made more efficiently at the regional level. Federal initiatives are limited to bi-cultural institutions and federal competencies (cf. paper on policy context).

Governmental initiatives on consultation, social dialogue and public debate, at whatever level, are presented in the paper on consultation and foresight. As already mentioned in the paper on policy context, it is important to remember that science communication is closely linked to innovation policy, in the main regions of the country.

2. The action plan of the Flemish government

The action plan 2001 is entitled "Action Plan for Science Information and Innovation". The formulation of the strategic goal of this plan shows that scientific and innovative culture are strongly linked in the meaning of the Flemish authorities: "Creativity, which is an essential property of both scientists and entrepreneurs, must be part of the day-to-day attitude, in such a way that people could act in an innovative way at the workplace and in daily life. The mental involvement of groups and individuals in knowledge and innovation is essential for welfare and quality of life"[669].

Science communication is explicitly linked with innovation policy; scientific culture must serve the economy. This strategic goal is translated into three general objectives of the Flemish governmental policy, which must be targeted to specific groups and evaluated through a set of indicators[670]:

- *To bring more scientifically and technically skilled people to the labour market.*
  Target public: youth at school.
  Intermediates: teachers, career advisers, parents.
  Indicators: number of students and graduates in scientific and technical curricula in high schools and universities, quality of the training programmes, adequacy to business needs and labour market shortages.

- *To create "societal support" for science and technology.*
  Target public: general public.
  Intermediates: media.
  Indicators: results of opinion surveys (to be planned regularly) on public attitude towards science and technology.

- *To improve coordination between science information and science policy.*
  To be carried out by public authorities.
  Indicators: milestones to be specified in an implementation plan.

A series of concrete measures are integrated in the action plan:

- Opinion surveys on scientific literacy in Flanders and impact surveys on science weeks and science festivals; impact studies of TV-broadcasts.
- Call for proposals for projects of targeted actions of Science and Technology awareness, for schools or the general public.
- Organisation and subvention of TV-programmes "Overleven" and "Curieuze neuze" and media campaign in local television (cf. paper on media).
- School competitions on science and technology. Exchange-days of pupils between general and technical schools.
- Network of Science Teachers (TOBO), development of teaching kits and didactical material.
- Science theatre "Wasda!" derived from the experience of a science theatre in the Netherlands.
- Exploitation of the "science truck" Experion, dedicated to secondary schools (which received an international award in the US in 2001).

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669 Vlaamse regering, *Actieplan Wetenschapsinformatie en Innovatie 2001*, Administratie Wetenschap en Innovatie, 2001 ; http://www.innovatie.vlaanderen.be

670 Price Waterhouse Coopers, *Startonderzoek Wetenschapsinformatie*, Administratie Wetenschap en Innovatie, Juli 2001 ; http://www.innovatie.vlaanderen.be

- Awareness modules "Switch Courses" (how daily-life technical devices work), for parents associations, senior associations and other cultural groups.
- Media campaign for science curricula in universities and high schools.
- Construction of a database on available expertise in science communication in Flanders.
- Specific actions in order to involve more girls in science curricula and professions.

These actions involve public partners (administrations, universities, research centres), associations (teachers, youth) and enterprises (not only as sponsors, but also as technical partners).
Within the framework of the Belgian Presidency of the EU in 2001, the Flemish government organised a European conference entitled "Public Awareness of Science and Technology in Europe and its Regions: Building Bridges with Society"[671]. At the Flemish policy level, this conference was designed as an opportunity for giving a European dimension to recent realisations such as Technopolis and the clustered initiatives towards schools.
The budget allocated by the Flemish government to public awareness of Science and Technology increased from about €0.75M in 1994 to €6.2M in 2001. It now represents 0.54% of the regional public expenditure in R&D. An important policy decision is to make a part of the annual budget (about €0.8 M) available through a call for proposals, open to any institution or group who wants to carry out targeted actions of Science and Technology awareness. In 1999, 19 projects were selected among 40 proposals; in 2000, 25 among 61 proposals; and in 2001, 65 proposals were received[672]. A specific department within the Flemish administration for research and innovation (AWI) manages the programmes of public awareness on Science and Technology.

3. The impulse and subvention policy of the Walloon government

A cell in the regional administration for research and technology (DGTRE) now coordinates all the efforts of the Walloon regional authorities in the area of science communication and scientific culture. This cell called "Promotion of diffusion of scientific and technical culture" is responsible for the management of subventions allocated to decentralised initiatives of science centres, universities and associations, for all kind of activities: festivals, exhibitions, workshops, publications, multimedia products, etc. It also initiates private sponsoring for these activities. The cell's objectives are:

([671]) Proceedings and conclusions downloadable from http://www.cordis.lu/belgium/17122001_prog.htm
([672]) Borey S., *Flanders: a case study*, in the proceedings of the conference *Public awareness of Science and Technology in Europe and its regions: building bridges with society*, Brussels, December 2001.

- Raising awareness for scientific curricula and professions among the youth?
- Developing a critical approach to scientific progress and technological achievements, including the social, economic and cultural issues.
- Giving an impulse to “cultural leisure” using science as an opportunity for surprising, having fun and learning.

Concrete interventions of the Regional authorities are:

- Support to the science centres PASS and Parentville, through regional investments parallel to funding from the European Social Fund. Promotion of their activities by the Region.
- Support to the “Bulletin Athéna” (cf. paper on media), which is managed and published by DGTRE.
- Sponsoring the TV-programme “Matière grise”.
- Support to universities for the organisation of science festivals and the implementation of units of “scientific public relations”.
- Support to various associations and NGOs for activities of science communication towards the youth or the general public.

The overall budget devoted by the Walloon Region to the promotion of innovation and the diffusion of scientific and technical culture is about €5.4M (2001), including the regional co-financing of the projects funded by the ESF, plus €0.6M coming from the French Community for Public Understanding of Science and Technology in the universities (since 2002). Since 1999, there has been a specific department for scientific and technical communication within DGTRE.

4. The support policy of the federal government

The Federal Science Policy Office (SSTC-DWTC) coordinates initiatives of the federal government, which are mainly limited to bi-cultural or international activities, for instance:

- Management of the National Museum of Natural Sciences (cf. paper on science centres), which is the only bi-cultural institution in the area of Public Understanding of Science and Technology.
- Design, implementation and operation of a specific web site of SSTC-DWTC for the youth (www.belspo.be/young).
- Co-sponsoring of Flemish and French speaking TV-broadcasts.
- Support to the European network of science museums and science centres, through hosting its secretariat.

Although the diffusion of scientific information belongs to the objectives of SSTC-DWTC, there is no explicit policy in this area. Nevertheless, SSTC-DWTC plays a very important role in the implementation of information and communication infrastructures that are essential to the diffusion of scientific knowledge:

- The BELNET network, which is the Internet network (backbone, servers and users connections) is used for free by universities and science centres.
- The management of national and international databases on scientific documentation and resources available in libraries and public documentation centres.

As a conclusion, it is fair to say that SSTC-DWTC does not appear as a very visible actor in the Public Understanding of Science and Technology landscape. It does however play an important supporting role in the "back-office" of Public Understanding of Science and Technology and in international networking.

French governmental actions: Creating a positive climate for science and technology

Philippe Chavot, Anne Masseran

A – Ministries

Ministries offer their support to many local initiatives (including associations) and coordinate certain events, organisations and museums. In addition, they also back various actions aimed at broadcasting scientific and technological knowledge. The latter will be the main focus of this chapter. For the sake of clarity, we propose to structure it around ministries and institutions involved in CST actions. Note, however, that these headings are arbitrary. Indeed, many projects are collaborative in nature and involve several institutions.

1 – Ministry of Youth, Education and Research.

Until 2000, the Ministries of Education and Research were together and formed one entity. The two ministries were subsequently separated and re-grouped in 2002. At present, the ministry representative in charge of research and new technologies is Claudie Haigneré. The current situation of CST is still influenced by the institutional proximity existing between these two ministries.

The Ministry of Research is responsible for the implementation of a general policy for broadcasting scientific and technological information and supervising the relevant institutions and museums. In July 1999, the Minister of Research, Claude Allègre, established a *Mission de la Culture et de l'Information Scientifique* (MCIS, Mission for Scientific Culture and Information) whose main functions are:

- to raise public awareness in matters of science and technology developments, in particular with the organisation of the yearly *Fête de la science* (Science Days); [673]
- to develop and promote the scientific and technology heritage;
- to assess and restructure the results of scientific research, their exploitation and their dissemination to various publics;
- finally, to supervise the museums under the authority of the Ministry of Research.

The MCIS is given directives by the *Conseil scientifique pour la Culture et l'Information Scientifique et Technique et les Musées* (Scientific Council for Scientific and Technological Culture, Information and Museums). The first president of the Council

[673] See final section of this report for details on Science Days.

was Jean-Marc Lévy Leblond, a physicist who played a major role in the science critics' movement of the 1970s and is now highly committed to CST actions. Based on directives, the MCIS is meant to assess and guide current actions, proceed with international comparisons, suggest new directions to explore, and provide impetus to the sector. The influence of this new organisation is still difficult to assess due to recent government reorganisation.

The Ministry of Research supervises the following CST institutions :

- La Cité des Sciences et de l'Industrie de la Villette (situated in Paris but with collections managed by La Direction Générale de l'Administration);
- Le Muséum National d'Histoire Naturelle (MNHN, Paris);
- Le Conservatoire National des Arts et Métiers (CNAM, Paris); and
- Le Palais de la Découverte (Paris).

In addition, it partly supports the various CCSTIs, nationwide and decentralised organisations that come under the control of the MNHN and CNAM.

2 – The Ministry of Culture and Communication (Ministère de la Culture et de la Communication)

The Ministry of Culture, which is headed by Jean-Jacques Aillagon since 2002, is at the heart of CST policies. Although rarely at the origin of initiatives, it grants or sponsors a large number of CST actions. The recent project of an Internet portal dedicated to the scientific and technical heritage[674] enables the Ministry of Culture and Ministry of Research to renew collaboration in actions promoting scientific culture. In addition, and because the French media system depends on it, this Ministry can be directly involved in media actions. For instance, it plays a prominent role in science-related audio-visual events, like the yearly *Nuit des Étoiles* (Stars night[675]), or national charitable events covered by the media, like *Téléthon* or *Sidaction*, which respectively focus on genetic diseases and AIDS.

3 – The Ministry of Youth (Ministère de la Jeunesse)

Headed from 1997 to 2002 by communist Marie-Georges Buffet, the *Ministère de la Jeunesse et des Sports* works in close collaboration with decentralised institutions dedicated to the youth.[676] Since 2002, the Ministry for Youth has been under the control of the Ministry of Education and Research is no longer headed by a minister or a secretary of state. The "ministry" is responsible for general public education and for all events or establishments – apart from schools – dedicated to young people and

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[675] See the chapter dedicated to the media in this report.

[676] Such as the *Conseils d'Éducation Populaire et de Jeunesse* (Councils for Popular Education and Youth) and the *Associations d'Éducation Populaire et de Jeunesse* (Associations for Popular Education and Youth).

children. Hence, organising CST actions aimed at young people falls within its prerogatives and is the subject of constant initiatives. In 1999 for instance, the Ministry of Youth was instrumental in the preparation of different exhibitions and events related to the solar eclipse. The *Ministère de la Jeunesse et des Sports* has long privileged astronomy due, perhaps, to the large number of learned societies or groups of young enthusiasts. It is worth mentioning that CST is considered here as "social and cultural practices" in the broadest sense, a definition that deeply affects the nature of CST actions. Indeed, this makes initiatives intended for children quite different from those intended for adults (i.e. the "general public").[677] Unlike most CST actions – which generally aim at bridging gaps in scientific knowledge and passing information on in a linear fashion – initiatives intended for children rely mainly on interactivity, albeit in their different ways. We will come back to this point later.

4 – Ministry of Ecology and Sustainable Development (formerly Ministry of Territorial planning and the Environment / Ministère de l'Aménagement du Territoire et de l'Environnement)

From 1997 to 2002, it was headed by Dominique Voynet who has environmentalist leanings and was succeeded by Roselyne Bachelot. The ministry is involved in scientific information actions for the general public and covers themes relating to the environment (greenhouse effect, ozone layer, …). Initiatives may be on an *ad hoc* basis (e.g. "Days for the Environment", "1,000 challenges for my planet", the citizens conference "Climatic changes and citizenship", etc) or of a more permanent nature (e.g. job creation with positions dedicated to environmental education in the scope of the "new services-youth employment" scheme (*nouveaux services-emplois jeunes*), organisation of an Internet portal with an area dedicated to environmental education[678]). These initiatives are often supported by the action of decentralised departments. Hence, the scientific and technological information inherent to these actions is meant to increase public awareness of social, environmental and cultural issues and to explain, or even justify, institutional actions.

Joint actions are developed with the Ministry of Education, such as environmental classes, operations like *L'École de la Forêt* (the School of the Forest) or the publication of teaching packs on risks prevention.

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[677] The same may be noted between popularisation magazines intended for the general public, such as *Science et Vie, Science et Avenir*, and those intended for children. See, in this report, the chapter dedicated to the media.

[678] www.prim.net

5 – Ministry of Health, Family and the Disabled (formerly Ministry of Social Affairs / Ministère des affaires sociales)

This ministry headed by Jean-François Mattéi, is also involved in CST actions. It coordinates several institutions broadcasting health-related information.

Among these institutions we must mention, first of all, the *Comité Français d'Éducation pour la Santé* (Committee for Health Education), created in 1955 and changed in March 2003 into the *Institut National de Prévention et d'Éducation à la Santé* (INPES – National Institute for Prevention and Health Education). It then became a public institution with enlarged competence to cover expertise and counselling functions in matters of prevention. The INPES is based on a network of committees dedicated to health education (21 regional committees and 90 local committees), which reach the public through the means of direct informative actions (conferences, etc). It publishes a journal geared to the general public, *La Santé de l'Homme* (Human Health) and a great number of booklets on health-related issues (AIDS, smoking, alcohol, ...) aimed at both the general public and professionals.

Apart from the INPES, several organisations under the authority of the Ministry of Health have started to play an important role over the last few years due to contextual events. Among these the *Agence Française de Sécurité Sanitaire des Aliments* (AFSSA, French Agency for the Medical Safety of Food), the *Établissement Français du Sang* (EFS, French Institute for Blood) [679], and the *Agence Française de Sécurité des Produits de la Santé* (ASSPS, French Agency for the Safety of Health Products). These institutions are not primarily concerned with ensuring scientific information and even less with engaging in a communication with consumers. Nonetheless, due to the increase in the number of public controversies and, as a consequence, of institutional campaigns aiming at restoring public confidence, they are becoming both actors in CST and experts at delivering the "opinion of the institution". [680] At a later stage of this survey, further investigation on this evolution of CST will be required.

B – Public research institutions

Along with the universities, the Ministry of Research supervises several research institutions. While these are quite often involved in CST actions supported by other institutions or associations, they also initiate their own actions with increased frequency. All have set up their own press office, which sets up and controls relations with the media.

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[679] The AFSSA is placed under the authority of the Ministries of Health, Agriculture and Consumers Affairs. The *Établissement Français du Sang* comes under the sole authority of the Ministry of Health.

[680] There are other expert committees which come under the Ministry of Research or the Ministry of Agriculture: let us only mention the *Commission de Génie Biomoléculaire* (CGB – Commission for Biomolecular Engineering), in charge of the GMO issue and the *Dormont Committee* in charge of ESB.

1 – The National Centre for Scientific Research (CNRS, Centre National de la Recherche Scientifique)

Established in 1939, the CNRS is the largest research institution in France and it is highly involved in CST actions.[681] It organises and supports a large number of initiatives and cooperates with other institutions, as with *Oser le savoir* (Daring knowledge), a series of exhibitions presented last year at the *Cité des Sciences et de l'Industrie de la Villette*. On the occasion, the CNRS delegated members to act both as consulting experts and communicators, delivering public lectures during specific exhibitions such as the one dedicated to GMOs.

In addition, the CNRS organises its own scientific communication initiatives. Headed *Science pour tous* (Science for all) they are available on the CNRS website. These initiatives aim at establishing a contact between the public (generally the younger generations) and science with the organisation of debates on current issues. Although the idea underlying such actions is described as "debating as to the whys and wherefores of scientific achievements", they aim to satisfy what is presumed to be the public's thirst for scientific responses to its questions.

Among these activities, let us mention for instance the yearly *Science et Société* conferences held since 1990, at which young people are given an opportunity to discuss current issues with researchers.[682] They involve the organisation of debates on current affairs during which researchers are face to face with young people. Similarly, the objective of the operation headed *Recherche et Passion* (Research and Passion) is to organise events for young people, teachers and researchers to meet and talk. At these meetings, teachers and young people may present scientific projects and receive guidance and information from researchers. The aim is to answer the teachers' queries, with the involvement of researchers and engineers, and to enhance the curiosity and scientific reflection of young people by offering them an authentic approach to research.[683] Thus science is able to find its place within the world of culture and this context contributes to highlighting its social utility. Finally, the *sciences-citoyens* clubs (sciences-citizens clubs) aim at establishing links between research and young citizens and include the visit of laboratories, conference-debates on current subjects or local issues.

In summary, two a-priori assumptions are strongly underlying these actions where the citizen is confronted with science: (i) the public is asking for scientific information and (ii) science is a legitimate authority when it comes to addressing current issues. Moreover, let us insist on the fact that these actions are also intended to inform young people and make them aware of scientific career possibilities. As a result, they also contribute in the renewal of the scientific community.

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[681] Details on the history of the CNRS may be obtained in the bi-annual journal *Histoire du CNRS*, (CNRS edition), published since 1988 by the *Committee for the history of the CNRS*.

[682] In 2000, it was organised at the Futuroscope in Poitiers.

[683] Source: CNRS web site.

2 – The National Institute for Health and Medical Research (INSERM – Institut National de la Santé et de la Recherche Médicale)

Like the CNRS and the INRA, the INSERM is involved in a great number of CST actions, most of them related to health and medicine. It organises conferences, exhibitions (such as, for instance, the itinerant exhibition "When science meets art"), and has established a European network "INSERM-Young people" and INSERM youth clubs mainly developed in secondary schools. It broadcast information to teachers and funds several journals, such as *Medicine-Sciences,* a Franco-Canadian (Quebec) journal aimed at the general public which creates a link between medicine and citizenship, or the more specialised journal *Dialogue – Recherche – Clinique – Santé*, published by the committee *Inserm/Société*. Reference should also be made of the collection of scientific files *Repères (*reference marks), established in 2001. "*This collection will be directed such as to provide each of us with "reference marks", not only in scientific fields but also in history, sociology and economy, enabling us to be in a better position to define scientific challenges and interactions between research and society to open, ultimately, to public questions".* For the moment, three issues have been published, on prion diseases, stem cells and life patentability. This collection is therefore intended to be topical, tackling problems raised by scientific and technological developments.[684] Finally, it has recently established a committee for ethical issues, which has launched an action on deontology and medical information.

3 – The National Institute of Agronomic Research (INRA, Institut National de Recherche Agronomique).

We will limit our description of the CST actions organised by the INRA to a recent and major initiative launched in 2000 (in collaboration with the Ministry of Health, the Ministry of Agriculture and the State Secretary of Consumer Affairs) in response to the current questions related to food: *Les Etats Généraux de l'Alimentation* (EGA – general conferences on food). According to the Institute, up to now, consumers were seldom consulted on their perception of risks, on their eating practices or aspirations, on what they consider to be the role of State institutions and more generally on their perception of food quality and safety. Last year local and regional forums were organised to restore a dialogue. The conclusions were addressed during a general meeting held in December 2000, namely l*es Etats Généraux de l'Alimentation*.

This action is symbolic of a new tendency shaping the current CST actions. The area that was up to now clearly located on the production map and the "dissemination" of knowledge, open more and more, under the pressure of current events and public resistance, on decisions involving techno sciences (such as GMOs). In this context, the strategy followed by the INRA is to open a new area, situated outside the institution but

[684] Source: INSERM web site.

that may be instrumentalised by the institution. Indeed, the objective of the EGA is clearly stated: "to facilitate the government's decision-making process on these subjects, to take into account the real needs and worries of the population, and to clarify the situation related to the public's expectations regarding the security and the quality of food, particularly as regards information."[685] Hence, the philosophy of the EGA is still based on an information gap: public acceptance of scientific and technological choices jeopardised by their lack of information on these matters. However, this model and its actions have been hijacked – especially at local forums – by interest groups (ecologists, farmers, consumers...) and the newly created areas also allow for the expression of opinions different from the scientific and "legitimate" ones. In brief, this action has allowed activists to argue against the promotion of science and technology. At present, a study is organised on the EGA experience, highlighting one of the main difficulties encountered by this type of participation exercise in France: "[…] the difficulty which exists in "transmitting" the contents of pre-forums to the decision-makers our hypothesis is that these weaknesses are neither marginal nor accidental. Indeed, we suggest that they reflect the specific manner of participation adopted by organisers towards citizens and the way they can contribute to public decision, out of synch with the very basis of "participative democracy". Furthermore, we declare that they have a significant negative influence on the perception of the legitimacy of such procedures".[686]

In the continuation of the program, we will take into account this transformation of the CST areas and the way in which they can be colonised by non-institutional actors.

Within the framework of CST actions run by public institutions, let us mention those of the *Commissariat à l'Energie Atomique* (CEA, Atomic Energy Authority), which aims, in collaboration with others involved in this field, "to improve public information on research in physical sciences and on its applications."[687] The information disseminated is formal and the aim is clearly to transform, by making it more transparent, the public's perception of an institution whose main objective – i.e. to develop nuclear energy – is being less accepted by French people.

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[685] Source: Ministry of Agriculture web site: http://www.agriculture.gouv.fr

[686] Study: "Etats généraux de l'alimentation : retour critique sur une expérience de participation citoyenne" (General Conference on Food: critical thoughts on an experience of citizens participation) , Source: INRA web site.

[687] Source: CEA web site: http://www.cea.fr/html/decouvrirlecea.htm

Governmental initiatives in PUS in Portugal

Maria Eduarda Gonçalves, Paula Castro

1. Background

A Ministry for Science and Technology was established, for the first time in Portugal, in October 1995, within the government formed by the Socialist Party.[688] This Department has introduced as one central axis of its policy – and for the first time in Portuguese history, the promotion of scientific culture to the general public. This objective has been implemented mainly through the "Ciência Viva" (Science Alive) programme, launched 1996 and is now run by the new Agency for Scientific Culture.

2. The *Ciência Viva* programme

The "Ciência Viva" programme is essentially a programme for the popularisation of science, which relies on the cooperation between, on one hand, primary and secondary schools, and on the other hand, universities and state laboratories. This programme, therefore, aims to mobilise the educational and scientific communities. Its main targets are pupils and students from primary and secondary schools. Its methodology emphasises the experimental teaching of natural and technological sciences.

The "Ciência Viva" programme has encouraged the formation of permanent networks among schools, through its special twinning programme, and has given rise to the establishment of "Ciência Viva" centres.

In the words of the ex-Minister for Science and Technology, the "Ciência Viva" programme found its origin in the recognition of the need to struggle for the "general appropriation of scientific culture by the Portuguese population". "This programme was born out of a decisive debate against Portuguese scientific backwardness". The Minister added: "We are firmly engaged in suppressing in a definitive manner this endemic and centuries-old malediction that has repeatedly broken down our capacity to innovate, maintained our international isolation and has expelled those who could have contributed to its development, from the country so many times" These popularisation activities are seen as "a responsibility, in the first place, of the national scientific

[688] The Ministry for Science and Technology gave place to the Ministry for Science and Higher Education (MCES), following the March 2002 legislative elections that led to the formation of a new government based on a coalition of the Social-Democratic Party and the Popular Party.

community" being also understood as a "collective responsibility".[689] In fact, as has already been pointed out, the government has played a decisive role, since the mid-nineties, in encouraging scientists and scientific institutions' involvement in the diffusion of science to the public.

The "Ciência Viva" programme relies on the notion of scientific practice as the understanding and manipulation of nature and of technical objects. One of its underlying goals is to counter the traditional theoretically-based teaching of sciences, by a methodology of teaching based on experimentation. A concrete consequence of this policy has been, recognition, contributions towards providing schools with scientific equipment and instrumentation.[690] The programme's emphasis on experimentation and on technology manipulation excludes both the discussion on the nature of science and technology, and the consideration of the social, economic and political contexts of their production from the learning and awareness processes.[691]

It could be noted that, this scientific culture policy is out of phase with the public image that science is acquiring in the mass media to the extent that it does not consider the social and political dimensions of scientific activity. This is because it is an image of science that is not only viewed as increasingly relevant to people's lives but also as uncertain and controversial.

The very use of the word "experimental" in describing the turn towards "science as it is actually done" tends to reinforce the epistemological primacy of those scientific disciplines organized around laboratory and experimental practice, such as physics, chemistry and some areas of biology.

"Science as it is actually done" was the title of a cycle of public lectures organised by the Ministry of Science, in Lisbon, between October 1996 and January 1998. These lectures brought a number of philosophers and historians of science, as well as many of the most prominent names in STS to Portugal.

The lectures, which consistently had a high attendance of both students and high school teachers, were published shortly after the cycle ended.

3. The Scientific Culture Survey

In this context, another initiative by the Ministry of Science and Technology is worth mentioning. This is the Scientific Culture Survey. This Survey was first conducted in Portugal in 1990 and 1992, under the responsibility of Eurobarometer, the research instrument being the Portuguese version of the Eurobarometer questionnaire. After

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[689] Cf. MCT, *Ciência Viva, Livro de Actas*, 2º Fórum Ciência Viva, http://www.mces.pt/ .
[690] Idem.
[691] It should, however, be pointed out that there has been one, but just one, experiment of the programme in the field of sociology: the initiative was taken by the Centre for Research and Study in Sociology (CIES), of ISCTE, in 2000.

these first years, problems with both the methodology and the rationale were largely invoked and the survey was discontinued in Europe.

Portugal, however, decided otherwise. From the mid-1990s onwards, the Science and Technology Observatory (OCT) – a structure of the Ministry of Science and Higher Education – took the responsibility for these surveys. These followed both the same rationale and the same methodology of the previous Eurobarometer surveys, with only minor changes in some questions.

According to the OCT, to maintain these national surveys served an important comparative aim, since it is an opportunity to analyse the evolution of the scientific culture of the Portuguese. It has also been suggested that these surveys are still important in a country like Portugal to legitimatise more investments in scientific culture.

Governmental PUS initiatives in Sweden

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski

The following text provides an indication of the role the Swedish government has in PUS initiatives. The text will try to connect the different efforts to the specific social and political context of Sweden. Some aspects have already been discussed under other headings, but the objective here is to give an overall picture of the governmental role in questions of public understanding of science.

General Policy Background

For the majority of the 20th century, Sweden was ruled by strong Social Democratic governments. After the Second World War, in which Sweden was not directly involved, a thorough welfare state was created. This meant large investment in the public sector. The distribution of science to citizens and the use of scientific findings in public administration were seen as important parts of democracy and rational governmental ruling. In the 1990s Sweden as an industrial country experienced a deep structural crisis. Half a million people were unfortunate enough to lose their employment, mostly from the traditional manufacturing industries. Governmental policy was to reframe Sweden towards a knowledge economy and geared workers towards the expanding field of information technology. Of course, this dramatic shift changed the way knowledge is viewed in the Swedish context. Increasingly, it is seen as something that can be commercially exploited. As will be evident, both the features of the traditional welfare state and the changes due to the crisis in the 1990s have influenced science policy and PUS in Sweden. Questions of democracy, social relevance and economic growth have directed the governmental efforts in different ways and at different times.

In the early 1970s, the 'sectorial principle', a Swedish variant of the Rotschild principle, was introduced into Swedish science policy.[692] In accordance with this idea, the university is the main public repository for science and scientific knowledge which may then help to solve problems within various societal sectors, be it housing, supply of

[692] Elzinga, A, 1993, "Universities, Research, and the Transformation of the State." In Sheldon Rothblatt & Björn Wittrock (eds) *The European and American University since 1800. Historical and Sociological Essays.* Cambridge University Press, p 191-233. The Rotschild principle is a policy initiative, which entail a contractual relationship between researcher and funder, in which the latter supplies resources on the condition that the knowledge produced has specific policy and social relevance; see *A Framework for Government Research and Development*. London: HMSO 1971, usually referred to as the Rothschild report.

energy, national transportation and local systems, environmental protection, health and welfare, etc.[693]

In the Swedish context it therefore became important to view research in the academic domain as open to public scrutiny and transparency. To this end, efforts must be made to inform a wider audience about the existence of academic scientific research, making it accessible to various *user* categories.

During the 1970s, a number of new sectorial funding councils were created. With this came an increasing attention to *user information*, both before and after projects were begun and finished.[694] For example the information was transferred via contacts with the media, special brochures, research catalogues, and the creation of publications targeted at specific sectors and funded by the sectorial councils themselves.

Another very important policy initiative is the requirement for researchers to disseminate their results.[695] In the new University Act of 1977, this new task supplemented the earlier two officially proscribed responsibilities assigned to the universities, teaching and research, and it was thus called the “Third Assignment” (*tredje uppgiften*). Such disseminated research information (*forskningsinformation*) should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have come to modify the text, somewhat changing its intent. Some core ideas are, however, still present, which goes back to the fact that the universities are part of a unitary national system and are publicly funded.

Initially, an important element of the “Third Assignment” was the emphasis on the democratic significance of research-based knowledge. The idea of research as a resource for changing society caused, in a political perspective, two democratic problems.[696] One of them was that the citizens needed to increase their awareness and control over these changes. Secondly, as knowledge increasingly became important for the possibility of citizens exercising their democratic rights, it also seemed

[693] See Elzinga, A, 1980, "Science Policy in Sweden: Sectorisation and Adjustment to Crisis", Research Policy, vol 9, no 7, April, p 116-146; 1990, "Triangeldramat bakom forskningspolitiken", (Triangleplay in research policy), in Wilhelm Agrell (ed), *Makten över forskningspolitiken*. Lund: Lund University Press, p 41-60. This means very little applied research is done in special government laboratories or institutions that fall under the direct authority of one or another ministry. Instead ministries support special research funding agencies that receive both unsolicited and solicited grant proposals from universities. These are sometimes called "sectorial research councils" to distinguish them form the more traditional basic research oriented councils which continue to allocate funds on the basis of a pure peer review process. The sectorial councils combine criteria of societal relevance and scientific excellence in their review procedures. In some cases the former dominate over the latter, in other cases the two-tier approach starts with scientific merit. Of course there has been a lot of debate around these procedures; they may be compared to the notion of "extended peer review".

[694] Several studies have been carried out during the 1980s on research utilization and modes of disseminating results linked to sectors: Björklöf, S, 1986, “Byggbranschens innovationsbenägenhet.” Linköping studies in management and economics, no 15, Diss; Boalt, C & Lönn, R, 1987, “Forskningsanvändning.” Tidskrift för arkitekturforskning, vol 1, nr 1; Ericson, B & Johansson, B-M, 1990, Att bygga på kunskap. Användning av av samhällsvetenskaplig FoU inom byggsektorn. BRF Rapport R 3; Nilsson, K & Sunesson, S, 1988, Konflikt, kontroll, expertis. Arkiv, Lund.

[695] Svensk författningssamling 1977:218.

[696] Om forskning. (About research) Forskningsproposition 1986/87:80.

increasingly problematic that dissemination processes traditionally were relatively marginal and skewed in favour of those in power, at the cost of a broader public.

The roots of this emphasis on the importance of enlightened citizens are often believed to go back to the 19th century when the Swedish democratic movement sought legitimisation by reference to contemporary scientific knowledge and scholarship. An important aspect of this belief was that education and not revolution is best for empowering people to change society and become democratic beings.[697]

A new formulation of the “Third Assignment” (1997) was intended to foster a more intense interaction between the universities and society at large and in particular with industry. In the Ministry of Education’s directive it was apparent that universities and colleges are meant to increase the extent of their collaboration with industry, public administration, organisations, cultural life and popular education. In a recent Science Bill, the objective is not only to disseminate research information to the public; it also explicitly states that industry must be a recipient in the dissemination process.[698] To make this easier, it is proposed that universities may create subsidiary companies, co-operating with industrial partners.[699] At the same time it is underlined that these collaborations should not be allowed to compromise the freedom of science.[700]

However, many now reinterpret the “Third Assignment” as a demand that universities and colleges should interact more intensely with industry.[701] For some, the “Third Assignment” is now associated with forms of interaction that go beyond informing about R&D results. One of the driving forces is globalisation, which is often referred to as a motive for developing university-industry landscapes to improve local or regional competitiveness in the marketplace. In addition, the government has recently stated that the “Third Assignment” has been important in fostering a new entrepreneurial spirit in universities and colleges.[702]

Another general policy directive is the current change which the Swedish research funding landscape is undergoing. Research granting agencies, of which there were many, are now brought together to form a small number of integrated agencies. Earlier, the responsibility of allocating research grants was divided between the *Swedish Council for Planning and Coordination of Research* (FRN), the *Swedish Council for Research in the Humanities and Social Sciences* (HSFR), the *Swedish Medical*

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[697] See e. g. Gustavsson, Bernt, 1991, Bildningens väg: Tre bildningsideal i svensk arbetarrörelse 1880-1930. (”Bildningens” way: Three ideals of educative formation in the Swedish labour movement 1880–1930.) Stockholm: Wahlström & Widstrand; Wallerius, Bengt, 1988, Vetenskapens vägar: om akademiker och folkbildningsarbete. (The ways of science: On academics and popular education) Stockholm: Folkuniversitet.

[698] FoU och samverkan i innovationssystemet (R&D and cooperation in the innovation system). Regeringens proposition 2001/02:2, p. 31.

[699] FoU och samverkan i innovationssystemet (R&D and cooperation in the innovation system). Regeringens proposition 2001/02:2, p. 44.

[700] Forskning och samhälle. Regeringens proposition 1996/97:5, s 60.

[701] Brulin, G, 1998, Den tredje uppgiften: Högskola och omgivning i samverkan. SNS Förlag och Arbetslivsinstitutet.

[702] FoU och samverkan i innovationssystemet (R&D and cooperation in the innovation system). Regeringens proposition 2001/02:2, p. 6.

Research Council (MFR), the *Swedish Natural Science Research Council* (NFR) and *the Swedish Research Council for Engineering Sciences* (TFR). In the beginning of 2001, the new *The Science Council* (Vetenskapsrådet) was established, taking over all of the commitments of the aforementioned agencies.

The Council has three divisions: one for humanities and the social sciences, one for medicine and one for the natural and engineering sciences.[703]. In addition to its commitment to "..support research" and to "..promote the scientific quality and renewal of basic research in Sweden", the objectives of the Council also include a responsibility "on a national level for general information on research and research results"[704].

At the national level a number of new strategic research foundations (*Strategiska Stiftelser*) have been created, independent from the government. Their mandate is to fund long-term motivated research that can provide added value in an economically or socially beneficial sense. These foundations help in matching funding and finding partners for industry or other 'users'. Aside from foundations to stimulate a science base for generic technologies and environmental concerns, there is also a specific foundation for knowledge and competence development (*KK-Stiftelsen*). Here the task of partnering includes attention to dissemination of research information that will be conducive to the development of regional policies for innovation.

With the introduction of the strategic foundations some funding has been shifted away from the basic research councils.[705] In addition, the earlier funding to the universities, earmarked for supporting efforts in "research communication" at the universities during the years 1993-96, has now been terminated. Within the universities this has given rise to some protest since "research information" is still very much regarded as an 'added on' to other, in the minds of faculty, more important activities. Arguably, research information has today attained a stronger position within policy. In a recent Science Bill, notably titled *The Open Higher Education*, it is explicitly said that the "Third Assignment" must take resources from teaching and research.[706]

Specific aspects

In addition to these large policy initiatives, the Swedish government has taken a number of other decisions regarding PUS. The discussed policy changes demanded information strategies on behalf of the universities, particularly stressing the internal information directed at employees while outward ambitions were restricted to information on new courses.[707] In 1964 the universities at Lund and Uppsala created

[703] Information gathered from the homepage of the Council; see http://www.vetenskapsradet.se/ .
[704] See http://www.vetenskapsradet.se/
[705] Forskning och samhälle. (Research and Society) Regeringens proposition 1996/97:7, p 45-47.
[706] Den öppna högskolan (The Open Higher Education). Regeringens proposition 2001/02:15, p. 220.
[707] Hjort, C, et al, 1981, *Ut med forskningen.* UHÄ & Liber, Södertälje, p 149.

posts assigned to disseminating information affiliated to the rectors' offices. The information secretaries work mostly involved internal business but they also supplied the media with information.

This early administrative 'popularisation' work was intensified in connection with a much debated reform in 1968-69 (*Pukas*). The government and the then minister for education Olof Palme had commissioned *UKÄ* (the National Board for Universities and Colleges) to perform an investigation into the possibilities of producing more undergraduates in a shorter time. The resistance to this reform prompted the government to be very generous in financing information activities at the universities. The information secretaries at the universities found themselves in a dilemma trying to inform about a new very much criticised reform both inside and outside the universities.

In Sweden very little applied research is undertaken in special government laboratories or institutions that fall under the direct authority of one ministry or another. Instead, ministries support special research funding agencies that receive both unsolicited and solicited grant proposals from universities. One part of this system is the creation of sectorial research councils; another aspect is the dependence on governmental agencies for applied research. It is important to note that governmental agencies thus become involved in discussions and actions concerning the "Third Assignment". In addition, in the Swedish governmental system the ministries are relatively small and flexible, while their agencies are much larger. The opposite case applies to most other countries. This gives the agencies a special position in Sweden, which must be understood when discussing governmental activities.

For instance, currently the Swedish government pursues an active IT-policy in several areas, directly affecting relations with the public. At the end of 1996, the Government assigned *Högskoleverket* (the National Agency for Higher Education) to co-ordinate a national system for disseminating research information on the Internet. The project resulted in SAFARI. This acronym translated means "the spreading of research information to the general public over the Internet".

The system aims at supporting groups like journalists, upper secondary school students, firms and other organisations, to find information about research in Sweden from a single source. The Agency (*Högskoleverket*) is responsible for developing and maintaining the system and universities and other research organisations are responsible for the information input.

Other government agencies not directly pursuing research and education policies are also involved in questions of PUS. One example is *Naturvårdsverket* (The Swedish Enviromental Protection Agency (SEPA)). The Swedish EPA has five fundamental principles: the promotion of human health, preservation of biological diversity, preservation of cultural heritage assets, preservation of long-term production capacity of ecosystems, and wise management of natural resources.[708] As these problems concern the public, the SEPA is also involved in addressing questions of the relation between science, citizens and politicians.

In May 2001, during the Swedish EU presidency, EPA organized a conference called “Bridging the Gap” together with the EU Commission and the European Environment Agency (EEA). The conference addressed several important questions; for example, the key issues incorporated discussions relating to whether there is a proper balance between the responsibilities of scientists and end users to pursue environmental policies; if the voices of the scientific community should express themselves more audibly; and if the European Research Area, the sustainable development concept and the Environmental action programme are the right tools to communicate research findings.[709] One of the conclusions of the conference was that “sustainability research must involve all stakeholders. Research on the dialogue between science, society and citizens is necessary, as a basis for a better understanding of user needs, decision-making under uncertainty and the nature of science”[710].

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[708] See http://www.naturvardsverket.se.

[709] See http://www.bridging.environ.se; also see the rapport *Bridging the Gap* from the conference, to be downloaded from http://www.bridging.environ.se/bridgdok/bridgtid.pdf

[710] *Bridging the Gap*; conference rapport (ISBN 620-8057-1), p. 26

The role of UK Government in PUS: Education and promotion while keeping science advice in expert hands

Josephine Anne Stein, Damian White

Introduction

Promotionalism, "spin" and "market research" are sometimes difficult to decouple from genuine public consultation and engagement in the UK; much of the controversy surrounding UK Government PUS activities stems from differences in perspective over the actual character and utility of these initiatives. Educational and other "deficit model" modes of science communication predominate in the British PUS movement; these are covered in other sections of this report such as those devoted to universities, science festivals and museums. These mainstream PUS activities receive government funding, both directly and indirectly, and as such reflect explicit UK Government policy on the merits of promotional PUS. Government-run consultative exercises such as (Technology) Foresight[711] and the Public Consultation on Biotechnology, which are also covered elsewhere in this report, similarly reflect Government policies and priorities as well as those of the people and organisations being consulted. The role of the UK Government in defining and in supporting these activities ranges from passive sponsorship to active execution.

This section focuses on the PUS initiatives of Government bodies themselves, including the scientific Research Councils. Much of the material on the Research Councils is drawn from Pearson (2001)[712]; that on public dialogue from Kass (2001)[713]. To place these activities into context, it is useful to consider the extent to which they are educational or promotional in character (ie deficit model) or genuinely consultative (ie democratic), and the extent to which the Government plays an active vs. a passive role.

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[711] The Technology Foresight exercise that began in 1993 was intended to bring generators of new knowledge together with knowledge users to discuss national priorities for innovation support. Technology Foresight did not include a significant element of public consultation, and its producer/marketing/expert-led character was subsequently felt inadequate; the next exercise dropped the word "Technology" and expanded stakeholder representation in an effort to extend the consultation to a broader constituency.
[712] Gillian Pearson, "The participation of scientists in public understanding of science activities: the policy and practice of the U.K. Research Councils", Public Understanding of Science, Vol. 10 (2001) 121-137.
[713] Gary Kass, "Open Channels: Public dialogue in science and technology", Parliamentary Office of Science and Technology report No. 153, March 2001.

Central Government

Until little more than a decade ago, consultations by the UK Government were conducted under strict adherence to the Official Secrets Act and were by definition inaccessible to the public. They were characterised by an odd mixture of expert-led advice and a culture of amateurism (closely associated with an ethos within the Civil Service that considered in-house expertise susceptible to bias). Advisory groups met in secret and delivered advice to Government in secret. It was not until the 1970s that the Government began to publish reports based on the recommendations of scientific advisory committees, where they could then be examined and challenged by other experts or by the public. By and large, these reports were not widely circulated and were relatively uncontroversial. Public access and public criticism were initially limited.

Gradually, however, a climate of openness and transparency in government took hold, accelerating in the 1990s, and with it the emergence of scientific advisory mechanisms from the shadows[714]. With this emergence, however, came controversy, culminating in the BSE (bovine spongiform encephalopathy or "mad cow") crisis of 1996. Government assurances about the safety of British beef appeared to be contradicted by a statement by the British Health Secretary that a cluster of CJD cases (Creutzfeld-Jakob disease, the "human equivalent" of BSE) were "most likely ... linked to exposure to BSE" (quoted in Gregory and Miller, (1998), p.177).

Public confidence in scientific advisory system and in the reliability of expert advice collapsed, triggering a spontaneous consumer boycott of British beef that was highly damaging to the industry. Jasanoff (1997)[715] observed that the extent of scientific uncertainty over BSE coupled with the extent of public debate led to a situation in which "the lay public was almost as well positioned as the experts to make sensible decisions about how to avoid the risk of BSE". This was clearly a profound challenge not only to the authority of the scientific advisory system but to the authority of Government itself, with questions raised over its capacity to protect public health and safety.

In the aftermath of the BSE crisis, and with the coming to power of New Labour in 1997, public consultation by the UK Government began to flower; S&T related issues prominent amongst those under consideration. Whether this was undertaken in order to elicit public input or to provide public reassurance cannot be established definitively, but a clear separation continues to be maintained in the UK between citizen consultation exercises and expert advisory processes that are embedded into policymaking processes. One

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[714] See, for example, a paper by Sir Robert May, "A Note by the Chief Scientific Adviser," Office of Science & Technology, March 1997.

[715] Sheila Jasanoff, "Civilization and madness: the great BSE scare of 1996", *Public Understanding of Science*, Vol. 6, July 1997, 221-232.

illustration of this is that the Kass/POST report on public dialogue in S&T (2001) was released on the very same day as the House of Commons Report on the Scientific Advisory System[716], in separate launch events (during national Science Week).

This, then, sets the context for our review and critique of public consultation/PUS activities by the UK Government over the past decade.

The first major public S&T-related consultation of the UK public by the UK Government was launched in 1992, by William Waldegrave, then Cabinet Minister under Margaret Thatcher, who was responsible for the newly-constituted Office of Science and Technology (OST, located within the Cabinet Office, and subsequently moved to the Department of Trade and Industry. This was a far-reaching, open process in which scientific bodies, universities, social groups, industry, professional associations, research entities of any type, and individuals, were invited to give their advice on the future direction of British science policy. Anyone could participate, and OST reported that it had received more than 800 submissions. The resulting report laid out a comprehensive strategy for Science, Engineering and Technology and how the Government's policies and objectives could contribute to the UK economy and to the quality of life.[717] Although many organisations (and some individuals) published their own views, the Government did not publish the evidence it had received, and according to sources familiar with OST, there was such a volume of evidence that not all of it was read.

A main outcome of this consultation served to reinforce the Government's contentions that science needed stronger linkages to industry, through a variety of means, in order to enhance wealth creation (and quality of life, although this always took a back seat to the economic aims). Was this exercise done to legitimise a pre-existing Government view, or was it a legitimate consultative process that allowed democratic shaping of national policies? Opinion differs.

More recent public consultations raise similar questions. A major initiative was the Cabinet Office's People's Panel, a sample constructed in 1998 which comprised 5,000 members of the British public with a profile representative of the population as a whole, using standard demographic categories such as age, gender and region. This Panel was constituted as a resource which could be engaged in different types of consultation, from focus groups to surveys, some of which relate to science. The consultation exercise on public attitudes towards the biosciences, perhaps the most significant example of this, is covered elsewhere in this report. It is worth mentioning here, however, that opinions of the nature of this consultation varied, with some activities seen more as market research conducted

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[716] UK House of Commons Science and Technology Committee, "The Scientific Advisory System", Report HC 257, The Stationery Office Ltd., London, 12 March 2001.

[717] "Realising Our Potential: A Strategy for Science, Engineering and Technology", May 1993, HMSO, London.

under firm Government control than as a democratic process in which participants had meaningful influence over the outcome (Irwin, 2001).
This type of public consultation at the level of Central Government remains relatively unusual, the Government's strategy being more focused on extending the more traditional consultation tools by putting discussion documents on line (at www.ukonline.gov.uk). Nevertheless, the Cabinet Office has developed guidelines on Government use of public consultation, and it used the results of an online consultation in the preparation of new guidelines on scientific advice (need reference!). More detailed discussion of this mode of public consultation is covered in another part of this report. Guidelines on public consultation have also been produced by the Department of the Environment, Transport and the Regions (DETR), aimed both at local authorities and concerning environmental risks. DETR has set up a Chemicals Stakeholder Forum as an advisory body on chemicals policy, risk assessment and regulatory issues. Both the Department of Health and the Ministry of Agriculture, Fisheries and Food are considering participatory dialogue as a way to address public concerns over food safety. An interdepartmental liaison group on risk assessment, drawn from a number of Government Ministries and agencies, recommended a greater role for public dialogue in all stages of risk assessment, from the identification of potential risks to the development of regulatory controls.

Government agencies, commissions and advisory bodies

Three official bodies set up by the UK Government since the BSE and GMO controversies in the 1990s have a specific remit to include public consultation in their decision-making processes:

- The Food Standards Agency
- The Agriculture and Environment Biotechnology Commission
- The Human Genetics Commission

In all three cases, science and the biosciences in particular are central to the areas for which these bodies are responsible.
The Food Standards Agency has an exceptionally clear commitment to "ensure that all relevant parties are given the opportunity and, whenever possible, the time to make their views known, including representatives of those affected by any proposed activity and the public." (FSA, quoted in Kass, p. 26). The Human Genetics Commission used the People's Panel to conduct a consultation on public attitudes towards human genetic information, and set up a Public Involvement in Genetics Sub-Group to consider various options for

public consultation, such as public meetings, internet discussion groups, focus groups and citizens' juries.

UK Parliament

The "Mother of Parliaments" is of course the most prominent and influential form of lay citizen involvement in deliberating on S&T-related issues and shaping national policies. Under New Labour, efforts to improve the representational composition of the House of Commons was most visible in the election of record numbers of women as Members of Parliament; reforms to the House of Lords aim to diminish hereditary membership while broadening the basis for nomination and selection of new members. However, the Parliament has relatively more internal expertise than the public at large. The House of Lords Select Committee on Science and Technology includes a number of highly distinguished scientists; the House of Commons Select Committee too has impressive expertise in science, technology and medicine amongst its membership.

In addition to the technology assessment studies performed by the Parliamentary Office of Science and Technology (POST), the Parliament receives advice through the "usual channels", inviting expert witnesses to give evidence, reading and responding to constituent mail and lobby groups, and accepting public petitions. More recently, the Parliament has been experimenting with electronic discussion groups, initially in such self-referential areas as electronic democracy and mechanisms for public consultation in S&T.

UK Regions, Local Government and Health Authorities

The new Scottish Parliament is a strong proponent of teledemocracy, allowing for example the submission of petitions electronically through its Website. The devolved Scottish Executive maintains a Website through which the public can access and comment upon consultation documents, and hosts electronic discussion fora on topics such as services for those with learning disabilities. The Welsh Assembly has implemented a moderated electronic discussion forum to augment more traditional forms of interaction with the public. A Civic Forum in Northern Ireland, comprising representatives of a highly diverse set of social groups, has been established as a consultative group on social, cultural and economic issues, providing advice to the Northern Ireland Assembly.

It is at local level, and within health authorities in particular, that public consultation in the UK is at its most highly developed and widespread. By 1997, over 40 local authorities had used citizens' panels. It is, however, in the healthcare sector that some of the most sophisticated S&T-related public consultations have occurred. One such example was a consultation of disabled users of health services in the Rochdale area (near Manchester), in which blind, deaf and disabled representatives of the user community served on the Steering Group defining the content of the study, selecting the contractors, and advising on the study progress, interpreting the data, and drawing conclusions[718]. Although the purpose of the exercise was to improve healthcare delivery, the Steering Group took a very broad view of what was required to do so, and addressed highly technological questions such as advanced communications and mobility aids.

Research Councils

A call to scientists to engage in PUS concluded the Bodmer report of 1985[719], "Learn to communicate with the public, be willing to do so and consider it your duty to do so."
Ten years later, a committee chaired by Sir Arnold Wolfendale reinforced this by stating "Scientists, engineers and research students in receipt of public funds have a duty to explain their work to the general public," (quoted in Pearson, 2001). These appeals to civic duty undoubtedly resonated with the scientific community and stimulated the PUS movement in Britain, but duty became more formalised and less voluntary as both strings and incentives were attached to Research Council funding.
Following the restructuring of the Research Councils called for in the White Paper of 1993, the engineering, physical and life sciences were given a remit to promote the Public Understanding of Science in their respective areas. This mission was incorporated into their respective charters and led to a great number and variety of activities, much of it sponsored by small grants schemes aimed at getting scientists to engage in PUS projects. All five of the "hard" science and engineering Research Councils require their grant holders to participate in PUS activities, and to report on what they have done.
All of the Research Councils either operate their own PUS training schemes or provide sponsorship for scientists to undertake training in science communication. While they typically spend about a quarter of 1% of their respective budgets on PUS activities, the total Research Council spending on PUS in 1999 amounted to £2.8 million (Pearson,

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[718] Public Health Resource Centre, Rochdale, "Needs Assessment of Rochdale Residents (aged 16 - 60) with Physical Disabilities and Sensory Impairments", Final Report, February 1995.
[719] The Royal Society, "The Public Understanding of Science", 1985.

2001). In that same year, the Research Councils employed a total of 25 full-time equivalent staff to administer their PUS programmes. All of the Research Councils operate PUS Websites, mainly targeted at children, and run activities for and produce publications for schools.

Three of the Research Councils require grant applicants to say how they will communicate their work to the public, and those receiving funding from a fourth are required to do the same. Upon completion of their grants, the awardees are required to report on what they have done.

The Economic and Social Research Council, not covered in the above discussion, takes a slightly different approach, encouraging grantholders to disseminate research results in the popular press and to engage with user groups in designing and conducting research. However, it most obviously manifests its commitment to PUS by sponsoring *research* on PUS. How does one communicate research on PUS to the public? This is where we leave the discussion!

Conclusion

As this section has shown, there have been a great number of UK Government initiatives in promoting science (largely through the so-called “Science Base”, which is dominated by the Research Councils) and in promoting public dialogue on science-related issues through augmenting and innovating democratic processes at all levels of Government.

The main emphasis of the UK Central Government policy is relatively passive support of mainstream PUS activities through its sponsorship of PUS activities by NGOs, through the Research Councils and related bodies such as The Royal Society, and by its agencies (such as the National Physical Laboratory). Although interactivity is encouraged, the educational or deficit model approach clearly predominates.

In areas like Foresight, and in the biosciences consultation exercise, the UK Government has played a very active role. The extent to which these processes are genuinely open and democratic is disputed. Some parts of the biosciences exercise would appear to have been conducted in a considered, deliberative manner, although the uptake of the results of these consultations is not necessarily influential. Other parts of the biosciences “consultation” more closely resemble market research.

The focus group exercises undertaken by New Labour, which some have perceived as influential in shaping national policies, are welcomed by some but have also attracted criticism for being anti-democratic means to bypass legitimate representative government.

Certainly there is a preoccupation with news management or “spin” that permeates current British politics, especially with respect to New Labour.

During the 1990s, the surge in interest in public consultation and dialogue was closely associated with the “popularisation” of PUS through, *inter alia*, government-funded science centres and government-sponsored civic activities. By 2003, the shine may have started to go off much of the consultative activity, although the promotional activities seem to have become more institutionalised. At the same time, following a two-decade decline in public funding of science, it has “bottomed out” and even started to recover.

Has the post-BSE, New Labour era ushered in new democratic tools related to PUS that are likely to withstand the test of time, or is the current wave of enthusiasm for public consultation a passing fancy? There is every indication that the mainstream scientific advisory system remains intact in terms of its expert orientation and control, and that the great bulk of Government-sponsored or organised PUS activities are conducted according to standard educational/deficit thinking. However, there has been an indisputable sea change in recognising the importance of science-related communication through direct links between the Government and its supporting bodies with the public. Whether this continues to develop into robust and lasting democratic development or becomes marginalised remains to be seen.

CHAPTER 4

National Profiles on Public Understanding of Science and Technology in Europe

Ulrike Felt

Throughout the rather detailed description and analysis of the situation in different countries with regard to PUS activities, we managed to identify rather different approaches to the problem, to observe a large variety of forces and dynamics at work and we were confronted in very different ways with the power of traditions and political cultures. We have met countries who position themselves as leaders and other as followers, we have realised the difficulty to think and speak about national concepts when in certain domains geographical borders have ceased to be a meaningful entity when it comes to science communication, we have seen the large discrepancies between rhetoric of the need for more society in science and the sometimes rather limited realisations.

Chapter two has confronted us with the national policy world and with the ways – the possibilities and limitations – the question of science, technology and society is conceptualised there. Throughout chapter 3 we have then delivered a rich and colourful picture of the concrete spaces, of the large diversity of activities that have been taking place there, of the multiple actors that inhabit and structure these spaces and of the diverse motivations and logics that are at work. Now we want to halt and try to draw the threads together.

The aim of the following six parts in this chapter is not to get into the details of a description of the divers national situations, but remain quasi on a meta-level and look at the overall structure with regard to PUS-initiatives that developed in each national setting. In a sense it is like taking an a real picture of a landscape – we are in this description not so much interested in all the little details, but much more want to see the overall structure, the great lines of development. These chapters will contain different elements to compose this picture. Offering a historical contextualisation is essential as it often delivers the necessary pieces of information in order to understand current developments. But writing these national profiles will above all mean to offer a narrative on the dominant lines of development, on the relation between the activities in the different fields we described, on the strength of particular practices which a country has developed, on places where important innovations have been taking place, but also about the weaknesses and the white spots on the landscape that became apparent.

As in all the chapters so far also here the country reports will be presented in an alphabetic order.

Austrian National Profile on Public Understanding of Science Initiatives

Ulrike Felt

Introductory remarks

The following chapter tries to draw an overall picture of the Austrian national profile regarding the initiatives in the field of Public Understanding of Science and Technology (PUS). The aim is to go beyond what has been described and analysed in the individual chapters and to take a look at the changes from a more meta-oriented-perspective. What are the major trends that we can discern in the Austrian case? What are the specificities of this national context, the difficulties, but also the more positive developments? And, can we formulate challenges to be taken up for the future?
This contribution will be structured in two parts.
In a first part I will try to sketch the historical relationship between science, politics and publics throughout the 20th Century in Austria. I believe that this historical excursion is necessary in order to be able to judge some of the contemporary difficulties/problems we meet in the area of PUS. It will also provide elements of information on the cultural context in which these initiatives are embedded.
The second part will then draw on the different spaces, which have been described in detail in Chapter 3. I will try to develop an overall assessment of the more positive developments that could be recognised in recent years; I will highlight the weak points remaining and will conclude with some ideas about how one could face the challenges that lie ahead for the Austrian context.

1. Elements of the historical context for PUS in Austria

Writing about the relationship between science and the public in Austria within the 20th century from a historical perspective is difficult for a number of reasons. First, the nation state Austria – as it is known today – emerged only after WW I a small part (6 million inhabitants) of the large Austrian-Hungarian Empire (with a population of no less than 55 million inhabitants). This moment in the Austrian history – as we would like to argue – had a long-lasting influence on the relationship between science and the public.

Second, it is important to comment that Austria had/has[720] no strong tradition in the history of science, although the country, and in particular Vienna, played in many ways a key-role in science in the late 19th and early 20th century. Consequently, writing this chapter I could not draw on a more or less comprehensive work on the role of science and scientists in the Viennese context. Further it is of interest to draw attention to the fact that most scientific books and articles written on *fin-de-siècle* Vienna make reference to the exceptional spirit that prevailed at that time in Vienna, but when it comes down to arguing this in a more detailed manner, they discuss philosophy, art, architecture or literature, but not science.[721] On top of the general lack of Austrian history of science even less has been done with regard to questions like science popularisation, the cultural embeddedness of science, science communication or public up-take of science. Only recently a number of projects have been commenced trying to shed light on this area.[722]

Third, it is important to remark that Austria, as it shares a common language with Germany, has always been strongly influenced by the developments, which took place there. In particular with regard to science communication we have to consider the fact that many of the German popular science journals and popular science books were largely diffused also in Austria and later – with radio and TV entering the stage – this is even more clearly visible. One could also argue that in the contemporary German context there was until the late 1990s no explicit debate about public understanding of science – a fact that nicely underlines an additional parallel.

Fourth, we have to consider that throughout the Austrian history of the 20th century one can observe the overwhelmingly central role played by Vienna, as the capital first, of the Austrian-Hungarian Empire and then of Austria. At the end of the 19th century with

[720] The few science history projects done in Austria were carried out on a project basis by free-lance researchers outside the university. There is not a single university chair devoted explicitly to the history of science. Only in the last 3 years a small group at the university of Vienna has been trying to build up a programme in the history of science in Austria.

[721] See for example: SCHORSKE, C. E. (1982/1980): *Wien. Geist und Gesellschaft im Fin de Siècle*. (Frankfurt/Main: S. Fischer).

[722] There is a group working on zoos as places of knowledge production and dissemination. Some work has been done on the members of the *Wiener Kreis* and their diffusion of scientific results. Research has been done on the working class movement and the popular universities however more under the institutional perspective than regarding the interaction-mechanisms between science and the public in this domain.

U. Felt has been carrying out a larger project funded by the Austrian National Science Foundation on media coverage of science and technology from 1900 - 1938. See some articles: "Lire la science à Vienne: 1900 — 1938", in B. Bensaude-Vincent et A. Rasmussen. (Hrsg.), *La science populaire dans la press et l'edition* (Paris: CNRS 1997): 237-255. "Why should the public »understand« science? Some aspects of *Public Understanding of Science* from a historical perspective", In M. Dierkes und C. von Grote (Hrsg.): *Between understanding and trust: the public, science and technology* (Berkshire: Harwood Academic Publishers, 1999); A Adaptacao do conhecimento cientifico ao espaco publico (The social and cultural tayloring of scientific knowledge in the public space), in M.E.Goncalves (org.) (2000): *Cultura Cientifica e Participacao Publica* (Oeiras): S. 265-289; Die Stadt als verdichteter Raum der Begegnung zwischen Wissenschaft und Öffentlichkeit: Refelxionen zu einem Vergleich der Wissenschaftspopularisierung in Wien und Berlin um die Jahrhundertwende, in Constantin Goschler (Hsg.) (2000): *Wissenschaft und Öffentlichkeit in Berlin, 1870-1930* (Franz Steiner Verlag Stuttgart): S. 185-220. A book publication is on its way.

the increasing industrialisation Vienna became a financial and administrative centre, which had at the turn of the century more than 2 million inhabitants (today 1,6 million inhabitants). Also, most of the newspapers were printed there since they could be distributed much faster throughout the country as well as to the foreign capitals. After the end of WW I, this relation centre-periphery became even more polarised: Vienna with nearly 2 million inhabitants was the capital of a nation-state with 6 million inhabitants and it was placed in the extreme-East of the country. Thus it was by far easier to keep trace of what happened in the centre, while things remained less visible at the periphery. The relation centre-periphery with regard to science-society interactions is one aspect where further investigation would be required in the Austrian context.

Finally, the history of Austrian science is characterised by the exodus of the best scientists for reasons of political and racial discrimination, an exodus that had begun in the 1920's and was accelerated after the "*Anschluss*". After WW II, Austria neither managed to develop a clear policy of denazification within the universities and in other societal sectors, nor did Austria make any concerted effort to bring back those scientists who had to leave Austria in the pre-war period. This means that after WW II the situation of the science system was disastrous both for reasons of lack of competent scientists to build up the science system to an international standard and because there was little money spent on research and development in general. Scientific and technological development was not seen as crucial to the development of the country, a fact that started to change only gradually from the 1970's onwards and which is still not present to the same extent as it is in other European countries. It is also interesting to note within this context that one of the dominant narratives about the absence of PUS initiatives in Austria tries to establish a causal relation between the loss of scientists due to the exodus and the lack of interest in science from the side of the public. I would very much like to challenge this explanation as being far too simplistic and not taking into account a number of other developments.

Let us now try to assemble some important elements in the history of science/society relationships within Austria. To begin, we should stress that the period late 19^{th} /early 20^{th} century was particularly important with regard to science communication. It has to be characterised by a collusion of different developments, three of which we will describe here.

Firstly a diversification of the public and places where science meets these publics occurred.

- Science education became obligatory in high-school curricula at the turn of the century.
- A growing number of people were able to read and thus get access to print media and the information on science and technology distributed there; due to

the widely spread "coffee-house culture" a lot of people read different newspapers there.

- The daily press which diversified largely in the beginning of the century became a central means to disseminate science and technology. From the turn of the century onwards, there was a broad range of newspapers produced in Vienna, covering the full political spectrum as well as all layers of potential readers; most of them more or less regularly treated issues of science and technology in different sectors of the newspaper; in particular newspapers with an international audience addressed technological issues in special columns, since they saw them as an important motor for economic development.
- At the beginning of the century issues related to science and technology were often treated in the form of the "Feuilleton"; this disappeared slowly and gave place to shorter, more news-oriented and less reflexive and broad treatment of these issues; this development has recently seen a change. Many newspapers start to have feuilleton-like contributions also with regard to science and technology. In the domain of human genetics this has been most striking.
- Popular courses organised by the university try to address part of those who have no access to the very elite university system (since 1895).
- The Working class movement started the first popular universities at the turn of the century and thus shaped in an important way science-society interactions at that time.
- Special institutions were founded to promote women’s education also with regard to science and technology (*Athenäum* founded 1900 was the first association devoted to this aim). They were seen as an important clientele as they were encountering technological developments both in their home and at their workplace and were supposed to adapt and accept them.
- Creation of the first Technical Museum in Vienna (1908)
- From the 1920’s onwards radio started to play an important role. As it was obliged by law to restrain from any political activity and as neutrality was enforced upon it, science – as a neutral terrain – was seen as an ideal part of such a radio programme. Science appears in the statistics with approx. 10% of the emitted programme, but we need to consider that also all kinds of language courses were subsumed here.

Secondly, the working class movement started to become one of the driving forces in the popular science movement.

- Science and ideology were closely interwoven in the working-class movement (scientific thinking and being a social democrat were thought to be closely intertwined)

- Education, and in particular with respect to science and technology, was seen as a major possibility to improve workers' situation within society;
- The movement was financially supported by the liberal bourgeoisie, as they needed better qualified workers in order to face the increasingly technologized work environment and they wanted to make sure that people would accept and support these changes. (Parts of these liberal bourgeoisie discourses resemble in certain argumentative structures those put forward in contemporary settings)
- Special buildings like the *Urania*, the *Volksheim* etc. were constructed in order to dedicate a clear "space" to science education in the town. These buildings were generally located in those districts of Vienna where most of the working class people and the low level employees lived. Thus the concept of creating local “knowledge-spaces” where people would live and meet science was realised.

Thirdly, the university needed to demarcate its place in the public sphere and thus started to use science communication as one possibility to do so.

- Around the turn of century the university felt increasingly threatened by the lack of support they got from the government. Quite contrary to the general picture of the situation in Vienna with regard to science at the turn of the century, the situation was far from being ideal. The buildings and laboratories were in a rather bad shape, technology for the labs outdated and little money available to improve the situation. Scientists often complained that much more attention was spent for improving the external appearance than to the development inside the sciences.
- The University was under influence of strongly conservative forces and this had as a consequence that researchers which were seen as too "left" had little chance to get any of the university positions, but also anti-semitism can be discerned very clearly. This means that many excellent scientists had to earn their money outside university in order to be able to continue their research. Many of them taught evening classes in the popular universities, which explains the high quality of teaching offered there to a wider public.
- Scientists thought that they should address the public in order to gain them as support against the government.
- But scientists also invested time in the communication of science because they wanted to establish the scientific world-view as the dominant one in the public space; this seemed particularly important in those areas where a large amount of folk-knowledge was present.
- The discussion about accountability for public money spent can be traced back to this period, and thus is nothing fundamentally new in the current debate.

Post WW I Austria entered a phase of crisis. First, there was a long phase during which Austria tried to adapt to the fact that it was now only an extremely small country without political power and that it had to build up a completely new identity. This also meant that other systems within the country, such as the educational system, the media system, etc. had to revise their policies. For the press this was an important period in which on the international level a number of changes occurred that were not really picked up in the Austrian context. One of them was the professionalisation of science journalism.

This first phase of crisis and redefinition of the self-understanding was followed quasi-immediately by the international economic crises of the late 1920's. The early 1930's then had to see the rise of fascism in Austria and the *Anschluss* in 1938 marked a clear break with the developments in the pre-war period.

Summarising this pre-war period, one could say that although rhetoric sometimes suggested otherwise, science-society relationships were clearly framed in the terms of a linear model. The public should be educated and taught the major scientific ideas by scientists in order to fight superstition and forms of folk-knowledge.[723] The initiatives taken were thus not at all concerned with making possible an interaction between science and the public or with taking the public serious in their views on problems and in their forms of knowledge, but much more with convincing/imposing a dominant scientific model on the whole society.

This attitude did not change fundamentally throughout the immediate period after WW II. As already mentioned, in the first years after WW II science and technology issues were not considered to be very important and scientists who had remained in Austria complained heavily about the disastrous situation in which they found themselves. Strong "brain drain" movements made many of the best students immigrate from Austria.

It was not until in the late 1960's and 1970's that a new phase started. Funding agencies for research had been founded in the late 1960's, a Ministry for Science and Research was created for the first time under the new socialist government, the universities were opened to a wider public and research and science in general got a higher (although still rather low) attention on the policy level. Expansion of universities also meant that an increasing segment of the population had followed higher education and thus was also acquainted with issues in science and technology. At the same time the 1970's were characterised by a growing environmental movement, which would play an important role in making scientific and technological change an issue of public debate.

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[723] DOLBY, R. G. A. (1982): "On the autonomy of pure science. The construction and maintenance of barriers between scientific establishments and popular culture", *Scientific Establishments and Hierarchies, Sociology of the Sciences* VI: 267-292.

From the 1970's onwards many gradual changes were slowly occurring. Although science and technology became – for short moments – hotly debated issues – as exemplified in the famous public vote around the first Austrian nuclear power plant Zwentendorf – they did at the same time not become a topic present in the public sphere on a continual basis. Science and technology never managed to gain the status of central issues, neither in the political arena, nor in the public esteem. This is reflected in the media, where science and technology had only a marginal place – if at all.

This is about to change since the mid-1990's. The debates about genetically engineered organisms, environmental problems and other kinds of controversial issues, the fact that there is increasing awareness that scientific and technological know-how and knowledge is essential for economic development, as well as a rising public pressure for accountability have led also to an increased presence of science and technology in the public space.

2. Assessment of the Austrian situation and some reflections on future options for development

Having now described in some detail the societal situation, let us reflect on the actual developments in Austria. To do so I will proceed in four steps. I will start by some more general observations that are of importance as they are the boundary conditions for any PUS-activity to be developed. Then I will focus on the general developments in the field of PUS activities in Austria and the structure this field has. I will summarize the most important observations we made regarding the way the communication of science and technology is undertaken. Finally I will take a look at how and for what reasons science communication is taking place and close with remarks on what is communicated about science.

Three general observations to start with:

- First, when speaking about raising public awareness or about public understanding of science and technology, we have to understand the fundamental differences the notion science has in the different cultural contexts. In German we use the notion of *Wissenschaft*, which embraces all the different disciplines and thus has a rather broad meaning. While this is important to state and has led to a number of interesting "adaptations" of "imported" PUS-initiatives at the same time we can perceive a certain tension there. In newspapers, for example, when the term science is used as header for columns, it is often implicitly used as synonymous to natural sciences and technology, on TV there is rarely any extensive or explicit reporting on the social sciences or humanities. Thus, there is a hesitation between the notions we use and their historically rooted meaning and the meaning they implicitly get in a contemporary setting. An excellent example is the Science week in Austria, which using the English notion of science in its title, while at the same time underlining the importance of integrating the social sciences and humanities.

- As a second comment I would like to stress that the same holds for the use of the notion *Public Understanding of Science*, which appears both in the Austrian and the German context without being translated or adapted to the more local traditions. This expresses two trends, which seem important. First, the discussion around public understanding of science has taken the character of a movement across Europe and thus there is a tendency in the case of late-comers – which is definitely the case for Austria – to pick up the vocabulary that is at hand. Doing so, however, it is often not reflected that with a certain rhetoric also the values lying behind are imported. The second and even more important factor is linked to the use of the notion *science* and thus implicitly inscribing into the Anglo-Saxon tradition of using this notion. This, as a consequence suggests that social sciences and humanities are present in the public sphere as “added on” the focus of the attention being on the natural sciences. A perfect illustration was the most recent PR campaign for *Wissenschaft* by the Austrian Council for Research and Technology Development, which ended up putting the term INNOVATION in its centre and alluding in the slogans exclusively to developments in the natural sciences and in technology.
- Finally, it seems crucial to understand that any dialogue-oriented model of science-public interaction would need on the one hand publics ready to formulate their position and to enter a controversial debate and on the other hand, scientists and science policy makers taking seriously the concerns and the knowledge present in the public sphere. However Austrian society has little tradition in civil discourse and generally people tend to avoid open conflict.

What are the main observations one could make with regard the development of PUS activities in the Austrian context?

- The first argument here would be a quantitative one, stressing that there one can observe a definite increase in activities trying to communicate about science and technological developments with wider publics. Classical medias are performing in this area with higher intensity, but also some new settings were created and experimented with, such as the science weeks or other smaller initiatives. Thus the sheer number of places where science and the public can potentially “meet” has increased and slightly diversified over the past years.

- With regard to the classical players, such as print-media, radio and TV we could observe a diversification in the communication genres. Thus we have hinted at the fact that the Austrian Broadcasting company also runs symposia on “hot” topics, inviting scientists to discuss with a general audience and then use this material to make all kinds of elements to be broadcasted. Also the fact that the Austrian Radio initiated the greatest internet platform on science news in Austria is one such example. Thus actors in this field try to work with synergy effects to increase the impact of their science reporting.
- Late but now quite intensively, the new media are used to disseminate scientific information. The notion dissemination was used deliberately here to hint at the fact that the idea that the internet could be an interactive medium and allow – in contrast to the print-media and TV – an interaction of the readers through forums has not yet been realised. The debates on science and technology, remain in these forums quasi inexistent.
- A further important observation to be made is the strong centre/periphery divide with regard to science communication. Indeed most of the big science museums are in Vienna or other regional capitals, there is an extremely high concentration of media in Vienna, the science week events virtually all happened in the cities which house universities. So far there is no clear tendency visible to counterbalance this polarisation.
- The state is still one of the central financiers of science communication activities and thus remains an important actor in shaping what is happening in this domain. Further more due to severe budgetary cuts which have been characteristic for the recent years, this is also a threat to the continuity in this domain.
- Finally, we should remark that by the time this report is being written there is still no clearly established specialised curriculum for science communicators. After an experiment of a post-graduate one year special training, which took place in the academic year 2002/2003, it is unclear whether it will continue or not.

Switching focus from the structural development to the way science and technology is communicated in the Austrian context, there are a number of interesting points to be made. In doing so, however, it is important to keep in mind that the way communicational settings are developed also clearly reflects the reasons why one wants to communicate with wider segments of the public.

- The first observation to make is that a majority of the initiatives we observe inscribe themselves within the logic of information campaigns or public relation activities and tend to believe that more information will lead to a better acceptance of scientific and technological change. This "ideology" of enlightenment is rather robust although at least two big examples in the recent Austrian history – the refusal of nuclear energy plants and the GMO debate – have clearly indicated the contrary. This is not only an Austrian phenomenon, and one could thus pose the question about what the underlying ideals and mechanisms in the different enterprises of science communication are. Thus the classical distance between science, which holds the expertise and the public which should be educated is still extremely present. We still often find ourselves confronted with what Dorothy Nelkin labelled so nicely "selling science". Science is definitely celebrated more, it is communicated or opened up for exchange or debate.

- As a consequence, the second point I make is that participatory exercises have so far neither been used very often, nor have been very successful. There is no tradition in this domain, no central actors who would push such initiatives, no institutional settings, to assure that such undertakings could be carried out in an independent way and thus gain credibility in the public sphere. The few cases carried out so far are good examples for models that have been imported (in the case of the consensus conference from Denmark), but could not be implemented in a way which would fit both the methodological need for such an undertaking as well as the local political and social context.
- Positive to remark is an increased reflection from the side of the museums about who their visitors are and how they could seduce them to get into interaction with science and technology. Many of the museums have at least partly integrated hands-on elements in order to enable visitors to engage with the object and the ideas that are embedded in this setting. Furthermore special institutions like the Kindermusum ZOOM have been founded, which address the younger age group and try to use their curiosity in order to make them engage with science. What is still missing in the Austrian landscape in this respect are science centres which are entirely based on a more interactive concept. There had been plans for one, however so far no steps have been taken bringing it any closer to a realisation.

Finally we should also take a look at what is – or what is not – communicated about science in the Austrian context.

- The most striking feature that becomes visible when analysing the science communication in Austria is the strong focus of what I would like to call "back-end communication". Indeed science is virtually never communicated as an activity as something "in-the-making", as a practice with all the difficulties and limitations, as a social world in which scientists act. Science is presented as ready made, as producing facts and breakthroughs, as a heroic enterprise – the heroes being predominantly male. In that sense science communication is not so much of an invitation to engage with science, to question or to debate critically the outcomes and their societal consequences. This also makes it difficult if not impossible for people to grasp the needs of science, to gain a realistic impression of the time necessary to develop scientific knowledge and technological artefacts and of the amounts of investment that is needed.

- The second observation is linked to the relation between the natural sciences and the social sciences that is produced through the se PUS-activities. While the former follow the pattern just described, social sciences are rather seen in their function as sciences explaining change in our societies, also with regard to scientific and technological developments. Sometimes they are squeezed in the role of translators for the natural sciences, but less seen as autonomous knowledge producing field with an impact on societal development. Thus we remain with a central question to be answered: Why is the role of social sciences in modern societies not questioned and presented the same way as the natural sciences are?
- Thirdly one could say that Austrian science communication has a strong tendency to get intense once a situation of crisis is already declared, and a high degree of polarisation is present. Then a lot of energy and effort is put into “getting the facts straight” and trying to position science and technology one way or the other. In these situations it becomes rather difficult to develop a more fine-grained and balanced discussion of the different facts of the problem, and thus most of the statements become implicitly “pros” or “cons”.
- Finally one could add that little effort is made to integrate science in a broader cultural context, or to use the French term – there is no “mise-en-culture” of science taking place. Neither in the media nor in other settings does science get its place in what is labelled culture. Science is kept apart, gets special places where it is exposed and discussed, while remaining outside of what it in fact should become an integral part.

Opening Public Understanding of Science: Belgian overview

Gérard Valenduc, Patricia Vendramin

This overview describes a set of initiatives that have contributed towards the launch of public understanding of science and technology (PUS) in Belgium, for the last five years. The evolution of PUS refers to the preliminary state of the question, based on surveys and studies that were carried out mainly during a "Technology Week", in the French-speaking part of the country in 1995.

The overview of the landscape of PUS in Belgium is structured as follows:
1. Back to a recent past: a critical overview of the relationships between science, culture and communication around 1995.
2. General trends in the recent evolution of public understanding and awareness of science and technology:
  - PUS and the general public: the return of science in the media (TV and press) and the creation of new museums.
  - PUS and the education system: initiatives that aim to raise awareness of science and technology among students and young people, and overcome shortages in scientific skills and professions.
3. Specific PUS initiatives in two selected areas:
  - the information society and;
  - sustainable development.
4. Raising awareness and increasing public participation in the debates pertaining to science and technology policies.

Without going too far in typical Belgian institutional problems, we must remember that the country is characterised by the coexistence of two main languages and cultures, Flemish and French. For all cultural matters such as media, books, periodicals, literature, and any form of mass communication, those cultures are closely linked to happenings in the Netherlands and France, respectively. The federal structure of the State entails a splitting of public initiatives and policies related to science and culture between the North and the South of the country. Science & technology policy itself is largely a proficiency of the regional governments.
For obvious cultural reasons, our overview mainly refers to activities within the French-speaking part of the country. However as far as possible, we have included some practical information on initiatives and institutions in Flanders.

1. Back to a recent past

The Walloon Regional Minister for Research and Technology decided to include the issues of scientific culture and science communication in the programme of a Technology Week held in 1995. The Technology Week, which started in 1990, consisted of a series of promotional activities for technological innovation in enterprises and research centres. It was initially designed as a response to the technology fair "Flanders Technology", which has been organised by the Flemish Government since 1985. Three opinion surveys were carried out in the region and published in a special issue of the Bulletin Athena[724]:

- A survey of public attitudes and expectations towards science and technology, carried out by FTU.
- A survey of representations and expectations of the general public as regards research priorities and research funding carried out by the University of Liège.
- A survey of the attitudes of young scholars in the final year of secondary school, towards science and technology, particularly information technology, carried out by the University of Namur.

At the same time, an association of researchers (Focus Research, Belgian association for the advancement of science) circulated results of a survey among science journalists and researchers, about the opportunities and difficulties of science communication in the media.[725]

These four surveys were productive empirical contribution to several conferences and debates with science journalists, researchers and policy makers, which were organised during and after Technology Week 95, in order to draw up a "state of the art" of science communication in the French-speaking part of the country.

The findings were not optimistic. They can be summarised as follows:

1. Science was poorly represented in the media. Although some newspaper had tried to publish a weekly science page, they had all disappeared. Scientific information was dispersed in economy, health or nature columns. The general scientific broadcast at the national French-speaking television (RTBF) was stopped, except for a bi-monthly programme on health and medicine; scientific correspondents only delivered occasional papers within radio or TV news.

   The FTU survey however showed that press and TV-broadcasts were the most important source of scientific and technical information for the general public; professional experience ranked second, education third, museums and exhibitions

[724] Dossier Les Wallons, la recherche et la culture scientifique, in Bulletin Athéna, n°110, April 1995.
[725] Dossier Les sciences dans les médias, Objectif Recherche, n° 15, February 1995.

far behind in fourth place. There was a demand from 42% of the respondents for more frequent and extended scientific information in the mass media.

A previous study, carried out in 1992 at the University of Brussels, showed that Flemish newspapers only devoted 2% of their written space to scientific information; that 13% of the articles were comments of well known scientists on current political events, 25% announced or commented on exhibitions or conferences, while 60% were related to research itself; among these, only a minority gave account of the whole process of a research project (initial questions, scope, context, methods, results, limits and new questions).[726]

2. The relationships between researchers and journalists were considered difficult, as there was a lack of mutual understanding. According to the Focus Research, "Journalists are under the pressure of editorial constraints and they must decode the messages of scientists who are really interested in the media, but often unable to explain the interest and scope of their results clearly. Researchers, who are used to controlling their own professional communication in scientific publications, are afraid of being misquoted by journalists and they often mistrust them".

   The survey of Focus Research however identified a demand for university training in communication among the researchers, as well as a demand for "scientific mediators" in the relationships between universities and the media. Focus Research also undertook a revival of the rather moribund "Association of professional science journalists".

3. At this time, the only well known science museum was the Natural Science Museum in Brussels, one of the last federal level scientific institutions, which was known mainly for its famous collection of dinosaurs. This museum was however undergoing a restructuring process. Other projects of creation of modern science parks were in gestation. There was thus very little supply of events and infrastructure in the area of scientific culture. The lack of national supply was however eclipsed by the fact that several foreign science centres were located nearby and could be accessed easily by Belgian visitors, for instance Evoluon in Eindhoven (NL), Espace ALIAS in Lille, and the City of sciences and industry in La Villette (Paris).

4. There were no structured debates on science and technology policy options, and consequently few initiatives for enhancing public participation in these kinds of debates. There were however emerging concerns for democratisation of R&D policy making, mainly through the development of technology assessment. The

[726] Canini G., Bloemen A., Wetenschap in de Vlaamse dagbladpers, in Massacommunicatie, Vrije Universiteit Brussel, 1992.

Federal Science Policy Office (SSTC/DWTC) organised the first national conference on technology assessment in 1994 and “public address” was one of the topics of this conference. One of the workshops was entitled “access to information and expertise”. One of the conclusion reached, was that more interactive methods of knowledge transfer were required in order to foster the involvement of social actors in technology assessment.[727]

Stichting Technologie Vlaanderen (STV), a foundation for technology assessment created by the Flemish socio-economic regional council, had developed several experiments of participative technology assessment in 1984. These however were limited to the areas of new technology and work. The STV activities and methods addressed workers, trade unions and managers directly and tried to involve them in a constructive assessment of technological options and their consequences.[728] However, there is little connection with PUS in the universal meaning.

5. Public understanding of science and technology was not a policy matter, neither at the federal or the regional level. There was no department for science communication in any regional or federal administration of R&D policy or of cultural policy and up till now, there still is not one

This was the state of affairs five years ago. The overview is not really exciting, but some factors of change were already nascent and they started to grow rapidly.

2. General trends in the recent evolution of PUS

2.1. Science centres (museums, parks and exhibitions)

There are new science centres in the French-speaking part of the country, which have taken advantage of subventions from the European Social Fund for the conversion of declining industrial regions because they are located in the Mons and Charleroi regions. (Objective 1). In addition, the national Museum of Natural Sciences, located in Brussels, has been renovated.

The European network, ECSITE (European Collaborative of Science, Industry and Technology Exhibitions) that was initially hosted by Focus Research, played an important role in stimulating these new initiatives in Belgium.

[727] Proceedings of the conference “Technology and Society”, Conclusions of Workshop 1 “Access to information and expertise”, SSTC/DWTC, Brussels, Nov. 1994.

[728] Berckmans P., Stichting Technologie Vlaanderen and participative technology assessment, in European Technology Assessment Panorama, European Commission, DG XIII, 1994.

2.1.1. The Park of Scientific Adventures (PASS), near Mons

The PASS[729] is built on a former coal-mining site named "Le Crachet", which was closed in 1969 and which has since 1989 been classified as an industrial patrimony. This choice of location was explicitly intended to bridge the past with the future. The architecture traduces this option: a foot-bridge, designed as long coloured pipe, linking the old building with the new one, leads the visitor from the exhibition of the former industrial patrimony to the new area of interactive scientific activities.

The project is supported by DGTRE, the regional ministry for research and technology, and financed by the European structural funds (€16 million from the European Fund for Regional Development (FEDER) and € 5 million from the European Social Fund (FSE)). The design stage of the project started in 1996. The main reference sources used by the designers were the Futuroscope in Poitiers (F), the Experimentarium in Copenhagen, the Civilisation Museum in Québec and, to a lesser extent, the Cité des sciences et de l'industrie of La Villette in Paris. The construction of the project started in 1998 and it was inaugurated in May 2000. Private sponsors and public agencies are now involved with financing the activities and exhibitions of the PASS[730].

The PASS includes two permanent areas: the "Pass'age", dedicated to children, and the "Grenier des histoires" (from the industrial past to the technological future). Eight other areas are devoted to sometimes temporary thematic exhibitions (planned for one or two seasons). A set of "scientific and diverting expeditions" have been proposed Outside for the park of adventures (40 ha): an ecological exploratory walk, a walk-down in an ancient mining tunnel with experiments on sound and light, a park of experimental machines of human propulsion, and a set of scientific observatories disseminated in the park.

The management of PASS expects about 300 000 visitors a year, not only from Belgium, but also from the North of France. Through the European programme Inter-Reg II, agreements have been made with partners in France and Flanders. It is primarily targeting schoolchildren, students and teachers, who are estimated to provide about 40% of the visitors. PASS develops specific marketing initiatives towards children, schools and teachers: packages for families, scientific documentation files for teachers and special conditions for school groups.

Another original initiative is that visitors are not left alone. A welcome team of scientific mediators address groups and individuals and propose pathways, schedules and expeditions in the park as well as documentation for a fruitful visit. This service is provided in French, Dutch and English. Scientific mediators are recruited and trained in the region of Mons, through a specific training programme supported by the European Social Fund.

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729 http://www.pass.be

730 Quintart J-C., *Passport pour l'avenir*, in *Athéna*, n° 159, mars 2000.

2.1.2. The Science Centre of Parentville, near Charleroi

This science centre[731] was created in 1996 and established in a castle and a park belonging to the Free University of Brussels (ULB), who inherited it from the well-known industrial family Solvay. The ULB transformed the ancient Solvay domain in a new infrastructure for science popularisation. The science centre is mainly designed for scholars and students. Its location near Charleroi allowed the University to get supplementary funding from the European structural funds, as an Objective 1 zone. Initially named “Museum of sciences and techniques”, it was renamed “Centre of scientific culture” in 2002[732].

The science centre includes a permanent area of interactive scientific activities, named Experimentation Space, and another permanent Communication Space (sponsored by the regional administration DGTRE). A third permanent area, devoted to biotechnology, will open in early 2004. Other areas are devoted to temporary exhibitions. The science centre also organises workshops and conferences for the students in the last two years of secondary school aged between 15 and18 years. During the holidays, science weeks are organised for children aged 10 and14 and teenagers between the ages of 15 and18.

The centre of Parentville also develops a series of partnerships with local cultural associations. Its integration in the ULB allows for close relationships with university researchers and professors, who are invited to give conferences and presentations in Parentville.

The science centre of Parentville takes part, as a Belgian correspondent, in several initiatives for scientific culture in France: for instance the night of stars held at end of March and the science week held in November. The science centre of Parentville is currently hosting the coordination of the European network of science museums ECSITE.

2.1.3. The Museum of Natural Sciences, in Brussels

This Museum created in 1846 and established in its current location since 1891, is the only federal institution devoted to scientific culture. The Museum is a part of the Royal Institute of Natural Sciences, which is entrusted with the conservation and management of the State collections of natural sciences (zoological, anthropologic and prehistoric collections, minerals, fossils, etc.). Since the federalisation of the State, the Federal Ministry has managed it for Scientific and Technical Affairs (SSTC/DWTC) as a “bi-cultural” institution. In 1997, the Museum got a radical “lifting”, aimed at rejuvenating and modernising its design and image.

There are several purposes for the restructuring process of the Museum[733]:

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[731] http://www.ulb.ac.be/ccs

[732] Léonard J-L., *Quand un musée fait peau neuve*, in *Athéna*, n° 178, février 2002.

[733] http://www.sciencesnaturelles.be/museum

- To implement seasonal thematic exhibitions, quite apart from the presentation of the collections, in order to organise scientific and cultural events at the national level.
- To improve the provision of services for teachers and groups from secondary schools.
- To get a more active involvement of the young public, through the organisation of holiday workshops or Wednesday / Saturday afternoon workshops.

During the last five seasons, very successful thematic exhibitions have been organised: examples of these kind of exhibitions include; “Five billion humans, all parents, all different” which ran from 1998 to 1999, “To live or to survive” from 1999 to 2000, “Communication” from 2000 to 2001 and “Very touch” from 2001 to 2002. Most of these exhibitions have an international trajectory, being adapted from or exported to other museums in Europe.
The preparation and implementation process of thematic exhibitions sometimes involve extensive participation of university researchers and potential users. For instance, “To live or to survive” was prepared in close cooperation with the research teams involved in a federal R&D programme on sustainable development. Different groups from the civil society were also associated with the project: for example environmental groups, North-South cooperation organisations, parents and teachers associations and the Federal Council for Sustainable Development.
(More information under §3.2).

2.1.4. Miscellaneous

Without attempting to be exhaustive, other permanent exhibitions related to science or technology can also be cited:

- The Euro-Space Centre, located in Libramont (Belgian Luxembourg), is an interactive exhibition of space technology, mainly attractive to children and scholars.
- The Belgacom Centre in Lessive (Belgian Luxembourg) is a permanent exhibition on the history of the telephone and the new information and communication technologies, located on the site of spatial telecommunication antennas of the first Belgian telecom operator.
- At the Belgian coast, the Sea Life Centre of Blankenberg is a permanent exhibitions devoted to marine life and costal zone protection.

Once more, it is worthwhile remembering that the country’s small size and its cultural connection to France and the Netherlands allows Belgians easy access to scientific cultural events in neighbouring countries.

2.2. Science in the media

The situation described in the state of the art in 1995 (§1) can be understood as a "the hollow of the wave", because there has been a significant comeback of science in the media during the last few years. This is evident in the press as well as on TV. Current events such as the GMO controversy, the dioxin crisis in spring 1999, the ESB crisis, etc., also contributed to an increase in the supply and demand of scientific information for the public.

2.2.1. Science at the TV

The French-speaking public service television channel RTBF, decided in 1998 to resume a 52-minute monthly science programme, entitled "Matière grise" (Grey matter), broadcasted on Thursday evening around 21:30 on RTBF1. This initiative was positively acknowledged, since RTBF was often criticised for having left scientific culture off its programming schedule. The first season's audience ratings were considered a success by RTBF's management. The new programme also enabled the enhancement of the team of scientific journalists and correspondents and the production of more frequent notices to be included in radio and TV news.

On RTBF's web site there is an extended section on "science and technology", coordinated by a science journalist. This web page contains all the texts of the notices written by science journalists for any radio or TV news; most of the notices are linked with a longer on-line article, containing references and links with other web sites. The coordinator of these web pages intends to develop a real "on-line science journal", as an aspect of the RTBF policy to implement on-line information services.

RTBF also broadcasts the French series "C'est pas sorcier", which has been produced by France3 since the autumn of 2000. Sequences of "C'est pas sorcier" are integrated once a week in the children's programmes "Ici Blabla", during the children evening prime time.

Apart from these new initiatives cited above, RTBF, continues "Pulsations", with a monthly TV-broadcast on health, "Cyber-café", a weekly TV-broadcast which is simultaneously broadcasted on Saturday night on RTBF2 and on the Internet (together with an on-line forum), and "Multimedia" a daily radio notice, broadcast at 8:40 a.m. on the first radio channel.

The concurrent private TV-chain RTL-TVi also introduced a new weekly science programme, entitled "Tout s'explique" (All can be explained) in 1999, co-produced with the French channel M6. It is a 20 minutes programme, broadcasted each Thursday at evening prime time (19:35).

As 95% of the households are connected to cable-TV and the audience of French channels is very high in Belgium, the French-speaking TV-viewers now have access to a wide range of scientific programmes from RTBF, RTL-TVi, FR2, FR3, TF1 and TV5

(the French-speaking satellite channel). However there is no consolidated data about the audience of scientific broadcasts among the Belgian population, for any of programmes.
Up till now, we do not have updated information about science in the Flemish media.

2.2.2. Science in the press

Besides obvious “cyber” or “multimedia” pages in all newspapers, several newspapers have recently enhanced their coverage of science and technology issues:

- After its restructuring and integration in the French press group France-Soir in summer 2000, the daily newspaper Le Matin started a weekly science page (on Wednesday), coordinated by a new science journalist and based on editorial partnerships with other newspapers of the group.
- The weekly magazine “Le Vif / L’Express” started an editorial partnership with the French science journal “La Recherche” in January 2001. Journalists from “La Recherche”, who usually addressed readers with scientific backgrounds, now wrote shorter articles for the general public.

Except for the specific case of Athena (see below), there is no science periodical published in Belgium, as the editorial market is probably too narrow. All the French magazines are however available in bookstores and kiosks. The situation is similar in the Flemish part of the country.

2.2.3. The case of the “Bulletin Athena”

Athena is a 48-page monthly magazine (ten issues a year), currently edited by the Walloon Ministry for research and technology. The bulletin was created in 1984 by the first regional government, as a quarterly information support for a promotional campaign of technological innovation in the region. The free-lance journalist who started the first issue in 1984 is now the editor of the bulletin working within the regional administration, and the regularity of publication became monthly at the beginning of the eighties. The aspect of “promotion of regional technology” is still present in the bulletin, but the purposes have evolved. The bulletin also deals with general scientific subjects and regularly includes articles on science & society issues. It also includes bibliographical notes, accounts of scientific events, etc. Nowadays, the development of scientific culture is presented as one of the key purposes of the bulletin.
Subscription to the Bulletin Athena is free and there are currently about 33,000 subscribers. At regional scale, it is a very extensive distribution, as high as that of many newspapers. As there are many institutional subscribers (libraries, schools, documentation centres, etc.), the estimated cumulated readership is about 50,000 readers.

In 1997, the editorial board of Athena carried out a survey among the subscribers, in order to characterise the journal's readers. The average age of the readers is 43.5 years; 25% are less than 30 years old, 20% between 31 and 40, 25% between 41 and 50. The readership is composed of employees (19%), professionals and executives (18% upper level, 14% middle management), and teachers (14%). 68% of the survey respondents have high school degrees. The main motivations of the readers are the improvement of their scientific culture (70%), the need for information on new technology (65%) and the enrichment of their professional documentation (26% comprised mainly of teachers and students). The reading ratio is relatively high: 38% of the readers read more than a half of the pages. The average satisfaction of the readers is rated 8/10.

The Bulletin Athena is a long-standing initiative of the Walloon public authorities, combining the promotion of scientific culture and a shop-window for regional scientific and technological activities. The financial investment of the Region is relatively low and the results are fruitful.

2.2.4. Training and networking of science journalists

In the autumn of 2000, a group of science journalists (from RTBF, RTL-TVi, Le Matin and Le Vif) and science faculty deans (from all French-speaking universities) decided to start a network of information exchange between journalists and researchers. They also submitted a project to the Regional Ministry for Research and Technology (DGTRE), in order to finance specific training workshops for the improvement of communication between science journalists and researchers.

This is a concrete indication that there is a change in the relationship between journalists and research institutions, and hopefully that DGTRE will financially support this kind of practical measure for the improvement of science communication.

2.3. PUS and the education system

As mentioned before about sciences centres or the media, the youth are the primary target for many initiatives. Priority is given to the youth as a consequence of several severe statements made about the lack of scientific culture and training among the Belgian children and students:

- An international comparative survey, published in 1998 by the International Association for Scholar Evaluation, showed that the level of scientific knowledge of Belgian French-speaking pupils aged between 14 and 15 years old ranked very low, far under the international and European mean. On the other hand, the level of Flemish pupils rated highly. The estimated gap between Wallonia and the international mean was 1.22 school year, while the estimated advance of Flanders was 0.96 school year.[734].

- The amount of hours of science courses is lower in French-speaking Belgium than in most European countries, and sciences courses are introduced later in pupils' curricula. Science teaching seems to be particularly weak at the primary school.
- The amount of students in science faculties dramatically decreased during the 90s, leading to a shortage of physicists, mathematicians, and chemists and, to a lesser extent, biologists, both as teachers and as researchers, in both Flanders and Wallonia-Brussels. In some universities, some science sections were temporarily closed, due to the lack of students.

According to a recent decision made in the autumn of 2000, one more hour of science teaching will be introduced in the first few years of secondary school. However, there is a general agreement that an improvement of basic scientific knowledge and motivation can no longer be considered an exclusive matter to school programmes and that it requires a synergy between the school system, the media and the science centres.

2.3.1. Interactions between PUS and school education

The PASS (see §2.1.1) and the DGTRE organised a conference entitled "La science, c'est pas sorcier", in October 2000, devoted to science teaching and scientific culture for children. The conference gathered teachers, children's books and reviews publishers, children's TV-programmes' producers and science didactics and science communication researchers.

The conclusions of the conference[735] emphasize three models of interactions between PUS initiatives and schools. The first is to be avoided, but the others can be promoted.

- In the first model, the schools become clients of external cultural institutions and science centres. Although it could be profitable for the science centres' visitors, this model is counter-productive, because it leads to a progressive abdication of the school system, which transfers the responsibility for science teaching to other actors.
- In the second model, schools cooperate with science centres and the media. This cooperation must however be well balanced: the school system has to formulate a learning project, in such a way that it can be understood and translated by the other partners.
- The third model is the resource centre. Resources available to teachers and pupils must be diversified, extended and made easily accessible: books,

[734] Monseu C., Demeuse M., L'enseignement des sciences, un réel défi pour notre système éducatif, dans le Bulletin Athéna n°142, Juin 1998.

[735] Léonard J-L., Le labo des mioches, dans le Bulletin Athéna, n 195, novembre 2000.

magazines, videos, cd-rom, visits, experiments, etc. Science centres can play an important role as service providers and “information brokers” for teachers.

2.3.2. PUS at the universities

Several universities recently started new initiatives related to science communication. Their immediate purpose was to improve the image of scientific curricula and attract more students into the science faculties. They however have another long-term objective, in which science communication develops as a “service from university to society” and is then integrated in a broader approach to the role of each university within the city and its local community.

- The university of Louvain-la-Neuve (UCL) organised the first edition of a festival entitled “Science infuse” in March 2000. The festival is based on the presentation of experimental projects developed by secondary school students and their teachers. Different awards are given out during the festival and “open doors” are organised in university laboratories. The second edition took place in March 2001. Meanwhile, the UCL opened a new “House of sciences”, in January 2001, managed by university researchers, students and secondary school teachers. It is designed as a resource centre for schools and provides a basic infrastructure (laboratories, computers and instruments) to implement experimental projects.
- Both free universities of Brussels (the French ULB and the Flemish VUB) organised a joint bilingual event in October 2000: “Wetenschaps-FESTIVAL des sciences”, with the same purposes as the UCL. The VUB also inaugurated a science centre named “Pavilion of sciences”, as a joint initiative of the science faculty and the Flemish Region government.
- The University Of Nauru (FUNDP) was the first to organise such a festival aimed at attracting the young. A yearly exhibition “Oser la science” started in 1998. The objective of this initiative is that several enterprises located in the region were associated with the preparation and management of the event. Like the universities, enterprises also wanted to highlight their attractiveness to young people interested in science and technology.

Universities appear as emerging actors in fostering the public understanding of science and technology. They are of course not neutral, as they want to stop and reverse the disaffection of students as far as the scientific curriculum is concerned. The positive aspect however is that they have become more aware of the image of science in society in general, and particularly with the youth.

3. Specific PUS initiatives in selected areas

This short section briefly highlights some specific initiatives of public understanding of science and technology in two topical areas: The information society and sustainable development.

3.1. PUS and the information society

Information society is a wide policy debate, including issues of work, employment, skills and competencies, quality of life, privacy, education, training, etc. Some recent initiatives try to develop public information and awareness as a cultural approach, besides obvious economic and commercial interests.

3.1.1. Initiatives at the federal level

In the period between 1998 and 1999, the federal Minister of economic affairs launched a set of workshops and conferences entitled “Agor@ 2000”, whose purpose was to develop a debate among the social and economic actors on the issues related to the information society. Eight workshops were organised with scientific experts, public decision makers, industrial managers and representatives of the civil society. Each of them resulted in a synthesis paper, which was used as basic input for a public conference. Eight half-day thematic conferences were then organised, in order to involve the general public.

From April to June 2000, the federal Ministry of economic affairs also launched another operation of popularisation, named “Road-show 2000: all on the net”. The campaign addressed SMEs and individuals and aimed at showing the appeal of getting connected the Internet. About 130 municipalities were visited, with a team of animators and a mobile infrastructure for Internet demonstrations. Each event started with an introductory conference, a video-film and on-line demonstrations.

The new Minister decided to start a new set of road shows in 2001, addressing school pupils aged between 12 and 13 years old. The purpose was the same: to convince the audience to get connected to the Internet and access on-line information and communication services.

3.1.2. Initiatives at the Walloon regional level

Technofutur is a joint project of the social partners, the public agency for vocational training (FOREM) and the regional Minister for employment and training. It is a network of initiatives, including 11 "competence centres" for training in the new skills and professions of the information society, and a permanent exhibition "Agora of the net", located in Charleroi. The general public, including students, can access this exhibition. It consists of three modules: the interactive exhibition itself, showing the development and potentials of the Internet, a kiosk, designed as a tutorial for a first easy access to on-line information services and a cyber-space, allowing extended connections to on-line services. Plans are currently being made to install a second "Agora of the net" centre in Liège. The main target public are young students and the young unemployed.

3.1.3. Understanding of technology … or opening of new markets?

As far as these initiatives can be considered public understanding of the information society, some critical questions have to be raised. The main purpose of these initiatives, as well as many other initiatives undertaken by associations and enterprises, is to convince the general public about the potential benefits of the Internet – and subsequently to develop the market for Internet services. Scientific and technical awareness and culture are not considered goals as such, but rather as means of achieving economic goals: accelerating the dissemination of information and communication technology in society as a whole. There are some similarities with the "proselytism" which characterised science communication in an earlier stage, many years ago.

This critique can however not underestimate the fact that the Internet trend is deeply renewing the interest towards technological and scientific matters, mainly among young people.

3.2. PUS and sustainable development

Sustainable development is also an entry gate towards science communication and scientific culture. Two initiatives related to public understanding can be cited:

- The Museum of natural sciences (see § 2.1.3) organised a very attractive exhibition "To live or to survive" in 1999-2000, which dealt with all the current topics of sustainable development: global changes, greenhouse effect, environmental protection, biodiversity, demography, North-South and inter-generational equity and solidarity, etc. As mentioned above, many associations of the civil society were associated with the design of the project. This was an excellent opportunity to organise a pragmatic and constructive dialogue between scientists and social groups, and it was successful.

- Focus Research started a transnational project entitled “Global (Ex)Change”, in 1998, associating a French partner (Espace Mendès-France, Poitiers) and an Italian partner (Fondazione IDIS, Naples). Clubs of 14 to 18 year old students were created in several pilot schools and they defined their own sustainability related projects. A scientific "Godfather" from a university then accompanied each club. The projects were coordinated through the Internet. At the end of the first pilot year, a joint conference was organised and sponsored by the European Commission.

In addition to this, a recent report from ULB researchers highlights the positive role of “information offices”, which aim at developing information and awareness for consumers on thematic topics, such as energy use, building renovations, transport, food, health, etc.[736] Some of these information offices are set up by the public authorities (e.g. the “energy counters” in the Walloon Region), other are set up by associations and receive some public subventions.
Sustainable development is however not only a matter of understanding, but also a matter of public debate on science and technology options. Public understanding and science communication are a necessary condition, but not a sufficient condition to implement such a public debate.

4. Public awareness and participation in R&D policy debates

The subject of this last section is not so much science communication and scientific culture, but the democratisation process of science and technology policy options. This process relies on manifold aspects:

- Access of social groups to relevant scientific expertise.
- Consultation of representative bodies in R&D policy making.
- Involvement of stakeholders in debates on R&D policy options.
- Direct participation of the public.

Although important, the first aspect is somewhat outside the scope of this report; we have analysed it in earlier studies and reports.[737] The other three aspects are briefly commented on hereafter.

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[736] Defrise D., Wallenborn G., Zaccaï E., Modèles de communication des connaissances scientifiques, Cahiers du Centre d’Etude du Développement Durable (CEDD/IGEAT), ULB, Bruxelles, 1999.
[737] Valenduc G., Vendramin P., Building a bridge between research programmes and the needs of society, Report for the European programme VALUE / Interfaces for innovation, FTU, December 1995.
Valenduc G., Vendramin P., La recherche scientifique et la demande sociale, dans “Associations transnationales”, revue de l’Union des Associations Internationales, Bruxelles, n° 6, 1997.

4.1. Consultation of social groups and representative bodies

Belgium has a long-standing tradition of institutionalisation of consultation processes in many areas of policy making, including R&D. Consultative bodies usually involve the "social partners", i.e. employers' and workers' organisations. Some of them have recently opened up to other social groups, namely consumer associations, environmental groups or other NGO's.

Consultation of social groups on R&D policy options may occur at two levels:

1. *The R&D policy level*. Each of the Federal States, the Flemish Region and the Walloon Region has set up its consultative council on science policy. These councils are comprised of representatives from universities and high schools, public authorities, employers' federations and trade unions. They have an advisory role, on either their own initiative or when the government requires advice. The regional councils are active, whereas the federal appears purely formal.

   The Federal Council for Sustainable Development is not only comprised of the usual representatives mentioned above, but it also includes some representatives of the civil society like NGO's, consumers and environmentalists. It has a permanent working group on scientific research and sustainable development, who advise the federal Minister of science policy directly.

2. *The R&D implementation level*. Many federal and regional research programmes have a management structure that includes specialised "accompanying committees" for the different sub-programmes. For many years, the accompanying committees of programmes such as applied social sciences, information society, sustainable development, transport and mobility, have been open to so-called "users representatives", i.e. social groups directly affected by the research topics. In some cases, these committees are also associated with the preparation of the calls for tender, the evaluation and selection of projects. There is now a policy decision to include groups of concerned users in all the accompanying committees of federal research programmes.

The participation of social groups in R&D consultative bodies can be met with several obstacles and be weakened by filtering and compromises. The pyramid of representation and delegation tends to filter out the "grass-root questions". Consensus seeking between divergent interests is not very favourable to the emergence of new ideas, although occasionally the compromises may be on new ideas rather than established understandings.

4.2. Involvement of stakeholders

Besides taking part in consultative bodies, there are some positive examples of deeper involvement of stakeholders in R&D policy debates.

4.2.1. Research meetings in the Walloon Region

From June 1996 to November 1997, the Walloon Council for Science Policy organised 10 one-day conferences-debates entitled “Les rencontres de la recherche”, open to the general public. Each conference was organised on the same pattern: keynote speeches, including foreign experts, round table with representatives of concerned stakeholders and discussion with the attendance. The subjects of the debates were:

- Research listening to the civil society.
- Organisation of the research system.
- Scope and means of R&D public financing in the Region.
- Industrial cooperative research centres.
- Sectoral and thematic orientations of regional public research.
- Valorisation of research results.
- Evaluation of the impacts of R&D on society.
- Social and cultural conditions of innovation.
- Internationalisation of R&D.
- Role of the researcher in society.

About 900 participants attended at least one of the debates. They came from industry, universities, public agencies and administrations, government, education, trade unions and other social organisations.

The Council published a synthesis of the contributions and debates and issued nine key policy recommendations for the future of research and technological development in the Region.[738]

4.2.2. R&D, sustainable development and the civil society

Another example is the process started by the Federal Council for Sustainable Development (CFDD/FRDO) in 1999. This Council wanted to increase the participation of civil society through the setting up of various working groups on thematic issues related to R&D and sustainability. In order to launch its campaign, the Council organised a public conference entitled “Scientific research, sustainable development and organisations from the civil society” in October 1999. The emphasis of the conference was on communication between scientists and the civil society.

[738] Graitson D., Les rencontres de la recherche, dans le Bulletin Athéna, n° 136, décembre 1997.

As a means of support to the campaign of CFDD/FRDO, the Federal Science Policy Office implemented a research-action project on scientific communication in the area of sustainable development. Researchers from the universities of Brussels and Antwerp and from the University Foundation of Luxembourg carried out the project. It was based on structured interviews about the perception of scientific communication between two groups of actors, researchers and research projects promoters; and social actors and stakeholders. The project results will be available soon.[739]

4.3. Direct participation of the public

There is an explicit interest of some research institutions and consultative bodies in Flanders as well in Wallonie, for participative methods of technology assessment, inspired from Denmark, Germany and the Netherlands: consensus conferences, scenario workshops, citizens' reports, proposals debates, local technology forums, etc. There is however no practical realisation up to now.

Annexes

List of web sites

Bulletin Athéna
http://athena.wallonie.be
Centre scientifique de Parentville
http://www.ulb.ac.be/musees/parentville
Conseil fédéral du développement durable
http://www.belspo.be/frdocfdd
Focus Research / Objectif Recherche
http://www.ulg.ac.be/obj-rech
Musée des sciences naturelles
http://www.sciencesnaturelles.net
Parc d'aventures scientifiques (PASS)
http://www.pass.be
RTBF "Matière grise"
http://www.rtbf.be/matieregrise/index.html
Science infuse
http://www.sc.ucl.ac.be/scienceinfuse
Services fédéraux des affaires scientifiques, techniques et culturelles
http://www.belspo.be
Technofutur
http://www.technofutur3.be

[739] Mormont M., Zaccaï E., Loots I., La communication scientifique en matière de développement durable, SSTC/DWTC, to be published in 2001.

An historical and political overview of PUS issues in France

Philippe Chavot, Anne Masseran

We have opted to draw the main lines of certain aspects of the evolution which led to the current concepts of CST in France. Thus this study provides a number of elements which may appear fragmented and should be considered as being part of a far more complex environment.

In France, there is no word for ”Public Understanding of Science” except the rather recent notion of *Culture Scientifique et Technique* (CST, Scientific and Technical Culture). Realisations in this domain take little into account IN the way the various publics take over or negotiate the scientific and technical knowledge with which they are faced in exhibitions or through direct experiments.[740] Of course, assessments are made through surveys or quantitative studies. However, the way the public (with its knowledge and culture) put scientific or technical knowledge into perspective – give it a meaning – is often of secondary concern. Instead, most studies insist on the purposes of the actors who have made CST exist, who give it shape, as well as the new ways of designing and considering CST spaces.
In fact, everything is as if the necessity to develop CST was taken for granted, as is the idea that "the public needs scientific and technological information".[741] This *a priori* hides a shade of meanings that becomes perceptible when one studies the terms used to describe CST actions. A first set of words refers to a very linear idea of the transmission and the acquisition of knowledge: "Transmission", "diffusion", "communication", "popularisation" of sciences and technology. These terms are generally used by ministries or research institutions, but also by some science societies of amateurs. A second set includes expressions such as "putting science in culture" or "sharing knowledge". They are used by actors carrying out actions and realisations that have their roots in the science criticism movement of the 1970's. These actors share both a will to put science, technique and society into close contact and an interest for the studies that highlight the perverse effects of scientific popularisation and of the

[740] Even though numerous studies have been carried out in France in museology, sometimes with an historical or theoretical stance (See the bibliography at the end of the report). These questions have been addressed during a symposium: *Les nouveaux territoires de la CST*, international workshop, Cité des Sciences et de l'Industrie, Paris, 8-9 December 2000.
[741] Ulrike Felt has analysed the interrelation and the social consequences of the following *a priories*: "the public is ignorant about science" and "the public wish to know more about science". Cf. FELT U., "Why should the public "understand" science? A historical perspective on aspects of the public understanding of science", *in* DIERKES M. & VON GROTES C.(Dir.), *Between understanding and trust - The public, science and technology*, Harwood Academic Publishers, Amsterdam, 1999.

"widening knowledge gap". However, this approach remains problematic: in "putting science in culture" there is the aim to democratise science and to soften scientific authority. But are these actions concerned by the issue of public understanding of science at all?
Finally, the complexity of the matter is further strengthened when one considers that most of the French CST actors privilege highly individual definitions of CST, or of what it should be. Indeed, many of them have difficulties accepting this very notion.

In order to understand the actions taken in the field of CST in France it is necessary to know the background. Let us make a detour through the history of science politics and look at the current context.

A – Historical elements

In France, CST actions are not merely attempts to spread or communicate (some) knowledge. What matters in the French case is to make science meaningful and arouse, in the public space, interest in and support for a pĺarticular value system based on and founded by science. This approach arises from the idea that, if the public benefits from a facilitated access to science, it will be in a position to judge and truly appreciate things or events. That presupposes that, on one hand, science is in a pre-eminent position in relation to the other means of understanding the world. On the other hand, to communicate science also means to promote science and the scientists (who are often represented as charismatic personalities such as, in France, Hubert Reeves or Pierre-Gilles de Gennes). This idea of CST is easily identifiable in current CST actions.
In the history of science politics, four key periods may be distinguished, during which the characteristics of present French scientific culture have progressively appeared. The ideals at the core of conceptions of communication of science and technology have been both stable and variable. Stable because, until today, the equation between scientific progress and social progress has hardly been questioned; variable because this equation has always been subject to redefinition. This can be linked to the fact that the notion of social progress has had different meanings according to the context:

- progress of living conditions in the 1930s;
- technical progress adapted to daily life and to the construction of a national identity during "les trente glorieuses" (the years 1945-1975);
- progress of the power of criticism in the 1970s;
- and, finally, progress of citizenship from the 1980s onwards.

In consequence, the evolution of the politics of diffusion of science and technology in France is directly bound – at the level of institutions, ideologies and actors – to the evolution of the more general political context. Below is a broad outline of this process.[742]

1 – Science and enlightenment

The diffusion of scientific and technological knowledge belongs to a long tradition that began in France towards the end of the 17th century. Personalities such as Fontenelle wished to give people from the wealthy classes and aristocrats a scientific education through the diffusion of treaties handling scientific and philosophic principles that he considered important. The public was well defined: gentlemen who wanted to participate in intellectual conversations, and women whose education needed to be widened by "non futile" subjects. Thereby, women would be able not only to converse pleasantly about "serious" subjects with cultivated men, but also, due to "their charm", attract the latter to science.[743] At that time, an important issue was also to assure legitimacy to the "sciences",[744] by defending their virtues before the public. During the second half of the 18th century, this trend was reinforced, leading to communication being considered inseparable from the production of knowledge. The Encyclopaedists, particularly Denis Diderot, considered the diffusion of knowledge – of all knowledges that fitted in with their philosophic principles – as a fight: they needed to justify its legitimacy faced with religious conservatism. In this context, the issue of the aptness of the new "sciences of life and of nature" had to be addressed in the public space in order to make it acknowledged together with the true philosophers who carried this knowledge.[745]

2 – Science for the prosperity of all

The late 19th century and the early 20th century form an important stage of this history of the diffusion of science and technology. Impressive projects of science popularisation were conceived under the leitmotiv "free access to knowledge for all". With the collapse of the Second Empire in 1870, room was left for movements of revolt of an increasingly exploited population who – in those years of Industrial revolution –

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[742] Of course, these developments are more complex. They are bound to the international context as well, a process that we cannot describe here.

[743] FONTENELLE Le Bovier de, *Entretiens sur la pluralité des mondes*, éditions de l'aube, la Tour d'Aigue, 1990. Préface. On scientific popularisation intended for women under the ancient regime, see, for instance, PEIFFER J., "L'engouement des femmes pour les sciences au XVIIIème siècle", in HAASE-DUBOSQ D. & VIENNOT E. (dir.), *Femmes et pouvoirs sous l'Ancien Régime*, Rivages, Paris, 1991.

[744] The term "science" with its modern meaning appeared in France only at the end of the 18th century. The knowledge of Fontenelle mixed philosophy, "physical appearance" ("physics"), astronomy, history, and even "literature".

[745] On the formation of boundaries between science and religion in the Encyclopaedia, see: DARNTON R., "Philosophers trim the tree of knowledge", *in The great cat massacre and other episodes in French cultural history, Basic books*, New York, 1984. On the general context of this transformation see: ROGER J., *Les sciences de la vie dans la pensée française du XVIIIème siècle. La génération des animaux de Descartes à l'Encyclopédie,* (3ème édition, complétée), Albin Michel, Paris, 1993.

were looking for new marks. As Charles Longuet put it in the Official Journal of the *Commune* (March 30th 1871): "This is the revenge of science and work, freedom and order, whose advent had been put off for nearly a century by government routine." After the defeat of the worker's revolt of the *Commune* (1871) and the government of MacMahon, the first Republic came to power in 1877 and made the education of citizens a priority. Jules Ferry opened schools for ordinary people, who would perceive the access to knowledge, especially to science, as a means to free themselves from an authoritarian regime and as the basis of an equalitarian society.[746] Furthermore, science education allowed the working class to find an alternative to and escape from the religious reference, to improve their condition of life, and to adapt themselves to the fast evolution of techniques that was taking place in the working world.
This movement involved new spaces of knowledge such as the Natural History Museum being opened to the public. The first popular newspapers dedicated to science appeared (*La Nature*, *La Presse scientifique des deux mondes*, and later on *Science et Vie*) and scientific articles of high standard were more and more present in popular newspapers.[747] Authors specialised in science popularisation, such as Camille Flammarion or Louis Figuier, published books intended for both the layman and the more cultivated members of the public. Finally, science made its appearance in novels and fictions, written by authors that were convinced of its social utility, such as Émile Zola (or, for a different literary genre, Jules Verne). This intricacy of science and fiction had contributed to the diffusion of values connected to science and their re-appropriation by various categories of public.[748] At the same time, the first societies for the popularisation of science were established, such as the French Society of Astronomy, founded by Camille Flammarion in 1897. At least, the radical political movements – especially those connected to International Socialism – based their argumentation not only on scientific contents (such as evolutionism, often used as a political argument), but also on scientific rationality.[749]

Soon after the First World War, science entered a "moral crisis". It was accused of having permitted a systematisation of massacres. So, the confidence that links science

[746] See, for instance, TERRAL H., *Les savoirs du maître. Enseigner de Guizot à Ferry*, l'Harmattan, Paris, 1998

[747] BENSAUDE-VINCENT B. & RASMUSSEN A. (dir*.), La science populaire dans la presse et l'édtition, 19ème et 20ème siècles*, Paris, CNRS Éditions, 1997. In particular PANET E., "Les éditeurs et le marché : la vulgarisation scientifique dans l'édition française", P. 33/50.

[748] B Beguet asks interesting questions on the readership of the various forms of scientific popularisation at the time where borders were built to protect the "serious and scientific"popularisation from fanciful works. See BÉGUET B., "Lecture et vulgarisation scientifique au XIXème siècle en France", in BENSAUDE-VINCENT B. & RASMUSSEN A. (dir.), *La science populaire dans la presse et l'édtition, 19ème et 20ème siècles,* op. cit., P. 51/68

[749] See Raichvarg D. & JACQUES J., Savants et ignorants, Une histoire de la vulgarisation des sciences, Paris, 1991 and BÉGUET B. (dir), La science pour tous. Sur la vulgarisation scientifique en France de 1850 à 1914, CNAM, Paris, 1990. Particularly: BÉGUET B., "La vulgarisation scientifique en France de 1850 à 1914. Contexte, conceptions et procédés", P. 6 /29 ; and BÉGUET B., "La science mise en scène : les pratiques collectives de vulgarisation au XIXème siècle", P. 129/147

to its public needed to be restored. During this period, there was a significant increase in the number of popularisation magazines, together with the development of technologies supposed to improve working conditions and daily life. Moreover, politicians displayed an unshakeable confidence in rationality and in the beneficial progress of science. The State became active in providing grants for science, justifying its support by the efficiency that science had during the times of war.

In 1929, the economic crisis struck France along with most European countries. Hence, science appeared as a means to attain a more deserving and better life (thanks to hygiene and health care) and a symbol of the prosperity of a nation. In this context, science was positively opposed to the values of capitalism, which has forgotten the essentials, the well being of each individual. Hence, Science appeared as the symbol of the good social order and as the guarantee of the prosperity of the individual. Moreover, scientific progress was often presented as the model of the necessary progress of humankind.

This peculiar ideology was intensely present in the left wing political movement. So, with the victory of the Popular Front of Léon Blum, the 1930s became the theatre of a revival of science education through the mobilisation of scientists, the creation of numerous associations, and the institution of new sites devoted to knowledge. The *Palais de la Découverte*, in Paris, was established with Blum's support, within the framework of the international exhibition *Science et art*. His designer, the physicist Jean Perrin, conceived it as a means to promote science, to make it closer to society by insisting on the values which he attributed to scientific research: beauty, indifference and purity.[750] Science was being considered as a "source of moral and social values, of democracy",[751] and popularisers thought that they could push aside the obscurantist theories that hinder social progress. As underlined by Petitjean, "There was in the 1930s a resurgence of an ostentatious neo-positivism, which presented itself as the modernisation of the Enlightenment."[752]

During the second world war, the positive, or even positivist, the various anti-Nazi political movements shared definition of “true”science and of “progressive”technologies. In this context, scientists had contributed to the war effort in the name of two irreproachable causes: the defence of science against its "ideological", dangerous and corrupted avatars and the defence of the free nation. The consensus that existed between left and right over the value of science lasted and would constitute a solid basis for CST actions after WW II.

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[750] See BENSAUDE VINCENT B., "In the name of Science", in KRIGE J., PESTRE D. (ED), *Science in the twentieth century*, Harwood Academic Publisher, Amsterdam, 1997, P. 319-338
[751] PETITJEAN P., "La critique des sciences en France", *Alliage*, n°35-36, automne 1998, P. 121
[752] Ibid, P. 121

3 – Science for the development of the nation

After the end of the Vichy regime, the democratic political tendencies of both the left and the right wings thought that scientific and technological developments would help reconstruct France. Big programs were implemented – nuclear, computer, aeronautical and spatial... – that would be pursued up to the 1980s. Science was being perceived as one of the main factors of economic and social development, working for the prosperity of all. A wide social consensus was being formed on the legitimacy of science and technology, whose validity, truth, utility, and integrity was not questioned. Hence, when the first criticisms appeared, they would not focus on science, but on the use of science.

In the 1950s and 1960s, supported by French communist party (PCF) members who gained power within scientific institutions, left wing movements got more and more involved in a criticism of the expansion of capitalism. They considered that scientific findings were diverted from a "just" cause, and that only those likely to be "profitable" were selected. Hence, liberal capitalism was accused of ruining the development of "good science". Nonetheless, the legitimacy of science remained uncontested. It was the uses that the capitalists put science to which were considered as perverse, and so there was a need to purify science and assure its autonomy.[753] In this context, most CST actions brought criticism over the politico-economic system – as was the case in the *Maisons de la Jeunesse et de la Culture* (MJC, Youth and culture houses), created in 1944, and within the *Association Nationale Science Technique Jeunesse* (ANSTJ) created in 1962. In the public space, science benefited from such a positive consensus that it was totally protected from political debates, or even from public debates.

4 – Science in the public space.

The consensus over the legitimacy of science started to weaken in the late 1960's. At that time, the dominant status of science, its working and also existing hierarchies within it were directly questioned. This criticism was first made by the radical left movement and then by ecologists. Both were struggling to make science and scientists responsible for the social, cultural and environmental consequences of scientific research[754]. They opposed communist scientists who, on behalf of their egalitarian ideology, accommodated well with existing hierarchies and defended the dominant position of science.

This movement, carried by young research workers influenced by the 1968 revolt, expressed its opinion through trade unions, several journals (*Impasciences*, *Labo-contestation*, *Survivre et vivre*...) and aimed at giving an international dimension to the

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[753] See DOLBY R.G.A., "On the Autonomy of Pure Science: The Construction and Maintenance of Barriers between Scientific Establishment and Popular Culture", in ELIAS, N., MARTINS H. and WHITLEY R., *Scientific Establishments and Hierarchies*, Reidel, London 1982. P. 267 – 292.

[754] See LEVY-LEBLOND J.M. & JAUBERT A. (textes réunis par), *(Auto)critique de la science*, Le Seuil, Paris, 1973.

criticism. In the late 1970's the movement softened: the PCF regained power within trade-unions and the newly established *Union de la Gauche* domesticated social contestation by making it a positive force within institutions. Although this science criticism movement lasted ten years or so, it would leave its fingerprint on CST actions. For the first time, debates over scientific development had taken place in the public space. In addition, while some actors of this movement launched the first critical studies on science popularisation, others inspired today's initiatives to promote CST. Indeed, most initiatives that have taken place since the 1980's are often directly or indirectly connected with this critical inheritance: the *Centres de Culture Scientifique, Technique et Industrielle* (CCSTI), The A*ssociation nationale des petits débrouillards* (ANPD, National society of small copers)*,* the *Boutiques des sciences* (Science shops).

5 – Enhancing the social acceptance of science.

By the 1980s, the economic and social crisis had set in. The Minister of Research of the recent socialist government, Jean-Pierre Chevènement, diagnosed a crisis in the relationship of trust that should link science to its public as well as a growth of irrationality. Hence, his objective had been to defend the "true" science by assuring its promotion in the public space. In this fight, the identity of left-wing ideology, scientific rationality, progress and social order was perfect. Science appeared as a means to get over the economic crisis.

The order progressively returned, especially because the government benefited from a peculiar protection against criticism. The critical movements became progressively institutionalised and lost some of their radicalism. Indeed, several committees were created over this period to manage the confrontation between science and society, such as the *Office parlementaire d'évaluation des choix scientifiques et technologiques* (OPECST, Parliamentary Office for Scientific and Technological Choices) or the ethics committees. These new committees, and particularly the ethics committees had to assess the "good"and the "bad" uses of science. Hence, the core, made up of "neutral and objective"science, remained unquestioned. The great programs aiming at promoting CST in France are to be understood within this frame: La *Cité des Sciences et de l'Industrie de la Villette* and the *Galerie de l'évolution.* These were established as majestic spaces, "cathedrals" built to celebrate products of science and technology, but they were never to become places for debate. Hence, the debate on scientific and technological development once more abandoned the public space.

B – The present context

The critical debate surrounding science and technology resurfaced during the last decade. Scandals such as the contaminated blood scandal in the late 1980s or, more recently mad-cow disease..., and pressure from the public (such as AIDS activists aiming at establishing an equalitarian relationship between physicians and patients and making the patients participate in decisions related to clinical trials), show that a reflective democracy is progressively taking root in France.[755] The equation scientific progress / progress of human condition is also being questioned. In public controversies, citizens' voices are also being heard that do not base their legitimacy on scientific authority. Other types of knowledge counterbalance the knowledge of experts and the debates on scientific and technological developments are no longer limited to the scientific sphere, they are becoming political too.
This gradual change of the place of science in society affected the CST actions of the 1990s. On one hand, there are some attempts to restore the confidence of the public, by asserting the transparency, the integrity and the independence of science (mainly with regard to economics). In that case, institutions try "to domesticate" these activists' movements by offering them new spaces, which are also spaces aiming at promoting science and technologies (the so-called *Fête de la science* (science days) constitutes the best example, cf. infra). On the other hand, critics are forcing open the doors of the institutional spaces to get their points of view admitted by the institution. That has happened during the recent public debates on GMOs that were aimed at collecting the "point de vue citoyen" but that were literally colonised by anti-GMO critics.[756] In that case, science is equated with other knowledges, and its status as an ultimate resource is negated. At least, new spaces have appeared that permit scientists and citizens to confront each other, for example, the *Cafés des Sciences* (Science Cafés).
In brief, the spaces where science and society interact have been largely redefined during the last years, and some of them are constantly colonised by different pressure groups. Also, after a long history in which science was both protected and kept at a distance from critics, science is finally questioned in the public space. Hence, if these debates are sometimes so intense,[757] it is maybe because they were not able to take place before. CST may therefore be a considered a changing environment, trying to adapt to the social mutations of the image of technoscience even if, quite often, it chooses to use very traditional means and actions.

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[755] For an introduction on the concept of reflexive modernity, see BECK U., "Risk Society and the Provident State", in LASH S. & al., *Risk, Environment & Modernity,* Towards *a New Ecology*, Sage, London, 1996, pp. 27-43.
[756] Marylise Lebranchu who was in charge of the consummation issue in the French Government called on consumerist associations to organise public debates on GMO. During the fall 2000, forums were organised in 60 cities in order to collect citizen’s opinion on GMO. However most forums were colonised by activists of several environmental organisations.
[757] Hence, if one follows the logic that wants that only the scientific rationality is able to propose technical solutions, one may only qualify the reactions of the French public faced with the Mad-Cow crisis as "psychotics" or "irrational".

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See also the Newsletters published by the Office de coopération et d'information muséologique (OCIM). The activities of OCIM are presented on their web site: http://www.ocim.fr/

National Profile – Portugal

Maria Eduarda Gonçalves, Paula Castro, João Arriscado Nunes

Contents

1. Introduction

1.1. Prolegomena about words

Just like each painter has a favourite and distinctive palette of colours, by which he can be recognized, each culture has, in a particular moment in time, favourite words for describing and constructing its social reality. And these words, as Putnam (1989) has stressed, carry an history with them, and their meaning is a product of social negotiation. It also happens that for issues socially recognised as important, or relevant, most of our words come in oppositional pairs (Billig, 1991; Moscovici & Vignaux, 1994), and each term of the pair can be approached by various discourses (Markova, 2000).

When addressing the issues discussed in this report, that is, issues pertaining to the broad field of the intersection between science and the public, different cultures use different words, different oppositional pairs of words, different expressions and thus different discourses.

In Portugal, the expression "public understanding of science" is not of common usage, and in reality it translates rather awkwardly to our language. The two expressions that are most frequently used in our country, both in political and in academic discourses, are the following: *scientific culture* and *scientific literacy*. Both are used in the sense of interest and information about science, and capability to use scientific knowledge, reasoning and tools.

When the first public opinion surveys about these issues were conducted in our country, the expression *scientific literacy* was much used, and there were complaints about our lack of scientific literacy, or about the high percentage of our scientific illiteracy, this being the other term of the oppositional pair. Since the word *illiteracy* in its most common usage had been a source of complaints and preoccupations for our society, given the high percentages of illiteracy that traditionally characterized our population, this term gained some importance for framing the debate. Thus, this debate, in our society, started out as a debate about a lack, that is, it started as a debate that proclaimed the existence of a deficit.

This idea of a deficit was present in a very common discourse, prevailing until recently, and stating that the level of scientific knowledge of the Portuguese is relatively weak, a fact that could explain its lack of understanding and interest for science.

This state of affairs has been attributed to both general factors – the traditional economic and social underdevelopment of the country, a high level of illiteracy, a history of political authoritarian regimes which looked at scientific research, and more generally at independent and critical scientific reasoning, with strong suspicion -, and to factors specific to science and technology.

More recently, that is, since the mid-nineties, the term scientific culture has gained space, and is now the official term for these issues, as can be seen by the fact that it is the term that the Science Ministry uses in its communication and documents. For this reason, we will use throughout this paper the expression "scientific and technological culture".

The expression scientific culture, by the words it aggregates, could be seen as a direct link to the idea of science as culture, that is, the idea that science is a part of culture, broadly understood. Nevertheless, the actual usage of the expression, and the way it connects to many current social practices, makes it acquire the more narrow sense of scientific information, or knowledge. We hope this will be apparent from what is said below.

The framing of the debate in our society around the oppositional pairs of literacy/illiteracy, knowledge/ignorance, information/lack of information, contact/lack of contact with science, may thus be another reason why the expression "public understanding of science" is not of common usage in Portugal. The term "understanding" can of course also be seen as opposed to the term lack of understanding, or to the term misunderstanding. But it also contains other potentialities – when we talk about the public "understanding science" we can also consider this expression as an incitement to trying to analyse the different paths that the appropriation of science and technology by the public may follow, and how this understanding connects to the contexts of appropriation and the identities and representations of the public (Irwin & Wynne, 1996). This would be a way of stepping out of a debate framed exclusively in terms of gaps that have to be filled, and of moving it to a terrain of more complex conceptualisations.

1.2. Scientific culture in Portugal

Public investment in research and development activities, as well as in education and training in science and technology, were rather low by European standards until the mid-nineties. Human and material resources available to research institutions have been insufficient for them to be more than dependent and marginal participants in the international production of scientific knowledge.[758] Portuguese research institutions, and other scientific institutions (namely, scientific societies) have also been socially and politically isolated for a long time. All these factors underlie the *fragility of current structures and activities for the diffusion of science*. No modern science museum was established until the mid-nineties. A limited number of initiatives in the popular science press survived only for a short period of time for lack of support, as well as of market.

Referring to scientific popularization in the seventies and the eighties, José Mariano Gago wrote, in 1990: “the popularization of significant science activities is scarce and, as a rule, lacks continuity. To the absence of a tradition of scientific journalism one can add the chronic emptiness of television in this area... “. He stressed “the non-existence of science museums and the fact that even a small exhibition on scientific themes, when conceived for the general public, is seen as an exceptional event” (Gago, 1990: 89).

The results of the most recent survey of scientific culture undertaken by the Science and Technology Observatory (STO) – a structure of the Department for Science and Technology – (the results were made public in November 2000) show that public awareness towards scientific themes and problems with scientific implications has increased, if compared to the results of the STO survey of 1997.

From the results of this survey it is also apparent a clearer recognition that science and technology can contribute to improve the quality of life, work and of the environment. The survey also reveals a considerable increase in the interest in new discoveries in medicine, and in recent inventions and new technologies. The percentage of those surveyed who are “very interested” in themes related to science amounts to 20% (twice the percentage obtained in the previous edition of the STO survey, in 1996/97) (OCT,

[758] The pioneering role of Portugal in the development of maritime navigations in the fourteenth and fifteenth centuries, which paved the way for scientific experimentalism, was, however, not matched, within the country, by a systematic recourse to the observation and critical reasoning that make up science (Macedo, 1991). Recent studies have shown the contradictions involved in the “intermediate” role of Portuguese science within world science (Nunes and Gonçalves, 2001).

2000). However, these numbers are still below comparable ones in other European countries, coming out of the survey carried out under the Eurobarometer in 1992.[759] Moreover, the growth of the interest and awareness of the Portuguese towards science has not been followed by improvements in the level of available information about these subject-matters. The percentage of those who say they consider themselves to be very well informed is still quite low. As stated in the survey's report, "the most striking result of this survey is, is at first sight, the growth of the distance between, on the one hand, the perception of the importance of science and technology as well as of interest towards them, which have clearly risen; and, on the other, the control of cognitive contents and the access to them, where there have also been improvements, but quite minor ones."[760]

Some changes in the behaviour of the Portuguese civil society, in the context of debates that involve scientific matters, are also apparent. The traditional passivity of civil society is giving place to greater activism, particularly in domains such as the protection of the environment.

In recent years, social movements in this field seem to be followed by a greater awareness, on the part of certain sectors of the population, concerning the relevance of scientific knowledge, as well as the tensions that surround it in contemporary technological society. By the same token, the encounters of science and the public appear to be expanding. Signs of this evolution are provided by the increase of media-driven social and political controversies where science turned out to be one of the main focus of the debate, and scientists have become first plan actors.[761]

These changes in the relationship between science and society in Portugal are, we suggest, the outcome of a series of convergent factors, that are not independent from political democratisation and openness of Portuguese society: improvements in educational and cultural levels of the Portuguese, their higher presence in school and in the university, a greater availability of information on science in the mass media, and the latter's more active role in the coverage of news about science and about scientific controversies. A further indicator of this new relationship between the public and science has been the inclusion throughout the nineties in various daily newspapers (namely the "Público", and the "Diário de Notícias"), of specialised sections on Science, and on Science and the Environment.

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[759] *Inquérito à cultura científica dos portugueses 2000*, *in* http://www.oct.mct.pt/pt/actividades/cultura/cultura2000/index.htm; see also "Afinal sabemos mais sobre ciência?", *Público*, 10 november 2000.

[760] *Idem*.

[761] There are many illustrations of this trend: the controversies on the Foz Côa rock art engravings (1994-97), on the geophysical experiment COMBO (1996), and on the installation of co-incinerators of industrial waste in Central Portugal (1998-00) (Gonçalves *et al*., 2001a; Gonçalves, 2001b; Correia, 2002). See *infra*, section 3.. Another area where public debate is likely to increase in the near future is human genetics.

The involvement of the Portuguese government, since the mid-nineties, in the launching of programmes and measures aimed at the popularisation of science also underlies the higher visibility of science and of new technologies particularly among the youngest segments of the population. Finally, the evolution of social attitudes towards science cannot be separated from the growing participation of citizens and social organisations and movements in formal and informal instances of public participation (e.g. public hearings of environmental impact assessment processes).

2. The public policy for scientific culture

2.1 Main goals and instruments

A Department for Science and Technology was established, for the first time in Portugal, in October 1995, within the government formed by the Socialist Party. This Department, led by José Mariano Gago (still in charge at the time of writing), has introduced as one central axis of its policy the promotion of scientific culture of the general public. This objective has been implemented mainly through the "Ciência Viva" (Science Alive) programme, launched in 1996. Moreover, every year since 1997, in November, a Science and Technology Week is organised by the ministry. During this week, which includes "the national day of scientific culture", a series of various events are held, including the opening of the doors of some scientific institutions to the public, and conferences and seminars on different scientific topics. These events take place all over the country.

The "Ciência Viva" programme is essentially a programme for the popularisation of science, which relies on the cooperation between, on the one hand, basic and secondary schools, and on the other hand, universities and state laboratories. This programme, therefore, aims to mobilise the educational and scientific communities. Its main targets are students of basic and secondary schools. Its methodology emphasises the experimental teaching of natural and technological sciences.

The "Ciência Viva" programme opens every year a public call for proposals of action in the field of the experimental teaching of science in schools to be implemented in basic and secondary schools. Scientific associations and societies, polytechnic institutes, research centres, state laboratories, science clubs, natural parks and business enterprises can also participate. Up to now, more than one thousand projects involving almost half a million of students of more than two thousand schools have been approved under this programme.[762]

During the summer, the "Ciência Viva" programme organises a programme for the "occupation of young people during their holidays", particularly in geology and astronomy.

[762] Cf. Mais Ciência, Mais Viva, Ciência Viva, Ministério da Ciência e Tecnologia, Lisboa, s/d.

The "Ciência Viva" programme has encouraged the formation of permanent networks among schools, through its special twinning programme, and has given rise to the establishment of "Ciência viva" centres, conceived as interactive meeting spaces. Examples of these centres are the "Centro Ciência Viva" of Algarve, the Planetarium of the Centre of Astrophysics of Oporto and the Infante D. Henrique Exploratorium of Coimbra. The "Pavilhão do Conhecimento" (Knowledge Pavilion) created in 1999, in the setting of EXPO-98 ("The Oceans – A Heritage for the Future") at the "Parque das Nações" (Park of Nations), in Lisbon, has been presenting a number of temporary exhibitions on science themes, most of them "imported" from other museums or similar institutions of foreign countries. Near Oporto, an interactive science space has been established as well, the Visionarium, under the initiative of a private body, the Industrial Association from Oporto.

In the words of the Minister for Science and Technology, the "Ciência Viva" programme found its origin in the recognition of the need to struggle for the "general appropriation of scientific culture by the Portuguese population". "This programme was born out of a decisive debate against Portuguese scientific backwardness", the Minister added (MCT, 1999). "We are firmly engaged in suppressing in a definitive manner this endemic and centuries-old malediction that has repeatedly broken down our capacity to innovate, maintained us internationally isolated, and has so many times expelled from the country those who could have contributed to its development" (p. 15).

The "Ciência Viva" programme is based on "a political belief" that "affirms without any doubt the decisive relationship between people's scientific culture and citizenship" (id.). According to the Minister, there is a close relationship between the exercise of freedom and scientific practice understood as the use of critical reasoning based on knowledge and experience, which are, in their turn, grounded on "registering" and "observation", "hypotheses", "deductions" and "learning by doing" (p. 14). "The teaching and learning of the sciences cannot be but experimental" (p. 18). "It is unacceptable that primary education is not technological education also" (p. 18). "... Ancient and melancholic Portugal ... limited itself to copying to its school programmes, as if they were modern, the last novelties, but it did not teach, nor did it allow the learning of measuring, registering or cutting, or the construction of hypotheses or proofs" (p. 16).

These popularisation activities are seen as "a responsibility, in the first place, of the national scientific community" being also understood as a "collective responsibility".[763] In fact, the government has played a decisive role, since the mid-nineties, in encouraging scientists and scientific institutions' involvement in the diffusion of science to the public.

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[763] Cf. MCT, Ciência Viva, Livro de Actas, 2º Fórum Ciência Viva, http://www.mct.pt/ .

2.2 The policy's rationale

Policy and programmes for scientific culture undertaken by the Department for Science and Technology are guided by an ideological frame of reference inherited, one might say, from the modern philosophy of "Les Lumières" according to which science was essentially the search for the laws of nature and of things, based on logic and deduction. The same ideology espoused the values of liberty and of democracy and thought of them as intrinsic elements of scientific practice.

The "Ciência Viva" programme relies on the notion of scientific practice as the understanding and manipulation of nature and of technical objects. One of its underlying goals is to counter the traditional theoretically based teaching of sciences, by a methodology of teaching based on experimentation. A concrete consequence of this policy has been, it has been recognised, the contribution to provide schools with scientific equipment and instrumentation.[764] Strikingly, the building up of intellectual competencies, together with "citizenship" competencies seems to prevail, in political discourse, over professional competencies.

The programme's emphasis on experimentation and on technology manipulation tends to exclude from the learning and awareness processes both the discussion on the nature of science and technology themselves, and the consideration of the social, economic and political contexts of their production.[765]

The "Ciência Viva" programme has been the object of generally very favourable assessments, namely from its international evaluation board, with regard to both its workings and efficacy. However, one of the members of the evaluation commission, V. Koulaidis, has called the attention to the fact that in "primary schools the teachers stimulate the involvement of students on a rather restricted set of subject-matters, ... (and) considerations on the nature of science are unfortunately reduced to methodological recipes". "In secondary schools, which present a broader set of subject-matters, the approach to teaching is traditional and, as a whole, activities and relationships do reflect an empirical image of the sciences".[766]

For Koulaidis, "it is not the experience as such that is important in the teaching of science, but rather the way in which the experience is used to put order into the interaction between theory and practice, to initiate students into the structure of the scientific conception, into the scientific way of expressing ideas, and into the scientific method of doing things" (p. 154-5).

Stressing the relational side of the projects carried out within the programme, the head of the National Council for Education, Teresa Ambrósio, has noted, however, that since "the partnerships value social knowledge, concrete things happening at local level, and

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[764] Idem.

[765] It should, however, be pointed out that there has been one, but just one, experiment of the program in the field of sociology: the initiative was taken by the Center for Research and Study in Sociology (CIES), of ISCTE, in 2000.

[766] Cf. MCT, *Livro de Actas*, 2º Fórum Ciência Viva, p. 153.

in enterprises, not only in research centres", they "develop the capacity of students and teachers, as well as parents and other social partners to interact", "they develop the capacity to take initiatives, as well as (their) understanding of the world, since these projects are related to practical issues of environmental education, agro-food problems, all of them in very concrete contexts and, therefore, the students improve their understanding of the world".[767] "... (T)hese projects ... are a means to promote democracy and thus to fight ignorance and the powers that accentuate ignorance", she added (id.).

Nevertheless, the privilege that the national policy for scientific culture assigns both to the natural and exact sciences and to technology does reproduce to a certain extent the distance between the "two cultures". Strikingly enough, in his Manifesto, in 1990, Mariano Gago called for a "special attention to be given also to socio-scientific questions, which emerge naturally as a candidate to the fulfilment of the gap resulting from the social separation of work and scientific culture ... this field tends progressively in almost every country to be excluded from the teaching room...", a trend which, according to Gago, "it is indispensable to combat" (p. 112).

Gago also criticised "the very strange cultural history that tends to render science autonomous in order to exclude it or separate it from the cultural image that it carries with it, and, by doing this, to legitimate the social non appropriation of the sciences and technologies" (p.121).

To the extent that it does not consider the social and political dimensions of scientific activity, this scientific culture policy is out of phase with the public image that science is acquiring in the mass media. Because this is an image of science that views it as, on the one hand, something increasingly relevant to people's lives and, on the other hand, as something uncertain and controversial.

It should be added that the very use of the word "experimental" in describing the turn towards "science as it is actually done".[768] tends to reinforce the epistemological primacy of those scientific disciplines organized around laboratory and experimental practice, such as physics, chemistry and some areas of biology. Subsuming under "experimental" the practices of observation, documentary and archival work, fieldwork, modelling and others, as often suggested by officials from the Ministry of Science, tends to conceal the diversity of scientific practices associated with different disciplines and, in the end, had the (unintended, for sure) effect of contributing to the emphasis on "traditional" disciplinary hierarchies, as well as to the "two cultures" split.

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[767] Cf. *Livro de Actas*, 2º Fórum, p. 123.

[768] This was the title of a cycle of public lectures organized by the Ministry of Science, in Lisbon, between October 1996 and January 1998, which brought to Portugal a number of philosophers and historians of science, as well as many of the most prominent names in STS. The lectures, which consistently had a high attendance of students and high school teachers, were published shortly after the cycle ended (Gil, 1999).

2.3 The scientific culture survey

Regarding the activities of the Department of Science and Technology, a last initiative is worth mentioning. It is the Scientific Culture Survey. This Survey was first conducted in Portugal in 1990 and 1992, under the responsibility of Eurobarometer, the research instrument being the Portuguese version of the Eurobarometer questionnaire. After these first years, problems with both the methodology and the rationale were largely invoked and the survey was discontinued in Europe.

Portugal, however, decided otherwise. From the mid 90s onwards, the Science and Technology Observatory (STO) – a structure of the Department of Science and Technology – assumed the responsibility for these surveys, and a new one was conducted in 1996/97, and another in 1999/2000. These followed both the same rationale and the same methodology of the previous Eurobarometer ones, with only minor changes in some questions. According to the STO, to maintain these national surveys served an important comparative aim, since they are an opportunity to analyse the evolution of the scientific culture of the Portuguese. It has also been suggested that these surveys are still important in a country like Portugal to legitimate more investment in scientific culture.

The 1996 results of this survey were followed both by laments over the scientific illiteracy of the Portuguese, and some criticisms of its methodological shortcomings. In an attempt to foster a larger and more systematic reflection about the interaction between science and its publics, in 1997 the STO financed a research project untitled “Science and its publics”. This was a multidisciplinary project, whose research lines developed a series of qualitative studies about concrete contexts of interaction between science and its multiple publics. Some guidelines for re-thinking the science-public relationship were thus highlighted in a final document, “Contribuição para o Livro Branco do Desenvolvimento Científico e Tecnológico Português (1999-2006), Cultura Científica, Ponto 1.7 do Documento de Trabalho OCT-01/98” (Contribution to the White Paper on the Portuguese Scientific and Technological Development (1999-2006), Scientific Culture, Section 1.7 of Working Document STO-01/98). [769]

Meanwhile, the 1999/2000 version of the scientific culture questionnaire was launched, with some revised questions. Nevertheless, in the whole, the rationale and the structure remain untouched (see Ávila & Castro, 2000, for an analysis of the fragilities of this survey – also an outcome of the project the STO financed, this working paper can now be found in the STO internet site, listed in the webliography).

As we have pointed out already, the results of the 1999/2000 questionnaire, when compared with the 1996/1997 ones, allow the report’s authors to state that it is possible to find an increase in the scientific knowledge of the Portuguese, in the interest they reveal for scientific issues, in their declared scientific practices (such as reading scientific magazines and visiting science museums) and in the importance they accord

[769] The results of the research project on “Science and its Publics” are under publication.

to science. These increases are, as is the norm in other countries, accompanied by a slight increase in criticisms directed towards scientific risks and problems (OCT, 2000).

3. The role of the Department of the Environment

In view of the importance of present debates concerning the environment, which are so closely related with issues and expertise of scientific nature, one would expect that the Department of the Environment (established in 1990, in Portugal) would promote action in the field of the popularisation of science, for the clarification of the scientific issues involved in such debates. However, initiatives in this area are not being pursued in a direct manner.

It is, nevertheless, possible to consider that, connected with the activities of the Environment Department, two issues are worth mentioning as contributions to the penetration of scientific issues into the public realm and media discussions.

One of them are the Environmental Impact Assessment (EIA) procedures and hearings. These procedures and hearings, and mainly those connected with the EIA studies, are always a medium that brings scientific issues to public reflexion and discussion. The scientists who are responsible for the studies often dwell lengthily on scientific considerations. The public involved in these processes is, thus, often lead to perceive scientific methods and instruments through the impact that these may have on their lives. We could consider this is the way to actually involve the public into a contextual understanding of science, and a motivated one. These EIA audiences may, thus, be considered an interface where science meets the public, even if they do not incorporate an explicit motivation of scientific diffusion. Several commentators have now analysed these EIA audiences and are unanimous in considering that they are monopolised by participants with a scientific background. Communication with the public follows mainly the *deficit* model, the public being seen as lacking in scientific information and constructed as in need of instructions and as subject to nimby syndroms.

A recent EIA process, concerning the incineration of toxic waste, clearly illustrates this point. In the beginning of 2000, the Environment Minister, faced with strong public contestation of a co-incineration project of toxic waste, decided that an Independent Scientific Committee (ISC) would study advantages and disadvantages of co-incineration in cement factories, and come up with a recommendation that would be followed by the government. Nevertheless, an even stronger public and parliamentary contest followed the ISC recommendation favouring co-incineration, and choosing the factories where it should be done. Several debates and interviews both with the Minister and with public figures opposing co-incineration, took place. And, to make a

long story short, another Independent Committee, this time with public health specialists, was appointed.
The main dimension that seems worth mentioning in connection with the question of public understanding of science, is the one pertaining to the intense use by the Minister of the idea that science and scientific expertise can decide environmental matters via a direct transposition of its findings to public policy. Translation and interpretation from the scientific data realm to the public policy realm were thoroughly constructed by the Minister as inexistent. Science was presented as something specialists do in their offices and is able to come up with unproblematic answers. These unproblematic answers were, afterwards, to be used as the basis for governmental decisions. Since the local authorities and the populations from the chosen places were not "illuminated" by science, but instead "obscured" by local interests, their voices could not be taken into account for an informed governmental decision.
This version of science – and of scientifically informed policy – echoed positively in large sectors of public opinion, and even strengthened the Minister's position in his own party. He is now often presented in the press as someone who is capable of informed decision-making, even if facing public (defined as local) contestation.
This co-incineration project, besides attracting criticism from the other political parties, also met with strong contestation from leading intellectuals from the area of the social sciences, as well as from scientists who actively contested the reports of the scientific committees, namely a number of members of the School of Medicine of the University. A citizens' movement was organised in the larger town near the planned site for the incineration, and social scientists were very active in the protests and debates in which local authorities and populations were given voice. Nevertheless, the difficulties of the management of the interface between local preoccupations and local interests, and of the interactions between local problems and global solutions somehow hampered the efficacy of the message, and, in the end, the Minister's construction of the issue seems to have gained more general purchase.

4. Organization and role of Science Museums

The science museums are traditionally seen as decisive arenas for the creation and diffusion of scientific and technological culture. Contrary to what happens with the mass media, here the agents of the popularisation of science and technology have the control over the instruments of diffusion, where in the former case they always remain dependent of the journalists. It is also true, however, that science museums were usually seen as part of the "high culture", and this socio-cultural definition[770]

[770] Here the science museums share the characteristics common to the art or archaeological museums.

contributed to erect an obstacle to a popularisation strategy comprising larger parts of the population.

Recently, the definition of the science museums as mass media can be seen a part of a new trend that attempted to bring them from the “high” to the “mass” culture. In the last years this trend has had an important impact in organization and role of the science museums in Portugal, through the involvement of the political institutions in the design of a strategy for the popularisation of scientific and technological culture. The major indicator of this evolution is that the concept of “science museum” seems to be progressively substituted by that of “science centre”. This change implies a strategic reorientation of the organization and role of these institutions: the ones that we may call “classical” – as the Science Museum of University of Lisbon, or the Natural History Museum, major structures usually situated in Lisbon covering a vast range of subjects and historical periods of scientific knowledge and instruments – are being superseded by more modern spaces, decentralized from Lisbon, characterized by more flexible structures, using new and interactive technologies, and in some cases dedicated to specific subjects (e.g., astronomy, geosciences, climate change or mathematics), dedicated to specific historical periods, and targeting specific audiences.

Although this does not mean disinvesting in the “classical” museums – these continue to be supported by political institutions and closely associated to the programme “Ciência Viva” –, this trend shows not only an important change in the conception of both the role and the organization of these interface spaces between scientific knowledge and its history and the lay public, but has implications in the expansion of the number of science centres: in the last years various centres were created in different cities[771], and six new “Ciência Viva” science centres are planned to open in the near future in cities of medium or small dimension all over the country.[772] These policy measures have the objective of constituting a dense network of science centres which, in articulation with the “classical” science museums (which also follow the modernising strategies employed in the science centres, as the use of interactive technologies) will be able to develop popularisation strategies (e.g., expositions and courses) directed to different and fragmented publics on a vast range of scientific subjects, not only with historical and general interest (e.g. physics or astronomy), but also highly actual and controversial (e.g., bioethics or environmental pollution).

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[771] As the “Pavilhão do Conhecimento” (“Knowledge Pavilion”) in Lisbon, the “Visionarium” in Santa Maria da Feira and the “Centro Ciência Viva do Algarve” (Algarve Science Alive Centre) in Faro.

[772] The “Ciência Viva” program includes the creation of science centres in Ovar, Amadora, Açores, Estremoz, Setúbal and Proença-a-Nova.

5. Development of the Portuguese STS community

Due to the youth of the social sciences in a country like Portugal, with the recent politically democratic history like Portugal, the studies on science (in its plural dimensions and carried by different disciplinary frames) are quite recent. Only in the decade of 1990 the STS community started to emerge, as a network of researchers working from different backgrounds (sociology, law, social psychology, education sciences, anthropology) began to produce systematic studies on various issues – the study of scientific based public controversies, of the scientific community's representations and practices, or of the relations between science and the industry and the economy –, or to participate in books organized under the subject of science's relationship with political power and democracy.

These books – together with similar events, as the "Revista Crítica de Ciências Sociais" ("Critical Review of Social Sciences") thematic number on "Science and Society" or the organization of various conferences – were important to create a network dynamic between a growing number of researchers, as the heterogeneity of their disciplinary backgrounds could hinder the establishment of intellectual and institutional ties and the communication between the studies carried from different theoretical and methodological frames. Moreover, these initiatives allowed this research area to gain considerable academic and public visibility. Another factor that contributed to the consolidation of the research area is related with the internationalisation process: the publication in international journals by Portuguese researchers, their participation in international conferences, and the inclusion of Portuguese teams in European funded projects with other countries form the EU space function as an expression of the developing status of the Portuguese STS community, contributing also to the research area's maturation.

Today, the STS community interests and studies reached a considerable degree of differentiation; in the last years there was an emerging interest in the study of science teaching in elementary and secondary schools, in the "laboratory studies", in the interaction between experts and lay people's conflicting rationalities in specific scenarios (like the EIA), and in the mass media coverage of science and the relations between experts, politicians and journalists. Concerning the study of the scientific and technological culture, and the study of the science's publics in particular, the Science and Technology Observatory (OCT) has played an important role in funding studies and launching challenges for reflection. Recently, the Centre for Research and Study in Sociology (CIES) created an Internet site (called "Scientific Culture and Knowledge Society") which organizes data on the research community and the studies produced in this area. This can be seen as an attempt to tighten the common cognitive and institutional references in a field, which grows at a fast pace.

6. Non-governmental initiatives

It comes out from what has been written that, in Portugal, the government has played a crucial, and direct role in furthering the public understanding of science by the citizens. This does not mean that non-governmental organisations have not been involved in this area, on their own initiative. However, in general, the popularisation of science by the scientists and scientific institutions has most often been occasional. Practical difficulties such as lack of funds and of institutional conditions, the insufficient motivation of scientists to engage in such activities (which are not taken into consideration for career progression purposes), and the lack of interest in the public, have hampered the efforts of those few who took the initiative of launching popularisation of science activities.

One may recall the activity of the "Associação de Ciência e Tecnologia para o Desenvolvimento" (ACTD) (the Association of Science and Technology for Development"), a non-governmental organisation created in 1995. Besides operating as a "lobby" of Portuguese scientists and technologists for the promotion of better conditions for the undertaking of research in Portugal, the ACTD organised a number of science exhibitions, in various parts of the country, in the late eighties and the beginning of the nineties. These exhibitions involved the participation of a considerable number of members of the scientific community, and received financial support from the then Secretariat of State for Science and Technology. Once most of its "political" goals had been achieved (with the creation of a ministerial department for science and technology, and the greater relevance acquired by research and development at the governmental level), the ACTD was transformed, in 1995, into an association devoted exclusively to the diffusion of science. But the Association decided to close its doors in 2000, based on the recognition of its inability to mobilise scientists to carry out its purposes.

Another association involving members of different scientific disciplines and institutions, the Portuguese Federation of Scientific Societies and Associations (FEPASC) was created in 1990. This non-governmental organisation has not been directly engaged in popularisation of science activities in its traditional sense, but rather in the promotion of public and academic debates about the social and political implications of science and technology.

7. Science and technology in the mass media

In a country with low levels of scientific and technological culture, with low levels of public and private R&D funding, the historical absence of a popularisation of science and technology policy and the invisibility of science both in the public sphere and the schools, the role played by the mass media in the construction of a public image of science and technology and in the creation of a scientific and technological culture may be even stronger than the one played in other European countries.

This does not mean, however, that the mass media, historically, had a special interest in the scientific and technological issues. During the decades of 1970 and 1980, the volume of articles in the newspapers and TV programmes, while pointing to an increasing trend in the near future, was quite low.[773] So, if the introduction of the scientific and technological culture in the governmental agenda is recent, so is the regular handling of science and technology by different mass media (including press, TV, radio and popular magazines). In fact, the affinity between the rising of the political and media interest in science and technology, and in scientific and technological culture in particular, is not casual. As a trend already observed in other countries, the creation of a governmental office is usually accompanied by a restructuring of the journalistic organization and to its readjustment to emerging dimensions of the policy agenda. This process resulted not only in the creation of specialized sections and journalists – the emerging new group of "scientific journalists" – within the newspapers (a trend unlikely to occur in TV and radio), but also in attempts to create an audience attentive to issues related to science and technology.[774]

One of the subjects given regular attention by the mass media is science policy: the development and evaluation of scientific and academic institutions (state laboratories, research units, etc.), the training of human resources, international cooperation, besides the promotion and evaluation of scientific and technological culture. Yet, science policy is far from being the subject given most attention by the mass media – the same happens with news related to basic scientific research: studies have shown that the issues related to the environment and technological applications enjoy the biggest portion of the press news in the nineties.[775] The emergence of supplements in the daily and weekly newspapers contributed to an impressive increase in the number of news printed within this decade, yet, as an unintended outcome, this trend resulted in an "escape" of the articles where science was more "visible" (the ones focusing in basic scientific research and science policy) from the main body of the newspapers to the supplements, restricting its potential public.

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[773] Machado, F.L. and I. Conde (1989), "Públicos da divulgação científica", *Sociologia – Problemas e Práticas*, 6, pp.81-100.

[774] The newspapers promote communication channels with their audience in order to probe its interests. In 2000, the daily newspaper "Público" promoted a survey where it asked the subjects their audience would like to see more developed. The two subjects most selected were tourism and science, technology and environment. Some months later, two supplement sections appeared about these subjects (the one dedicated to science, technology and environment is called "Terra" ("Earth")).

[775] Within the TV arena, this trend was followed and reinforced by the emergence of a programme called "Saúde Pública" ("Public Health") in SIC Notícias (the first Portuguese channel dedicated fully to information and news).

So, while being strongly related with political institutions' attention and dynamics – with the political actors functioning as important sources on which scientific journalists must draw upon, responding to needs of the latter to preserve their space within the internal news economy of their organization –, the mass media develop their own logic of theme-choice, moving away from the issues and concerns demonstrated by the political institutions' official discourse. This non-coincidence between the official and the media attention has its most clear example in the mass media coverage of science-based public controversies (an important number of which have emerged in the last decade). A second group of studies undertaken in these field focused upon this intense, conflicting and sometimes highly charged with political significance events, highlighting the way mass media both represented and shaped the controversies, constituting an extension of the public arena where different actors state their arguments and try to influence the political and the scientific outcomes of the controversy.

From the political point of view, these events were seen as triply damaging: for the scientific institutions and scientists, for the political institutions responsible for the scientific and environmental issues, and for the creation of a scientific and technological culture. These apprehensions could well be justified: it is very likely that these highly media-driven events – which reach the TV prime time and radio news, and not only the newspapers – are prone to shape the public's image of science and scientists in a stronger way than the daily news appearing mainly in the newspapers, read by a very small number of people [776]. If to this fact we add the lack of visible "goods" produced by science in Portugal – such as important scientific discoveries, technological improvements or economic revenues directly related to R&D –, then we can conclude that the image of science and technology in the Portuguese public sphere can sometimes deviate from the one political institutions try to promote.

This situation has been acknowledged by the political and scientific institutions, which know that, for better or worse, a scientific and technological culture – in a country where the mass media occupy such a central place within the other socialization groups (such as family, school, peer-groups, work) – cannot be created against the influence that mass media enjoy in the public and private spheres. In the present, the mass media are decisive spaces used not only to science and technology's popularisation, but to the «popularisation of popularisation» (Gago, 1990: 90), functioning as carriers of the messages of the initiatives designed by political institutions.

[776] Following results from the most recent survey of scientific culture undertaken by the Science and Technology Observatory (STO), only 8,3% and 19% of the respondents declared to read "regularly" and "once in a while", respectively, news articles on science and technology in the press. The TV, not surprisingly, enjoys a larger slice of the market: 13,4% and 32,6% of the respondents declared to see "regularly" and "once in a while", respectively, TV programmes on science and technology.

8. Conclusion

In attempting to articulate some final conclusions about the intersection between science and the public in Portugal one is forced to acknowledge the central role played by the government in this field.

The Science Ministry has been the main actor in the promotion of the various initiatives devised to foster a scientific culture in the public and is responsible for the main reflexive instrument for the assessment of this culture, the scientific culture survey. Governmental initiatives in this field have involved the scientific and academic communities, and enabled them to put into practice popularisation activities that they could hardly pursue on their own.

This central role of the state is of course neither new nor specific of this field, since ours has traditionally been a centralized society. The Portuguese civil society lacks both the tradition and the channels for a more enlarged and active social participation – the percentage of those engaging in social contestation actions is low, and the percentage of those belonging to non-governmental organizations is also low.

The nineties were, however, for our society a decade of very rapid and important changes in various fields, and also in the one that concerns us here.

1. Where the central administration is concerned, the values of public information and public participation were peripheral values for many years. Today these values are very much a part both of governmental discourses and of a growing bulk of legislation. Most current legal directives on environmental matters, for instance, now explicitly incorporate these values. In most of these directives, however, public information is seen as a one-way process – the public is to be informed – and the channels and procedures for public participation are left largely undefined in terms of timing and implementation.
2. In the very beginning of the decade we could still be characterized as a society where both scientific knowledge and interest were very socio-economically stratified, as is the case for industrialized societies, as opposed to post-industrial ones (see the comparative analysis of Durant *et al*., 2000 for the EU countries). Ten years after, however, both knowledge and interest seem less socio-economically stratified (OCT, 2000), and we started accompanying the trend towards post-industrialization, i.e, the contributions to our GDP show a decrease in the value added by the industry and an increase in the value added by the services (see the 2001 World Development Indicators, from the World Bank).
3. At the same time, the last decade was also, for us, the decade of media-driven science-based social controversies. The first was BSE, and many followed, and so we received the impacts of the politicization of science and technology as other technologically more advanced European countries, and public debate, however incipient in some fields, also occurred.

4. What this few indicators may show is the complex and contradictory terrain in which discourses and practices connected with science-public issues are taking shape in our country. On the one hand, bureaucratic and hierarchical values ascribing social responsibility mainly to experts and governments, and elites in general, are still widespread. On the other hand, new values of public information and participation, ascribing responsibility also to civil society and individuals are penetrating society, both as a general normative discourse, imported from the outside, and as a genuine aspiration of many sectors.

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Initiatives on public understanding of science in Sweden

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Introduction

To understand the specific set-up of public understanding of science (PUS) in Sweden, it is useful to start with some of the fundamentals of Swedish culture, and its research and policy contexts. Sweden is a large and relatively sparsely populated country (8.8 million). It has a total land-surface of 450,000 km2, making it in this sense one of the largest countries in Europe, with boundaries stretching from the Baltic Sea in the south, to a point in the north well above the Arctic polar circle. There is a long coastline that circumscribes much of the country's contours. This geographical and demographic setting has always been problematic in that large distances have to be covered in order to connect various cities and regions. Still, when it comes to education and public understanding of science, this becomes a notable aspect indeed. 85% of the population is concentrated in three major urban areas and of these one in particular stands out. Stockholm and its surrounding area hosts two of the country's four traditional universities. It also has as many inhabitants as the two other major regions, (west Sweden and the south of Sweden) combined. Most of Sweden's political, intellectual and cultural resources are invested in Stockholm. This means that opinion leaders in the other regions complain about a skewed centre-periphery relationship that benefits Stockholm and its environs.

State driven efforts at PUS are therefore mostly originate in Stockholm in a context where the political, cultural and commercial powers are dominant.

Sweden as an industrial country went through a structural crisis in the 1990s. Half a million people became unemployed, mostly from the traditional manufacturing industries. Governmental policy was to reframe Sweden as a knowledge economy and thus geared people into the expanding information technology area. This shift has of course changed the way knowledge is viewed. Increasingly, it is seen as something that can be commercially exploited. In Sweden there has been, as we shall see, an interesting merger of the civic tradition of public understanding of science with a more practical and economic tradition of industrial exploitation of science.[777]

The geographical position of Sweden is also important. Sweden has no land connection directly to the continent. In the Summer of 2000 a bridge between Sweden and Denmark was completed, connecting Malmö with Copenhagen and supposedly counterbalancing the commercial, political and cultural importance of Stockholm. Sweden has, in many senses traditionally been somewhat aloof from the rest of Europe, preferring with its Scandinavian neighbours to cultivate a Nordic ‘brotherhood’. The entrance into the European Union in January 1995 has of course changed this to an extent.

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[777] Talerud, B, 2000, *Högskolans arbete med sin samverkansuppgift*. (University strategies for interaction) National Agency for Higher Education, 2000:2 AR, p 24-27.

Three “archetypes” of PUS-initiatives

There have been many diverse initiatives on PUS in Sweden since the early 1970s. These activities are not connected to a particular medium or an actor and they have been accentuated in various ways during different periods. It should also be noted that the Swedish concept ‘vetenskap’, like its German counterpart ‘Wissenschaft’ is much broader than the English notion of ‘science’. It includes not only the natural sciences, medicine, agriculture and engineering sciences, but also the humanities and social sciences, as well as legal science and theology.

It is possible to discern, suggested by the material itself, three ‘archetypes’ of PUS-initiatives in Sweden:

- Practical – the understanding and use of science in a commercial and/or bureaucratic context.
- Cultural – the understanding of science as a cultural entity and resource.
- Civic – the understanding and use of science in a “democratic society”[778].

The present overview of Swedish initiatives in PUS is divided into three parts. The first deals with some important research and policy contexts. The second section maps various media and actors on the Swedish PUS landscape. The third part highlights a few cases that seem to be of particular interest and which also illustrate (and blur the boundaries between) the three archetypes mentioned above.

I. Contexts

The Universities

Sweden has four large and traditional universities; these also act as generators of scientific information to broader publics. Two of them, as mentioned, are located in the Stockholm region (Stockholm University and Uppsala University). One is situated in the west of Sweden (Göteborg University). The fourth is located in the south of Sweden (Lund University). In addition one university was created in 1965 in the northern part of Sweden (Umeå University). Linköping University was given that status 1975. There also exist a number of colleges that have grown incrementally and subsequently invited into assuming the role of university; Karlstad, Växjö and Örebro have so far succeeded. Previously, colleges did not have the right to award PhDs. Candidates had to be linked to a university, which supplied the necessary training. With these newer institutions also comes a somewhat different type of scientific information, more commercial in tone.

[778] These three ”archetypes” are also identified by Shen. See, Shen B, P, S, 1975, ”Science literacy and public understanding of science”. In S B Day (Ed) *Communication of scientific information.* Basel: Kargel, p 44-52. Variants of the three ”archetypes” are also used in Swedish research policy. See *Forskning i kontakt med samhället* (Research in contact with society). SOU 1977:5

During the last decade there has been a long-winded discussion on the governmental policy of decentralising university funds from the traditional universities to the new colleges.[779] The proponents of this policy have suggested that the state give research resources to these areas so that the intellectual capacity in the surrounding region can be stimulated. Opponents on the other have hand maintained that Sweden is too small a country to disperse its research funding in this way. In order to produce university departments of international excellence, they say, one has to focus resources on a few specific places in such a sparsely populated country.

By and large the Swedish research system continues to be dominated by the old universities which in turn are marked by well-established disciplines.[780] The new colleges for their part are geared more towards interdisciplinary institutional forms and also towards crossing the boundaries between academia and the rest of society. Together with County Councils and Regional Districts (landsting), they often promote regional and local development policies to stimulate industry and the public domain. Thus, while the traditional universities highlight their international research links, the newcomers are more integrated with their regional setting and are motivated into supporting regional growth. Seen in another way, the traditional universities have taken a national responsibility for PUS, but this task has never actually been very high on their list of priorities. The colleges have taken a regional responsibility and this kind of interaction has from the very start been of great importance.

Apart from the tensions between new and old institutions another factor important for understanding the Swedish context is the deeply-rooted academic chair system. In the past, university departments were led by one specifically designated professor who was responsible for quality and specialisation in his/her department. Indeed, in many cases a university department only had this one professor. This old system is a survivor from the times when a professor was supposed to knew ‘everything’ in his/her field. In today's specialised science, this system has become obsolete, with one department hosting many specialities, the professor only in control of one or a few of them. Professorships, as they had been so scarce, were extremely sought after and the basis for many an academic conflict. However, in 1997, the new system was established, whereby the title of professor is awarded not on availability, but on merit. Since then, many researchers have acquired the title of professor, however, the fundamentals of the chair system remain. The new system, which shares similarities with the American tenure track system, does however seem to enhance one of the problems in the Swedish system: the lack of academic mobility.

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[779] 1994, *Tvärsnitt*, no 3-4.

[780] Wittrock, B & Elzinga, A, (Ed) 1985, *The university research system: The public policies of the home of scientists*. Stockholm: Almqvist & Wiksell International; Agrell, W, 1990, *Makten över forskningspolitiken.* Science and technology policy studies 1. Lund: Lund University Press.

In the Swedish research system, it is very common to take your degree at a particular university and then stay there for most of your academic career. One of the few incentives to move has been the chair system which itself provided very few positions on the national scene. These 'chairs' have been so attractive in the past that it seemed to be worth the move. In the new system, however, this impetus seems to have lost some of its attractiveness.

The chair system, as it has been structured in Sweden, has had repercussions on PUS as well. Journalists have traditionally sought opinions from researchers with a professor's title, rather than from an actual specialist at the same department. When a researcher is given space on TV news, more often than not you will find that s/he is presented as "Professor" whilst very little precise information about his/her field of expertise is given. The title alone seems to give credibility to news features.

This tendency of reporting from the top, is strengthened by the way less established researchers are often more cautious in their public statements, afraid of saying something that might jeopardise their academic career. Senior researchers have already proven their worth, have less to lose and are often more at ease in an interview situation both on air or in the press. For the future, the new tenure track system is an important feature with regard to different PUS initiatives, since merit portfolios and teaching acumen are given much more credence.

"The Third Assignment"

Recognition of PUS in academia is associated with a very important legislative move, namely the mandate for researchers to disseminate their results.[781] Because this new mandate supplemented teaching and research, the two earlier officially proscribed tasks assigned to the universities, it was called the "Third Assignment" (*tredje uppgiften*). In the new University Act of 1977 it was stipulated that, apart from education, research and research training, universities would henceforth also be officially responsible for disseminating research information (*forskningsinformation*) to the public. In addition, such information should provide insight into how new knowledge had been gained and how it could be practically useful. Subsequent revisions of the University Act have modified the text, but without fundamentally changing its intent or rationale, which goes back to the fact that the universities are part of a unitary national system and are publicly funded.

An important motivating element of the "Third Assignment" is an emphasis on the democratic significance of research based knowledge. The notion of research being a resource for changing society is created from a political perspective and has produced two democratic problems.[782] Firstly, the citizens needed to increase their awareness

781 Svensk författningssamling 1977:218.

782 *Om forskning*. (About research) Forskningsproposition 1986/87:80.

and control over these changes. Secondly, as knowledge has increasingly become important for the possibility of citizens exercising their democratic rights, then it seemed increasingly problematic that dissemination processes were traditionally relatively marginal and skewed in favour of those in power, at the cost of a broader public.

The roots of this view are sometimes held to go back to the previous century when the Swedish democratic movement sought to legitimise its cause by reference to contemporary scientific knowledge and scholarship. An important part of this argument was that education and not revolution is best for empowering people to change society and become democratic beings![783] The notion of an officially stipulated "Third Assignment" is not as alien as it may appear. In actual fact, the Swedish academic tradition has, since the beginning of the 20th century, prided itself on its professors being "civil servants close to the people" (*folkliga ämbetsmän)* due to the fact that universities have always been national/public institutions. In the 1920s and 30s this ideal was perhaps more prominent than it is today; at Göteborg University for example every year professors held public lectures which were then published in a special university series.[784] Now that the universities are under pressure to define their identities, profiles and *raison d'être* more clearly, their mission statements or 'visions' often gain impetus from this chapter of the past.

Over the years, the "Third Assignment" has been criticised for being toothless.[785] Very little money has been allocated to support what is a monumental task. In addition, there has been very little pressure put on researchers to invest in work in popularising their research. It is still common in some disciplines that popularisation is detrimental to one's academic career. The universities have mostly been satisfied in their implementation of the "Third Assignment" by assigning the task to specific information units. Furthermore, some researchers with a penchant for popularisation are frequently used by the media consulting them free of charge since it is taken for granted to be part of your duties as a scientist. Other colleagues not burdened by such assignments have more time for research. This reinforces the prejudice that popularisation efforts on behalf of scientists are far from meritorious with regards to academic credibility.

This is also reflected in a new formulation of the "Third assignment" (1997) intended to foster a more intense interaction between the universities and society at large, but in particular with industry. In the Ministry of Education's directive it is apparent that

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783 See e.g. Gustavsson, Bernt, 1991, *Bildningens väg: Tre bildningsideal i svensk arbetarrörelse 1880-1930.* ("Bildningens" way: Three ideals of educative formation in the Swedish labour movement 1880–1930.) Stockholm: Wahlström & Widstrand; Wallerius, Bengt, 1988, *Vetenskapens vägar: om akademiker och folkbildningsarbete.* (The ways of science: On academics and popular education) Stockholm: Folkuniversitet.

784 See e.g. Olsson, Björn, 1998, "Att torgföra vetenskap: Det vetenskapliga föredragets och populärföreläsningen teori, praktik och kultur." (To promote science) *Svensk sakprosa*, nr 24, Lund; Poppius, Ulla, 1991, *När lundaprofessorerna höll bondföreläsningar: Centralbyrån i Lund för populära vetenskapliga föreläsningar, folkbildningsavdelning vid Lunds universitet 1898-1970.* (When Lund professors held lectures for the peasantry.) Lund: Skånes bildningsförbund.

785 *Högskolans samverkan med näringslivet.* Riksrevisionsverket, RRV 1996:53, RRV 1996:56.

universities and colleges are now supposed to increase the extent of their collaboration with industry, public administration, organisations, cultural life and popular education. At the same time it is underlined that these collaborations should not be allowed to compromise the freedom of science.[786]

In practice, many now reinterpret the “Third Assignment” as a demand that universities and colleges should interplay more intensely particularly with industry.[787] What is envisioned officially is a collaborative interchange and mutual influence as a constitutive element in the production of knowledge in the interface between researchers and practitioners from various fields with society. This associates the “Third Assignment” with forms of interaction that go beyond informing about R & D results. One of the driving forces is globalisation, which is often referred to as a motive for developing university-industry landscapes to improve local or regional competitiveness in the marketplace.

During the past decade the “Third Assignment” has also come to be linked to questions of greater accountability, and an increasing number of both internal and external evaluations of structures and performance. To a large extent, this has come to focus on determining whether or not universities at various administrative levels have mechanisms in place for quality assurance; in contrast to the situation in some other countries, the outcomes have not been directly tied to resource allocations from the Ministry of Education and Science. The most recent Science Bill (1996/97) where it is stated that the “Third Assignment” should be clarified in the University Act to focus on interplay with the surrounding society and dissemination of familiarity with the university and higher educational activities.[788] It is the articulation of policy frameworks that is most significant.

Policy

The first more general science policy reform of interest is the introduction, in the early 1970s, of the ‘sectorial principle’, which is a Swedish variant of the Rotschild principle.[789] In accordance with its aims the university is the main public repository for any science that may be applied to solve problems within various societal sectors, be it housing, supply of energy, national transportation and local systems, environmental protection, health and welfare, etc.[790]

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786 *Forskning och samhälle.* Regeringens proposition 1996/97:5, s 60.

787 Brulin, G, 1998, *Den tredje uppgiften: Högskola och omgivning i samverkan.* SNS Förlag och Arbetslivsinstitutet.

788 See: *Forskning och samhälle.* Regeringens proposition 1996/97:5

789 Elzinga, A, 1993, ”Universities, Research, and the Transformation of the State.” In Sheldon Rothblatt & Björn Wittrock (eds) *The European and American University since 1800. Historical and Sociological Essays.* Cambridge University Press, p 191-233.

790 See Elzinga, A, 1980, ”Science Policy in Sweden: Sectorisation and Adjustment to Crisis”, *Research Policy,* vol 9, no 7, April, p 116-146; 1990, ”Triangeldramat bakom forskningspolitiken”, (Tringleplay in researchpolicy), in Wilhelm Agrell (ed), *Makten över forskningspolitiken.* (The power over researchpolicy) Lund: Lund University Press, p 41-60. This means that in Sweden very little applied research is done in

The argument for this system of engaging academics in applied research is that first of all the universities are, after all, national civil service facilities belonging to a national unitary system of science and higher education in Sweden. Secondly, research in the academic domain is generally open to public scrutiny and transparency, which is important since sectoral research is supported from the public purse. This means that efforts must be made to inform a wider audience about the existence of this kind of research, making it accessible particularly to various *user* categories.

The manner in which the 'sectorial principle' has been played out in the Swedish context makes for a very special situation. In most other countries, a large array of special research institutions and in house research units exist. These, to a large extent, supply specified knowledge to users within government. This takes a burden off the shoulders of university scientists, who in general can concentrate their work within academia. Many Swedish researchers, it has been claimed, work within two different worlds and are asked to fulfil needs both inside and outside of the University.[791] It is interesting to relate this to ideas of PUS. As many Swedish researchers work within these two worlds, the task of communicating with the public is not as well motivated and comes at best third on the list of priorities.

During the 1970s there was a proliferation of sectoral funding councils, and with this increasing attention to *user information*, both before and after projects were begun and finished, respectively.[792] In some cases the information was direct, but in many cases it was indirect, for example through contacts with the media, special brochures and research catalogues, or the creation of sectorally oriented publications funded by the sectoral councils themselves.

A second general policy initiative is that of the "Third Assignment". In line with the general impact of neo-liberal ideologies, and certain structural adjustments in the science funding landscape, the late 1980s saw a greater emphasis placed on facilitating university-industry partnerships. During the 1990s this led to a re-conceptualisation of the "Third Assignment". The meaning of 'interplay' is now taken to also include changing the accent of undergraduate and research training in the

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special government laboratories or institutions that fall under the direct authority of one or another ministry. Instead ministries support special research funding agencies that recieve both unsolicited and solicited grant proposals from universities. These are sometimes called "sectoral research councils" to distinguish them form the more traditonal basic research oriented councils which continue to allocate funds on the basis of a pure peer review process. The sectoral councils combine criteria of societal relevance and scientific excellence in their review procedures. In some cases the former dominate over the latter, in other cases the two-tier approach starts with scientific merit. Of course there has been a lot of debate around these procedures, they may be compared to the notion of "extended peer review".

791 Flodström, A, 1999, *Utredning av vissa myndigheter.* Näringsdepartementet, 19 nov. See also Talerud, B, 2000, *Högskolans arbete med sin samverkansuppgift.* National Agency for Higher Education, 2000:2 AR.

792 Several studies have been carried out during the 1980s on research utilization and modes of disseminating results linked to sectors: Björklöf, S, 1986, "Byggbranschens innovationsbenägenhet." *Linköping studies in management and economics, no 15*, Diss; Boalt, C & Lönn, R, 1987, "Forskningsanvändning." *Tidskrift för arkitekturforskning,* vol 1, nr 1; Ericson, B & Johansson, B-M, 1990, *Att bygga på kunskap. Användning av av samhällsvetenskaplig FoU inom byggsektorn.* BRF Rapport R 3; Nilsson, K & Sunesson, S, 1988, *Konflikt, kontroll, expertis*. Arkiv, Lund.

direction of commercial utility to satisfy industry's needs to recruit highly qualified employees. Especially with the advent of attempts to develop research capacities at regional colleges, some of which are (sometimes successfully) bidding for university status (after a national accreditation procedure), a number of new actors have come onto the scene. County Councils and Regional Districts (*Landsting*) have started to more consciously develop regional innovation policies. In this context new funding has also become available for universities and colleges. Allocation of such funding however involves participation of local users, which means that grant applicants must also take this into consideration, providing a further incentive for deploying popularising skills.

In the 1990s many policy discussions focused on the Swedish problem of the structural lack of competence and knowledge. It was said that the number of university educated persons in the workforce was lower than in many other countries. This and the advent of the 'knowledge society' were mentioned in relation to the linkage of university and business communities.

A third general policy regulative has been the change in research funding structures. At the national level a number of new strategic research funds have been created. Their mandate is to fund long-term motivated research that can provide added value in an economically or socially beneficial sense. These foundations require matching funding and partnering with industry or with other 'users'. Aside from foundations to stimulate a science base for generic technologies and environmental concerns, there is also a specific foundation for knowledge and competence development (*KK-Stiftelsen*). Here the task of partnering includes attention to dissemination of research information that will be conducive to the development of regional policies for innovation.

With the introduction of the Strategic Foundations (*Strategiska Stiftelser*), some funding has been shifted away from the basic research councils.[793] Also, the earlier funding to the universities which was earmarked for supporting efforts in 'research communication' at the universities during the years 1993-96, has now been terminated. Within the universities this has given rise to some protests since 'research information' is still very much regarded as an 'added on' to other (and in the minds of faculty), more important activities. Despite the inclusion of the "Third Assignment" in the University Act, popularisation in the everyday lives of most scientists and scholars is, as a rule, not a high priority; nor does it weigh heavily in the deliberations of academic appointments boards at the level of the faculties.

Swedish research funding is currently undergoing a new major change. Research granting agencies, of which there have been many, will now be brought together into a small number of integrated agencies. Two of these will join together basic research councils into larger national authorities, while a couple of others will perform a similar function on the applied side, reducing the number of sectoral funding councils. Thus,

793 *Forskning och samhälle.* (Research and Society) Proposition 1996/97:7,p 45-47.

four new public authorities started their work in January 2001 whilst the previous research councils and some other agencies ceased to exist. One interesting new change is the creation of *Forskningsforum* (The Research Forum) with the task of creating dialogue and collaboration between researchers, fund-givers and others affected by research.[794]

II. Media and actors

Universities and colleges

At the level of actors, the background to the present activities concerning PUS at Swedish universities can be found in the reforms characterising Swedish universities and colleges during the 1960s and 70s. These changes demanded the creation of information strategies on behalf of the universities, particularly stressing the internal information directed at employees while outward ambitions were restricted to information on new courses.[795] In 1964 the universities of Lund and Uppsala created posts assigned to disseminating information affiliated to the rectors' offices. The information secretaries' work mostly involved internal business but they also supplied the media with information.

This early administrative "popularisation" work was intensified in connection with a much-debated reform in 1968-69 (*Pukas*). The government and Olof Palme, the minister for education, had commissioned *UKÄ* (the National Board for Universities and Colleges) to perform an investigation into the possibilities of producing more undergraduates in less time. The resistance to this reform prompted the government to be very generous in financing information activities at the universities. The information secretaries at the universities found themselves in a dilemma trying to inform about a new, much criticised reform both inside and outside the universities.

Since then, all Swedish universities and colleges have established information units or Kontaktsekretariat (Contact secretariats). During the 1980s some universities and engineering schools also introduced technology parks. Some information units later started to produce newsletters for both internal information and externally promoting the image and profile of their university or college. The quality of these newsletters and university tabloids is somewhat sketchy. These serve primarily as an information source for university employees but also have a wider circulation most notably to students and major news media.

As already indicated, today it is possible to distinguish different strategies in PUS from the traditional universities and the colleges. The traditional universities stress their credibility with rhetoric emphasising their extensive international research activity, of

794 *Forskning för framtiden: En ny organisation för forskningsfinansiering.* (Research for the future: A new organisation for funding research) Proposition 1999/2000:81
795 Hjort, C, et al, 1981, *Ut med forskningen.* UHÄ & Liber, Södertälje, p 149.

being at the forefront of research and in this line bringing about initiatives in practical understanding of science. In addition to this the traditional universities have an advantage in the larger number of initiatives in civic and cultural understanding of science compared with regional colleges (and recent universities), since they have long established and large faculties of the humanities and social sciences.

Once every year many humanities faculties at the traditional universities open their doors for the larger public. These Humanistdagarna (*Humanities days*) feature popular lectures as well as opportunities to visit university departments to see and participate in various activities. This initiative has been going on since 1985, when it started at Lund University. Soon, Stockholm and Göteborg Universities followed suit. It is one of the most important actions towards a *cultural* public understanding of science. In Gothenburg this activity results in a yearly publication collecting the popular lectures.

The regional colleges are more likely to promote a practical public understanding of science. This obviously ties in with strategies of regional and local developments towards industry and administration. Several of the regional colleges in Sweden are involved in networking ambitions aimed at joint actions of knowledge exchange between colleges throughout the country and local and regional administration and industry.[796]

Practical public understanding of science has been the hallmark of The Swedish University of Agricultural Sciences (SLU) from its establishment. SLU was established in 1977 but its roots stretch back more than 200 years. Its main campuses are located at Alnarp, Skara, Ultuna (Uppsala) and Umeå. Research and teaching activities are carried out throughout the country. As in other countries, agriculture has a long-standing tradition of experiments with agricultural extension services.[797]

SLU is a university with a clearly defined role in society: to take responsibility for the development of learning and expertise in areas concerning biological resources and biological production. This responsibility stretches over the wide-ranging fields of agriculture forestry and the food industry to environmental questions, veterinary medicine and biotechnology. Applicability is a keyword in research at SLU and in its contacts with industry and society. Such contacts are cultivated by SLU Kontakt working in co-operation with the different departments at the university as well as with industry, organisations and national and regional authorities. This is accomplished through an array of initiatives from seminars, distance learning courses, collaborative web-sites, and the coordination of projects to assisting in the commercialisation of research results. In fact, the latter raises questions of what should and should not be included in the concept of practical public understanding of science.

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796 Talerud, B, 2000, *Högskolans arbete med sin samverkansuppgift*. (University initiatives to interaction) National Asgency for Higher Education, 2000:2 AR, p 34-35.

797 See Eriksson. O, 1993, *Sveriges lantbruksuniversitet och centrumbildningar: Fågel, fisk eller…? En kartläggning. En kartläggning av nio centrumbildningar med SLU-anknytning.* (The University of Agricultural Sciences and creation of new knowledge centres) Uppsala: SLU/Förvaltning, 30.

The Nordic Forum for Research Information

1970 saw the establishment of The Nordic Forum for Research Information. Its purpose is to create a network of researchers and practitioners, and to perform state of the art reviews on knowledge transfer as well as to discuss theoretical and methodological questions in this context. The Forum also seeks to stimulate greater interest in and the enhancement of quality assurance of knowledge diffusion; one way of doing this is by issuing a newsletter (*FKF-Nytt*) and promoting a series of seminars and conferences. The forum was dissolved Spring 2003 in order to focus on conference activities.

Science journalists

The Swedish Association for Science Journalism was established in 1972, by 2000 it had 135 members.[798] Its purpose is to:

"facilitate open, multifaceted, well-grounded but critical science journalism that sheds light on the impact of science on society, nature and culture. Further it is to facilitate exchange of knowledge and collaboration between members and to carry on continuous discussion relating to professional ethics, as well as promoting international co-operation".

In accordance with the latter, the Association is a member of the European Union of Science Journalists Associations (EUSJA). The Swedish Association organises science journalists from the media, and informateurs at the universities, colleges and public agencies. Since the mid 1990s it has, together with the Institute for Future Studies and the Science Radio (public service) organised recurrent annual seminars. These constitute some of the few fora in Sweden today where representatives from research on popular science (often international guest speakers), journalists and natural scientists can meet and exchange ideas, experiences and opinions. The seminars are usually held in a large auditorium. They draw a huge crowd, although many of those attending only have a slight interest in the research angle; however they of course may be stimulated further in this direction. The association also produces a newsletter called Ugglan (*The Owl*).

Press

Morning dailies

The referendum on nuclear power (1980) had repercussions on the interest in the reporting of science in the media. Several of Sweden's larger daily newspapers established editorial staffs and feature pages on science in the late 1970s and early 1980s. However, due to falling advertisement revenues and circulation in the 1990s,

798 See http://www.ordvet.se/sfvj/omsvjf.html.

some of these initiatives have now ceased, and science is now covered as any other possible newsworthy subject would be.

Sweden's three largest morning dailies (*Dagens Nyheter, Svenska Dagbladet* and *Göteborgs-Posten*) all have editorial staffs concentrating on science both as a news and feature area. Almost all of Sweden's morning papers have cultural pages covering literature, art, research in the humanities and they function as a forum for cultural criticism. Indeed, the highest frequency of PhDs in the Swedish press is probably to be found at the editorial staff and freelance writers on the cultural sections.

Tabloids

Swedish tabloids also have cultural pages but lack specialist sections on science. However, most tabloids include magazine supplements, most notably on Sundays, that feature research results on popular topics such as health, nutrition, beauty, lifestyles and psychology. These articles are written and graphically packaged in a very popular form. Scientific results are redressed by journalists who often know very little of the research background. Still, these articles find a very large readership. Two additional aspects of these kinds of articles are worthy of note. First, while some research material is featured in two or maybe three pages, it is just as common to see results cut-down to a few lines and displayed almost as an object of curiosity. Second, scientific knowledge is often published adjacent to knowledge from other professions and sometimes even beside articles from the New Age sphere.

Magazines and newsletters

In the middle of the 1960s several sectoral councils collaborated in the creation of a high quality popular science magazine *Forskning och framsteg* (Research and Progress, 1966-). Since then the magazine has been supported by a foundation set up by a host of research funders.[799] However, it is very much independent and has a readership of about 50,000 for each of its 8 issues per year. It is worthwhile noting that this would enable it to be solvent even without the money from the Foundation. Still, this extra money enables the journal to put together a product totally without advertisements, which further ensures independence and integrity. Many of Sweden's most noted science journalists are on the staff of this journal and articles are either written solely by these or in collaboration with a researcher. In the latter case a process starts with the researcher producing an article in as popular a language that s/he can muster. This is usually not sufficient for popular publication and the journalist thereafter

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799 The Foundation is supported by several sectoral councils, but also among other the Humanities and Social Sciences Research Council (HSFR), the Medical Research Council (MFR), the Social Science Research Council (SFR), the Engineerings Sciences Research Council (TFR), and the Royal Academy of Sciences.

rewrites the article and feeds it back to the original author who will then perform another rewrite. Articles from this journal actually often carry some weight within academia, despite their popular form. As it is serious and research driven, many researchers read it in order to keep up with other research fields other than their own to uphold a general scientific literacy.

Apart from this very important initiative, for the most part, Sweden had its commercial boom of popular science magazines in the beginning of the 1980s. Again, in the mid 1990s there was a rise in publications of this kind. Some of the earlier magazines were rather short lived, for instance *Populärvetenskap – Rymd, medicin, teknik, framtid* (Popular science – Space, medicine, technology, future, 1982-83), *Teknikmagasinet: Populärvetenskap, äventyr, science fiction, rymd, data* (The Technology Magazine: Popular science, adventure, science fiction, space, computers, 1983-86) and *Vetenskap för alla: Populärvetenskapligt magasin* (Science for all: Popular science magazine, 1985-87).

Illustrerad vetenskap (Illustrated science, 1984-), which has a circulation of about 140,000 is the most widely read popular science magazine in Sweden at present and seems to proliferate. *Illustrerad vetenskap* presents science stressing visual representations and it sometimes features archaeology and social anthropology. In contrast to this publication stands *Teknik och vetenskap* (Technology and science, 1985-) issued by Chalmers University of Technology in Gothenburg in association with a commercial publishing firm. Like *Forskning & framsteg* this publication is research driven and researchers read it in order to keep up with other research fields. With a circulation of 13,700 it aims to reach technicians, civil engineers and decision-makers in trade and industry.

The 1980s period also saw some good examples of the popularisation of the humanities. The journal *Tvärsnitt* (1979- Crosscuts) is an example of a PUS-initiative from a cultural angle. The journal is funded through the Humanities and Social Sciences Research Council (HSFR) and has a circulation of approximately 5,000. Its successive editors have come from the history of ideas and science, a discipline that has a special Swedish tradition, and enjoys widespread popularity when it comes to cultivating the national heritage of learning. Several scholars in the history of ideas and science are also active in research on the popularisation of science in Sweden, e.g., Kjell Jonsson, former editor of *Tvärsnitt*, Gunnar Eriksson (former Chair history of ideas and learning Uppsala University), and others.

Tvärsnitt features articles specifically in the realm of the humanities and social sciences, but more recently also in science and technology studies in a broad sense. The ambition is explicitly to contribute to a greater cultural and civic public understanding of contemporary scientific theories, research and debate.

Populär arkeologi (Popular archaeology, 1983-) is an example of another research driven publication with cultural and civic ambitions. Its civic ambitions are represented by debates and articles emphasising the societal function of archaeology in connection with issues like peace, democracy, and civilisation critique. Articles are written by professional archaeologists presenting projects and relating them to the research front. As with the aforementioned *Forskning & framsteg,* the editorial staff rewrites the article and feeds it back to the original author who will have a chance to perform a rewrite. With a circulation of 4,500 the magazine functions as a source of information for professional archaeologists both in and outside of academia, but it is intended for a general public in style and form. Articles often stress prehistoric production and technology together with new methods in archaeology, in particular those drawn from the natural sciences.

The beginning of the 1990s saw an additional rise of popular science magazines in Sweden. For instance *Fakta: Om natur, geografi, kultur och forskning* (Facts: Nature, geography, culture and research) replacing *Vetenskap för alla* from the earlier period, *Populär historia* (Popular history), *Månadsmagasinet Lexicon* (Monthly Lexicon), *Populär vetenskap: Månadstidning om teknik, vetenskap och forskning* (Popular science: Monthly issues on technology, science and research) and *Facts & fenomen* (Facts & phenomena).

Some of these publications experienced satisfactory circulation figures at the beginning, for instance *Facts & fenome* had a readership of 49,400 in 1996 and *Populär vetenskap* had 30,000 in the same year. However, none of these magazines except *Populär historia* made it beyond 1997. *Populär historia* (Popular history, 1991-) has a circulation of around 22,000 for each of its bi-monthly issues and is well supplied by texts from eminent historians based at universities in Sweden.

The Royal Swedish Academy of Sciences, best known for awarding the Nobel prizes in physics, chemistry and economics, publishes the newsletter Akademin *anser* (According to the academy) in which prominent members of the academy discuss the scientific aspects of important societal problems. The academy has a long tradition (the oldest in Sweden according to some) in PUS with a focus on the practical. In 1741, its *Grundregler* (Ground rules) already stated that as soon as a research result “matured” it should be brought to the public.[800]

The Royal Swedish Academy of Engineering Science also publishes its own newsletter (*IVA-Aktuellt*). This features a practical public understanding with a focus on engineering and economics. *Ny teknik* (New Technology) is a journal owned by the associations of civil engineers and engineers. It has a wide circulation (approximately 135,000) among professionals from different fields but with an Engineering background.

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800 Kärnfelt, J, 2000, *Mellan nytta och nöje*. (Between utility and pleasure) Diss: Institutionen för idé- och lärdomshistoria, p 70.

Labour unions have a strong standing in Swedish society. As such, almost every Swedish union has its own magazine where scientific results are presented, often in the form of a practical base for the profession. A current example is the professionalisation of teachers via science, and earlier examples are the similar processes regarding social workers and journalists.

Internet

Sweden has one of the highest percentages of Internet users in the world, 27% compared with 23% in the USA. Internet use in the Stockholm area is even higher at 34%. According to some statistics, Swedish Internet usage scores twice the European average.[801] Most dailies, tabloids, magazines, newsletters and the institutions behind them can be found on the Internet. For instance the Council for Planning and Co-ordination of Research (*Forskningsrådsnämnden* (FRN)) has an extensive Web-site with the newsletter *Vetskap* (Knowing) easily available on- line. *Populär arkeologi* also offers a free electronic version of its newsletter.

The Swedish government pursues an active IT policy in several areas. At the end of 1996, the Government assigned *Högskoleverket* (the National Agency for Higher Education) to co-ordinate a national system for disseminating research information on the Internet. The project resulted in SAFARI, an acronym in Swedish translated as “the spreading of research information to the general public over the Internet”.

This system aims at supporting groups like journalists, upper secondary school students, firms and other organisations, to find information on Swedish research from a single source. The Agency (*Högskoleverket*) is responsible for developing and maintaining the system and universities and other research organisations are responsible for information input.

Books

Popular science books seem to be somewhat out of fashion in Sweden today. Except for translations of particularly English and North American best-sellers, Swedish writers in this tradition today are relatively few; Peter Nilsson (Astronomy) and Georg Klein (Cancer research) are two of the few examples. When it comes to children’s books the situation is somewhat different as publishing houses are more willing to publish “science for kids”, for the most part because children’s books are viewed as an important commercial area to exploit.[802]

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801 Figures from database ”Ditt land och ditt liv” (Your country and your life) created and controlled by Forskningsgruppen för samhälls- och informationsstudier (The researchgroup for societal and information issues) These figures are not to find in any public report, but made accessible on request.

802 See for instance the books by astronomer Marie Rådbo, 1998, *Runt i rymden* (Around in space), Opals förlag, Stockholm; 1996, *Rymdens gåtor* (Enigmas of space), Opals förlag, Stockholm.

Reviews and comments on this kind of literature have not been particularly abundant on the cultural pages in the press. Nevertheless, since the late 1980s Sweden has experienced a boom in popular history, starting with historian Peter Englund's *Poltava – The defeat of an army.* (Poltava – Berättelsen om en armés undergång), published in 1988. Englund has since written a number of books and has also been active in cultural journalism. He is currently connected to the daily newspaper *Dagens Nyheter*. In connection with the boom of popular history, Sweden had its own modest version of a science war. Well known journalist Herman Lindquist wrote several books and featured in a series of documentaries (1993-1995) on Swedish public television under the title *Hermans historia* (Herman's' History). Following Lindquist's first book, a rather hectic discussion on his (outdated) perspective of Swedish history ensued. His opponents characterised his work as reductionist, claiming he focused too much on a few important personalities and events. Peter Englund was among the many proffesional historians to engage in this debate on the cultural pages of *Dagens Nyheter*.

One book which gained short-lived but intense attention in the 1990s was written by the linguist Sven Öhman (who has a background in science) His book of 1993 entitled *Svindlande perspektiv* (Dizzying perspectives /note:in Swedish the word *svindlande* also means cheating) prompted a series of debate articles in the cultural pages of major national newspapers. One of Öhman's most prominent and most discussed theses is that popularisation can be or usually is dangerous – it seduces the reader into believing that s/he knows something when such is not really the case. Popularisation is dangerous because it erodes ordinary people's common healthy anchorage in the world of everyday reality around them, a world they have no problem navigating in normal situations. What the popularisation of science can do, according to Öhman, is destroy this sense of certainty, forcing people to take seriously the fact that their understanding and life experience actually does not rest on the solid ground that it is often claimed to do, thus removing the seemingly secure basis for taking a position on fundamental questions.[803]

TV and radio

The 1980s saw the advent and subsequent boom of commercial TV and radio in Sweden. Since, the Swedish based commercial channels occasionally take up science. A wide array of channels is now also available via satellite that offer popular science programs (*Discovery* etc). As Sweden is a country of nature romantics, nature and wildlife programming has a strong tradition in TV and radio. Almost all of the Swedish based commercial channels have regular programmes on nature and wildlife. Occasionally, more spectacular foreign produced science programmes are broadcast, with very high production values. Commercial radio however, has so far not attempted

803 Öhman, S, 1993, Svindlande perspektiv, Stockholm: Wahlström & Widstrand, s 160

to include any initiatives concerning PUS, although one commercial radio station is collaborating with the arrangers of the Gothenburg International Science Festival for shorter feature reports during the event.

Public service broadcasting in Sweden, in particular radio, has a long tradition in PUS.[804] Beginning in 1949 and experiencing bursts of development during the 1970s and in the late 1990s, Swedish public service radio (SR) now boasts an extensive editorial staff and several programs (news and features) covering the humanities, social and natural sciences and medicine.

Swedish public service TV (SVT) started covering science in 1971, but even in the late 1950s, progress in technology was regularly featured on *Tekniskt magasin* (Technology magazine). The TV programme “The world of knowledge” (*Vetenskapens värld*) hosted by channel one, has since produced feature-length programmes often jointly produced with TV-companies in the UK and the USA. “Nova” on channel two, which has a more news oriented perspective on science started in 1994. In 1995, “Upper storey” (*Hjärnkontoret*) on channel one was launched. This programme presents science for schoolchildren, and is often followed up with discussions or question and answer sessions with scientists on the Internet.

The Swedish public service network also broadcasts educational programmes both on TV and in the radio, often in collaboration with the universities. Lately some of the universities have started broadcasting lectures on TV sometimes as part of distance education programmes. The onset of digital TV has seen the creation of a specialist (commercial) knowledge channel (*K–World*), featuring high-quality programmes on science and culture.

Science centres and Science Museums

The Museum of Science and Technology (*Tekniska museet*) was founded in Stockholm in 1924 by a consortium including the Federation of Swedish Industries, the Swedish Academy of Engineering Sciences, the Swedish Association of Engineers and Architects and the Association of Swedish Inventors.

The building currently housing the museum was built between 1934 and 1936, though the idea of a museum of Swedish engineering and industrial history had been around since the start of the twentieth century. The museum's collections and exhibition area has grown considerably over the years, and the total exhibition area is now 18,000 square metres. The museum attracts around 200,000 visitors every year.

Apart from a range of museums based on the specialities of a certain or several scientific disciplines, there exist some 20 different science centres in Sweden, most of

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804 Nordberg, K, 1998, *Folkhemmets röst: Radion som folkbildare 1925–1950.* (The voice of the people) Eslöv: Symposion.

them established during the 1980s. Furthermore, in Gothenburg, a very ambitious science centre has been created. *The Universeum,* the inauguration of which was in June 2001, is supposed to have a national responsibility, thus serving other science centres with innovation, knowledge and ideas.
The objectives of this centre are to generate experiences that increase the desire to enhance knowledge and active involvement with science and technology, to publicise know-how and research at universities and in the world of business and to enhance the attractiveness of the region of West Sweden. The primary target group is children and young people. The centre is a joint venture by the Municipal Association of the Gothenburg Region, Göteborg University, Chalmers University of Technology and the Western Swedish Chamber of Industry and Commerce, in close collaboration with the business community.

Gothenburg is also the scene for a massive political and economic effort in creating a new institution, The National Museums of World Culture. Established in 1999, it is a state museum authority which groups together four museums with collections originating mainly from outside of Sweden and Europe. Three of the museums are located in Stockholm: The Museum of Far Eastern Antiquities, the Museum of Mediterranean and Near Eastern Antiquities, and the National Museum of Ethnography, whilst one is located in Gothenburg: the Ethnographic Museum. The latter will be incorporated into the new building of the Museum of World Culture in Gothenburg, set to open its doors in 2003. The Museum of World Culture is itself is one of the largest museum projects in Sweden in recent years. The general mission of the National Museums of World Culture is to display, represent, and interpret the various cultures of the world. The museum authority strives to further the understanding of the world and humankind through cross-disciplinary scientific work, and through new forms of exhibits and public outreach activities, using a range of artistic, archaeological, ethnographic, historical, and other perspectives. The aim is to promote public understanding and appreciation of different cultures, their history, as well as their interrelationships.

In order to establish closer collaboration between Göteborg University and The National Museums of World Culture, *Museion* has been created. As a multidisciplinary research and educational agent *Museion* is also said to embody the “Third Assignment” thus initiating seminars and university courses with alternative exam-forms. This, however, has illustrated the difficulties in trying to merge university culture with its strict demands for knowledge control in exams and the museum culture which is sometimes characterised by Frank Oppenheimer’s words “nobody fails in a museum”.

III. Cases

The Council for Planning and Co-ordination of Research (FRN)

In 1979, *Forskningsrådsnämnden* (FRN- the Council for Planning and Co-ordination of Research) was established in order to support the "Third Assignment" among other things. A year earlier a number of suggestions were presented as to how research information from universities as well as from public agencies and other organisations to the public might be improved. In essence, it was argued that such efforts should be more directed towards prioritised 'interest groups': other researchers, journalists, trade union organisations and the youth. This is also the line that to some extent came to be followed in policy efforts. Efforts to more explicitly involve researchers in the popularisation of science have mostly been to provide support for training in popularisation and the evaluation of such educational ingredients.[805] FRN has special stipends for journalists wanting to spend a few months in scientific labs, or researchers wanting to spend some time with national newspaper editorial offices. In 1979, FRN was provided with special funds earmarked for "research information". It was not a large sum, amounting to 4 Mkr; by 1996/97 the sum set aside for FRN in this context was 9 Mkr; by 1999 it was 10 Mkr and for 2000, down to 8.5 Mkr.

In 1979, the question of whether or not to phase out nuclear power was the most important political issue in Sweden. It would remain an issue of high policy priority in the decades to come. In 1980 there was a referendum on this topic in an attempt to totally remove it from a seemingly endless political debate. As the nuclear power issue was based on many different research fields, the link between science and democracy seemed obvious.[806] There was an officially perceived need to find means to channel efforts and systematise them to popularise the issues at stake and give wider publics insight into the science-based controversies that kept emerging.

In preparation for the referendum, a host of study circles were organised to stimulate expert arguments and to analyse the pros and cons of nuclear power. In subsequent years, this civic initiative towards PUS has continued to be very important in Sweden. However in later years, it has perhaps been overshadowed by activities aimed at a more practical understanding of science. With a strong civic ambition, FRN launched a publication series called "*Källa*" (The Fount), focusing particularly on areas where one finds differences amongst experts, i.e., controversies in and about science. A *Källa* publication is typically structured around a dialogue between two researchers who

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805 For an example see 1984, *Utbildning i forskningsinformation inom högskolan.* FRN. Rapport 84:7. For examples of youth as a prioritized group concerning research information, se: *Barn och ungdom och forskningsinformation.* Projektstöd från FRN 1979-1981. Översikt 19811006, dnr 81/21/78:1; Forkman, B, 1981, *Barn möter forskare.* Rapport från ett försök i Lund vårteminen 1981. Utgiven av delegationen för forskningsinformation vid FRN, okt 1981, ISSN 0280-0950:2; *Forskningsinformation för barn och ungdomar. Förslag till åtgärder.* FRN, ISSN 0348-3991; *Låta veta. Vägar till forskningsinformation till barn och ungdom.* FRN, ISSN 0348-3991.

806 Dyring, A, 1988, "Public dialogue on science in Sweden." *Impact of Science on Society,* no 152.

differ in their views and understanding regarding a given question of considerable public interest. Often, this goes back to different theoretical grounds for knowledge claims, and the assessment of uncertainties. A third party, the mediator, comments on the propositions of the two antagonists, and tries to find a middle ground of convergence as well as distinct lines of disagreement. The mediator, for the most part, plays the role of a pedagogical consultant rather than trying to promote convergence of views for the sake of some policy objective. The first eleven issues of *Källa* dealt with the problem of nuclear power. Later issues have taken up topics like computerisation and its social impacts, forestry and acid rain, cancer research, ozone layer depletion, violence in society, sports/steroids, and most recently gene technology.
FRN, in association with a publishing house, also issues *Forskningens frontlinjer* (Researchfront), in which scientists themselves write about their respective specialities. Some of the recent titles have taken up the environmental consequences of war (*Krigets miljöeffekter*) and an anthropological study of men's relationship towards machines, *Män och deras maskiner* (Men and their machines). The report-series *FRN: s rapportserie* gives accounts on the different research projects that have been funded by FRN, which also offers stipends for researchers wanting to develop popularised versions of their work. Each year FRN organises a conference for staff responsible for PUS activities at universities, research councils and other organisations. The theme for 1990 was "Communicating Science". Every two years, FRN takes a national initiative called Populärvetenskapens vecka (*The week of popular science*). The arrangement is localised at a different university each year working as a hub in an array of activities linking universities, museums, science centres, communes and business companies.

An interesting form of PUS is a collaboration between FRN and *Klara soppteater* (Klara Soup Theatre – a theatre company in Stockholm) resulting in Science Theatre. Here scientists and researcher re-enact important scientific and societal issues on stage. The initiative has resulted in six performances so far, covering subjects like gene technology (*Gensvar*) and Brain research (*Ja, hjärna!*). Some of the performances have been broadcast on public service TV.
FRN is also initiating and providing support to projects directed towards schools at the gymnasium level (ages 16-18). A strong ambition has been to overcome the culture gap between natural sciences and the humanities. This has resulted in a nation-wide theme revolving around the environment as history. Taken up by gymnasium schools all over Sweden, this has led to exhibitions at museums and public presentations. Another example of this kind is directed towards the program of education in caring at the gymnasium level which aims at fostering awareness among pupils concerning research in the area of caring and the treatment of this type of research by the media. Food has been the theme of yet another project directed towards the gymnasium, in this instance with an extensive web-site in collaboration with *Högskoleverket* (the

National Agency for Higher Education), where pupils can engage in chat sessions with scientists. The aim is to make pupils and teachers more familiar with the Internet, make contact with researchers and learn about recent research on food and health.

The International Science Festival in Gothenburg

It often takes a long time for good concepts on a grand scale to be realised, and the correct setting is of vital importance. A positive example of this is the Science Festival in Gothenburg, which has now been running annually since 1997, covering 10 days in May.[807]

Arguably, this is the only science festival existent in Scandinavia. However, this depends on how one defines a science festival as something apart from a popular science week, as the science week is prevalent in Sweden as well as in the other Scandinavian countries (and indeed elsewhere). The major difference is that the popular science week is usually on a national basis, and involves all the universities. The science festival is a local initiative and therefore enjoys a higher profile. Everybody in Gothenburg knows that there is science festival occurring, you cannot miss its activities, and the trademark orange colour is everywhere. An important difference is that the festival is much more popular and is conceptualised by non-scientists, there is also an emphasis on science being fun. The Popular Science Week is, by comparison, more University driven and serious in tone.

Another entity from which the Science Festival should be distinguished is the 'Open House', in which a faculty or a university for one or more days invites the greater public to sample its activities. This constitutes a local initiative, which is much smaller in scale and also university driven.

Ideas for the International Gothenburg Science Festival started in the late 1980s and early 90s with a small group of people working in the intersection between Göteborg University and the municipality of Gothenburg. The key institution is Göteborg & Co, which works to promote the development of all types of activities in Gothenburg. This institution is divided into several sections, for instance one dealing with tourism, another with industry and a third engaged in attracting major events to the city. Mostly, Göteborg & Co has only a supporting role in the latter. However, the Science Festival is one of two events which it actually organises itself, with a staff of four people working full time to draw in necessary funds and to implement the festival.

The Science Festival in Edinburgh served as a model for the Gothenburg initiative. Several trips were made to study its organisational set up. It was noted that the two cities had some structural similarities, which suggested that a similar arrangement could work in Gothenburg.

807 Most of the following is based on an interview with Annika Lotzman Dahl, projectleader, Göteborg & Co, August 21, 2000.

In 1994, a survey was made among schools, companies, the municipality and the university on attitudes towards a possible science festival. The survey had a positive outcome. With this result in hand it was somewhat easier to set things in motion and start implementing the idea of a Gothenburg Science Festival.
It is important to note here that starting up a major event like this is actually relatively easy in Gothenburg. There exists an easy-going and rather quick decision-making structure among the city's major actors. This can be contrasted with the situation in Stockholm, with many more actors, with both a national and local responsibility, exhibiting a much more complex and time-consuming decision-making process. Perhaps this is one of the advantages of being a second city, such as Gothenburg. It is not uncommon for major initiatives to be set up initially in Gothenburg and after a few years be replicated in Stockholm. Such has been the case with the Göteborg Film Festival and the Book Fair. Both of these have attained a high level of success and have later been replicated in Stockholm, as with the Science Festival. A pilot event for a science festival took place in 2001 in Stockholm, while the major effort was made in 2002, when Stockholm celebrated its 750th anniversary as a city.
In implementing the Science Festival, an attempt was made to imitate the simplicity, creativity and sense of excitement found in Edinburgh. A major difference, however, was that in Edinburgh, events cost money, whilst for Gothenburg, almost all attractions were to be free of charge. The basic idea was to have two programmes, one for schools and one for the general public. To attend the school programme, there was an initial charge, but the public programme was to be free of charge. The rationale for this lay in the organisers outlook on target groups. Basically, the organisers wanted to reach everybody in the City. Still, the people were divided into five different target groups: academics, non-academics, senior citizens, students and youths. An additional target group was children, a group automatically covered by the school programme. Extensive yearly evaluations have shown that members of groups that rule more freely over their time are more likely to be interested, as such, academics, senior citizens and students are extensively involved in the festival. The problem groups are non-academics and the greater youth, and in order to have a good chance in attracting these groups it was necessary for the attractions to be free of charge.

There exists a necessary ambition to work with flexible concepts and rejuvenate the Festival each year. Surveys have shown, not surprisingly, that the most popular subjects are medicine, space and history. The Festival will thus typically revolve around themes connected to these fields. At the same time, there is a need to connect with current events. In the year 2000 the organisational work started with the selection of four themes; communication, scientific turning points, science in everyday life and life and medicine. In addition, a project leader was selected for each of these topics. Thereafter, a general invitation was made to researchers to give talks on subjects of their own choice. Contributions coming in this way which could not fit into the themes were instead put under the heading of a fifth theme: elementary and extraordinary.

To take care of the logistics, some 80 students are recruited and trained for the role of festival host. They serve as guides and see to it that the attractions work smoothly, checking equipment and so on.

The expectation for the first year was to attract 25,000 people, but the outcome was at least 40,000 (Gothenburg has 550,000 inhabitants). Since then the results has been around 48,000, but much hinges on the nature of the May weather and the number of activities offered. The volume of activities in 1999 was rather too extended and it was radically cut back for the next year.

Some of the most interesting activities at the Festival should be noted. In the middle of the central shopping complex of Gothenburg, the festival sets up a scene featuring the 'Academic Quarter'. Here, researchers are invited to attract crowds whilst giving a 15 minute talk. Usually, this is a condensed version of a full talk that is scheduled later at a different location. As such, this is a vehicle for trying to get new people into visiting new places. Many researchers prefer to avoid the 'Academic Quarter', perceiving it to be both unserious and unsettling. However, many visitors and researchers have found it a refreshingly relaxed experience. In the first year, only three of a large number of invited retired professors showed up for this activity. But in 2000, there were 43 researchers performing in the 'Academic Quarter'.

The idea of new places for new crowds is essential for other activities as well. A central ambition of the festival is to attract people who are not used to, and are uncomfortable with the buildings associated with the university. Instead, attractions are placed in buildings and places, which are not usually associated with science, such as coffeehouses, museums, squares, parks and shopping malls.

Another interesting activity is the co-operation with the local science centre. The science centre is invited to test its new instruments and machines during the Festival. These are then thoroughly evaluated by staff as large crowds watch, often in amazement. Members of the audience are also invited to use this technology.

A particular innovation this year was the so-called 'Private Show'. In these 'Private Shows', a researcher situates him/herself in a tent, and is available for private consultations with visitors. Each individual visitor is given five minutes. This quickly turned into a very popular attraction and queues can be somewhat on the long side.

Thus far, the Science Festival has been arranged one year at a time. Each year an evaluation is made to see if there is to be a continuation the following year. It is hoped that there will soon be a decision on whether a commitment of three years is preferable. Organising the festival in three year cycles would make it easier to collect the necessary funds, which is usually a difficult process. The budget for the festival is currently 5.2 million Swedish crowns. Providing the bulk of sponsorship are four organisations; Chalmers University of Technology, Göteborg University, Business

Region Gothenburg and Göteborg & Co. Each of these invests 500,000 SEK. In addition, large amounts of money are donated by two industrial firms in the region: Volvo and SKF. Some 20 other partners donate smaller amounts of money. The regionally dominant morning daily, *Göteborgs-Posten* also plays an important part, freely printing and distributing the festival programme to its subscribers. The newspaper also includes in free advertisements for activities on each day of the festival. In the year 2000 there was also a co-operative agreement with a local commercial radio channel. Surprisingly however, none of the large research fund-givers, including FRN, have chosen to support the festival.

It is important to note that different sponsors are involved for different reasons. For the universities it is a matter of fulfilling the "Third Assignment" directive, with an emphasis on cultural understanding of science. Another reason is that the festival is a good platform to work in a proactive way in recruiting students. Other sponsors are more interested in attracting good will and also in the long term strategy of placing more people in universities and subsequently into local companies. In a sense, this is also a way of implementing a long term practical understanding of science. Some sponsors see their involvement as good citizenship, and stress the civic aspects of being involved in the public understanding of science.

The Nobel Museum

A new initiative regarding PUS, (and something unique for Sweden), is the Nobel Museum which opened in 2001. This museum benefits from one of the strongest, most easily identifiable trademarks existent in the scientific landscape. Of course, there is a heavy emphasis placed on the great men and women of science, but the museum also had an initial exhibition focusing on the theme of creativity.

The Nobel Foundation is an institution that has changed very little during its 100 year history. The activities undertaken by the foundation are guided by a circular process, whereby each year, everything is done according to the same procedure as the previous year, with everything culminating in the Nobel festivities. Nearing its Centennial in 2001, the foundation decided to do something radically different. It was decided to make Nobel a more public institution. To this end, a Nobel Museum would be erected to celebrate science, literature and peace, as well as the individual prize-winners. There are already several other Nobel Museums in the world, located in places where Alfred Nobel marked his presence. As such, Sweden in general and Stockholm specifically are thus rather late in joining the list.

Preparations for this museum have been ongoing for several years. The name Nobel is associated with excellence in several ways, so of course the museum itself has to excel and have exhibitions of the highest possible quality. The Nobel trademark is a very strong one, as such, there are many actors wishing to be associated with it. Thus, the museum project has succeeded in attracting people with very high intellectual competence, as well as generous fund-givers.

Whilst most reactions to this initiative have been very positive, there has been some criticism regarding funding. The Nobel Foundation is obviously very wealthy, yet the foundation has claimed that it cannot give funding to the museum from its own resources. It is said that the money in the foundation can only be used for the Nobel awards and the ceremony surrounding it, since that is what is stipulated in the testament of Alfred Nobel. This has meant that the municipality of Stockholm has agreed to finance the building, while the foundation is responsible for filling it with content of high quality. Thereafter, the foundation applied for funds from a large amount of Swedish fund-givers and also from various business sponsors. Most of these were only too happy to provide support. However, there have been some complaints that the testament could have been interpreted more generously, in which case the foundation would have been able to use some of its vast wealth for this project. Instead, money has been taken from fund-givers who would otherwise have been able to give it to research.

While this has been a valid complaint, the people working with the museum have answered that the total amount of money being taken is, in perspective, so slight and taken from such a diverse amount of fund givers that it does not warrant such criticism. In any case, what comes out is the opening of a great public window for science in Sweden and an added profile for Swedish research. In addition, proponents claim, the Nobel case is a prime example of the “Third Assignment” in action and why should only the first and second assignments receive funding?

The first exhibition at the Nobel museum has ‘creativity’ as its theme. It is thought that this topic crosses disciplinary boundaries, and will help to find common ground between research, literature and peace work. The exhibition opened in April 2001 and has been produced in three copies. One of these will stay put in Stockholm while the other two will tour the world.

The Nobel Museum is an example of a cultural public understanding of science. Interestingly enough, there is a bridging of the two cultures involved in the project. The ideas put down by Alfred Nobel a hundred years ago make this connection necessary, as prizes are awarded both to natural science and to literature. The construction of the Nobel categories, formulated so long ago, places restrictions on how research can be treated in the museum. It can be said that such differing fields make for strange bedfellows, but in effect it is a rather exciting combination, and something that would not be put together like this in another circumstance.

IV. Summary and conclusion

PUS is a very hot topic in Sweden at present. However, there is a very specific slant in this trend. Against the background of the “Third Assignment”, initially conceived primarily as a democratic project, the main idea is now to build interfaces between universities and other institutions. The new colleges and universities are at the forefront of this process, whilst the more traditional universities are slower in catching on.

In general discussions on the emerging ‘knowledge society’, ideas on PUS are reframed. What we, in this text term ‘practical PUS’ has come to dominate in recent years. Higher education and research are seen as important motors for regional development in the new EU-context, which is very much built on the idea of strong regions. In a context in which knowledge and quality are more important for companies competing on the international arena it becomes vital for regions to have strong centres of research and education, which can support the work force and transmit knowledge from research frontiers into business and industry.

Initiatives in practical PUS are therefore directed mainly towards groups that can integrate research information and put it to work in their own professional fields in business and administration. The sectoral research councils counted this as an important part of their task and lately it has been a crucial function of the contact and information agencies at universities in Sweden.

Civic PUS, that is research information of significance for the citizen as a member of a democratic society, is an ambition that has been toned down with the general reinterpretation of the “Third Assignment”. Still, some new interesting initiatives have evolved in this area, for instance those directed towards schools. These initiatives are connected to the development of ideas on the knowledge and multicultural society. To understand this fully it is important to bear in mind that PUS initiatives in Sweden are based of the concept “Vetenskap”, equivalent to the German “Wissenschaft” and much broader than the British notion of “Science”. FRN is the foremost actor pushing for a civic PUS. In regular news reporting, the media tends to highlight scientific controversies connected to political sensitive areas such as biotechnology.

Cultural PUS is not as constrained to immediate utility as is the practical, but is instead valued more as a resource, contributing to a more general appreciation of science and its culture. This ambition has long been cultivated in feature length science journalism and in science documentaries featuring contexts of discoveries. The Gothenburg International Science Festival and The Nobel Museum are interesting new initiatives in this direction.

Public Understanding of Science in the United Kingdom: A leading country, but to what destination?

Josephine Anne Stein

The United Kingdom regards itself as a pioneering, highly innovative country in the field of Public Understanding of Science (PUS), leading the way in developing a great variety of organisations, techniques and activities associated with the promotion of science. It is also a country in which many science-based industries have suffered severe, even catastrophic declines due to the erosion or collapse of public confidence. One has only to look at the nuclear power industry, which has one of the biggest and most lavish programmes aimed at public understanding, and the recent devastation of the beef industry in the wake of the BSE ("mad cow") crisis, to see how the two phenomena co-exist.

Another peculiarity of the UK is the continuing influence of the Royal Family and the House of Lords in public life. Perhaps the paradoxes associated with PUS in the UK are best symbolised by the current controversy over genetically-modified foodstuffs, which was inflamed by comments made by the Prince of Wales, a prominent organic farmer. The British Science Minister is Lord Sainsbury, whose family runs one of the largest grocery businesses in the UK and has strong links with the biotechnology industry. Surveys conducted by MORI show that the UK public is second only to Denmark's in its knowledge of science -- but whom can they trust?

This OPUS profile report starts by reviewing the origins and development of the PUS movement, and goes on to review the emergence of the deficit theory and various related academic critiques of "standard PUS", which are in turn critically analysed. The main PUS actors in the UK are described, along with major PUS activities such as "Science Week" and the Edinburgh Science Festival, and major popular science publications and broadcast programmes. Recent interest in public consultation has also led to a spate of academic and policy studies, public opinion polling, and experimentation with public participation, including over the Internet; brief descriptions of some exemplars are included, with additional references appended in a bibliography/webliography. The profile concludes with some reflections on current plans to expand PUS activities in the UK, particularly through interactive science museums, and on what may have – or have not – been learned from the past 15 years' experience of PUS and research into PUS itself.

The Public Understanding of Science Movement

Although organised science communication through education, museums and promotional activities of the professional societies has been ongoing in the United Kingdom for centuries, the birth of the PUS movement in contemporary Britain can be ascribed to a report produced by The Royal Society in 1985 entitled "The Public Understanding of Science". This report, often referred to as the "Bodmer Report" after Sir Walter Bodmer, the chairman of the working party that produced the report, established a rationale for PUS and touched off a series of new or re-invigourated bodies and activities that are known collectively as the Public Understanding of Science movement.

The Bodmer report was very much a product of Thatcherite Britain, in which public expenditure of all kinds had to be justified in terms of its contribution to national prosperity. The Royal Society, the UK's national academy of sciences and its most prestigious professional scientific society, responded to political pressures for public "accountability" by setting up the committee on PUS, with a mandate to examine the interface between scientific knowledge, the public, and the scientific enterprise (ie, the creation of new knowledge). The main conclusions of the Bodmer report were:

- National prosperity depends on science and technology;
- The pervasiveness of S&T in daily experience necessitates public understanding of science;
- There is therefore a need for basic science education that covers such everyday life experience;
- Government bodies should provide popularised versions of science-related reports;
- More and better quality coverage of science is needed in the media;
- Industry and the Civil Service also need a better understanding of science;
- Scientists need to communicate with the public more effectively; and
- The Royal Society should make Public Understanding of Science a priority.

In addition, the Bodmer report found that there was a mismatch between public interest in science (high) and public understanding (low), and called for more research on PUS (of the monitoring, survey variety). The report called upon museums to innovate and to expand their science-related exhibits and activities. It called upon the media to promote positive images of science and scientists, and for educationalists, authors and those in the cultural industries to expand their coverage of science-related themes.

The "bottom line" of the Bodmer report was that there being few public issues *without* some scientific content, public understanding of science was essential to the proper functioning of Britain as a democracy. It is worth a minor diversion to observe that in the mid 1980's, another commonly used term for Britain was "UK plc" (expressing the Conservative philosophy that the country should be run like a private company – without reference to democratic principles ...). The scientific community was called upon to simultaneously come to the aid of the ailing British economy – and an ailing British democracy.

Prior to this explicit recognition of "science as the engine of national prosperity", a clear malaise characterised the relationship between British science and its supposed economic and social beneficiaries. Beleaguered "boffins" in the laboratory, feeling the effects of successive years of cuts to academic and research funding, hunkered down defensively, while the "chattering classes" bemoaned the inability of British industry to capitalise on the wealth of knowledge and inventions produced by UK scientists and engineers in the laboratory.

The Bodmer report was the first of two major (apparent) tonics to the British scientific community. The second, Technology Foresight, was initiated by the Office of Science and Technology in 1993 with the aim of identifying emerging technologies that would have a significant influence on wealth creation and the quality of life in the UK. Although the research community continued to experience cutbacks in public funding, they did receive a form of public approbation, and the call for relevance and accountability struck a chord with both the public and the scientific community. Once the calls were sounded, the policies (and the funding priorities) followed. In a time of declining budgets, one couldn't affort *not* to subscribe to the new orthodoxy. Whether reluctantly or enthusiastically, the scientific community responded. Public Understanding of Science activities began to flower.

In specific terms, the Bodmer report laid the groundwork for a new body, the Committee on the Public Understanding of Science (COPUS), which was established jointly in 1986 by The Royal Society, the Royal Institution and the British Association for the Advancement of Science (BAAS). COPUS has provided a focal point for the expert-led PUS movement, coordinating a stream of activities, some of which are described later in this report. Both the Bodmer report and COPUS served as a catalyst for a more widespread and diffuse movement to promote science: the Public Understanding of Science movement.

The Public Understanding of Science movement arose from a perceived need in the scientific community to increase public knowledge of science in order both to improve the basic competence of the citizenry and to promote public support for government R&D expenditure. PUS was animated by observations of public “scientific illiteracy” as measured by surveys that revealed extensive public ignorance of specific “general knowledge”-level established scientific facts and theories. This ignorance, it was feared, indicated an inability of the citizenry to exercise responsible democratic influence over public issues increasingly based on science and its applications. (It is interesting to reflect that scientists' illiteracy of other types of knowledge, such as minority natural languages and cultural values, was not perceived as a threat to democracy).

The Deficit Model and academic research on PUS

It wasn't long before the Public Understanding of Science movement attracted criticism in the UK. The essential nature of the criticism was to challenge the notion of what constitutes "public understanding of science". According to the PUS Deficit Model, the Public Understanding of Science movement is constructed around imparting expert knowledge and building public competence in formal scientific assessment techniques in order to overcome deficiencies in public understanding, thus promulgating a more sound basis for citizenship. In other words, PUS was a unidirectional communication process whereby the expert supplied the knowledge to fill gaps in lay public understanding.

To some observers, PUS was little more than a public relations exercise designed to elicit public support for public funding of research by having the experts convey the excitement of discovery to an ignorant but eager public. In other words, to some critics, Public Understanding of Science was not so much about understanding as about reinforcing the traditional social position of scientists as learned, enlightened, and beneficent authorities.

Traditional or standard PUS activities have not acknowledged the public's less formal understanding of everyday phenomena; nor have they examined the public's capacity to absorb and deliberate on scientific theory and evidence when offered in a balanced and interactive format. The PUS movement drew criticism for its failure to acknowledge lay competence in absorbing and assessing scientific evidence in context, and for its failure to recognise the ability of social movements and individuals to undertake their own research and form their own working models of, for example, reliability and risk.

As Wynne (Handbook) observed in the case of the sheep farming communities affected by the Chernobyl nuclear disaster, lay experiential knowledge could be more sophisticated, accurate and relevant than abstracted or reductionist expert knowledge, and he argued vigorously for legitimisation of lay, experiential knowledge. Irwin and Wynne carried these ideas further by exploring the capabilities of "citizen science" as a way of both promoting and legitimising the way in which public understanding can both encompass and convey reliable, evidence-based knowledge, especially in specific cases of public controversies.

Wynne and Irwin's critiques of the Deficit Model argued for valorising local, experiential or non-credentialled lay knowledge, while calling for greater reflexivity within the scientific community. However, even these theories implicitly espouse a form of scientific rationality, formal or informal, as being the appropriate basis of sound decisionmaking in the real world. As in “Science Wars”, a shared commitment to scientific rationality within the both the mainstream "hard" scientific community and the STS (Science Technology and Society, or science studies) community is almost uncontested. The debate centres more on credentialism than on how to reconcile scientific rationality with social values in public affairs.

A number of academic researchers in the UK, many from the sociology of science, and from related fields and even outside academia, began to deconstruct what was meant by "public", "understanding" and "science"[808]. Papers began to appear and meetings were organised to discuss the constituencies and natures of various "publics", the meaning of "understanding", and even revisiting the more philosophical basis for defining genuine "science" amidst the frenzy of popularisation brought about by the PUS movement. Research on public understanding of science seemed to be spiralling inwards in some kind of STS whirlpool, with few practical results emerging that would have identifiable relevance to policymaking. There were two main responses:

The Economic and Social Research Council (ESRC) sponsored a research programme on Public Understanding of Science in 1998-1999, consisting primarily of a set of research fellowships in PUS and a set of meetings in which research results could be presented to practitioners in PUS and policymakers, and discussed. Organised by the Science Policy Support Group, and under the academic leadership of Alan Irwin, "users" were identified in the policy community, about a dozen discussion meetings were held with users and the research fellows.

The House of Lords Select Committee on Science and Technology undertook its own inquiry into Science and Society, drawing upon not only the ESRC Programme but a great body of additional studies and PUS activities. The report took a comprehensive look at:

- Public attitudes and values
- Public understanding of science
- Communicating uncertainty and risk
- Engaging the public
- Science education in schools
- Science and the media

The Lords Committee heard or received written evidence from over 100 professional associations, S&T-based companies, agencies, research institutes, media companies, non-governmental organisations and individual experts. They were advised by John

[808] For example, "What Public? hat Understanding? What Science?”, meeting at the University of Leicester, 9 July 1998.

Durant, Professor of Public Understanding of Science at Imperial College and Brian Wynne, two of the UK's most prominent scholars in PUS. The Committee made visits to both the USA and Denmark, which is regarded as having some of the world's most sophisticated knowledge and experience of public understanding/public consultation related to science. The House of Lords' report, published on 23 February 2000, is an impressive overview of the state of PUS in the UK.

The House of Lords' report recognised the existing crisis in public confidence in S&T and science advisory systems. It endorsed earlier calls for openness in the UK scientific advisory system, and while vigorously supporting the need for independent advice, encouraged scientists to be explicit about their sponsorships and affiliations. The Lords acknowledged and supported the PUS movement, although the report significantly finds that "the crisis of trust has produced a new mood for dialogue." PUS, in other words, is no longer enough, according to one of the most elite and exclusive bodies in Britain.

The Lords called upon the Parliamentary Office of Science and Technology (POST) to "maintain a watching brief on the development of public consultation and dialogue on science-related issues, and to keep members of both Houses informed." In mid December 2000, POST announced that they are in the process of preparing a report mapping and evaluating public participation in S&T-related public policy making, which they aim to complete by the end of March 2001.

Technology Foresight: How lack of public involvement spurred on the PUS movement

The Technology Foresight exercise of 1994-1995 was a major consultation exercise designed to improve linkages between the research community and those using new knowledge, and to inform priorities for public R&D spending. Technology Foresight was explicitly expert- and producer-led, and participation was controlled thoughout, with no significant public consultation element.

Technology Foresight was organised by the Office of Science and Technology, which is now part of the Department of Trade and Industry (DTI). It brought together producers and "users" of knowledge (defined as industries or other organisations, such as hospitals, which utilise new knowledge for innovation). The public as citizens, and even as consumers, were almost completely neglected. A public consultation phase did precede the Technology Foresight exercise, but this was not based on any communication of science itself. The vast majority of about 800 respondents came from the research community, and the evidence was not published.

Participants were invited, many of them selected by co-nomination within the expert community, and were overwhelmingly white, male, well-educated, and well-connected. As one member of the Manufacturing, Production and Business panel observed, with tongue slightly in cheek, "There were no people under the age of 35, no small companies, and no women: in other words, none of the people who would deliver the results" (David Stout, SPSG Seminar on "The Technology Foresight Exercise: History and Process", London, 26.10.95)

Although the experiment was proclaimed a success by those who organised and conducted it, the lack of end-users or public involvement attracted widespread criticism at the time and led to the establishment of new exercises intended to include the public. For example, the British Association for the Advancement of Science almost immediately set up a new programme, called "Visions for the Future", that set out to involve young people in discussions with prominent scientists. However, whereas the main, multi-million pound Technology Foresight exercise was firmly embedded in the Office of Science and Technology with the explicit objective of informing policymaking, the BAAS' initiative was small, and enjoyed only informal and episodic contact with policymakers.

The second Foresight exercise run by the DTI dropped the word "Technology" altogether. It added the tagline "Making the future work for you", in an attempt to make the exercise both more relevant and more accessible to the public. Although the consultation did include a broader range of stakeholders, not necessarily themselves expert in science or technology, some participants did concede that there was little difference in practice to the previous round of Technology Foresight, in terms of public involvement or even public communication.

The failure of both Technology Foresight and standard PUS activities to reverse the directionality of information flow (i.e., to achieve "scientists understanding of the public") led to many other initiatives designed to achieve mutual understanding through interaction between scientists and the public, often with an explicit objective to influence policy. However, the bulk of PUS activities in the United Kingdom continue to fall under the rubric of the Public Understanding of Science movement as characterised by the deficit model. Many PUS activities have become more entertaining and more interactive, but retain more of the traditional "mission to explain" (a phrase often employed by the BBC) than the "mission to understand" in a mutual sense.

A profile of British PUS

It is impossible to do justice to the extensive PUS movement in the UK in a short report, especially as so much activity is organised in "bottom-up" fashion by schools, universities, research institutes, companies, industrial and professional associations, museums, libraries, the media, the arts and letters, community associations, regional authorities and individuals. This section is by no means comprehensive, even in the types of PUS activities that are undertaken; rather, it is an attempt to briefly describe some of the most prominent features of PUS in the United Kingdom. More detail can be found in the “spaces” chapters in elsewhere in this OPUS report.

The Royal Society

Having commissioned the Bodmer Report, and set up COPUS along with the BAAS and the Royal Institution, The Royal Society renewed its long-standing commitment to PUS in the 1980s. The Royal Society has long organised public lectures and open days where scientists exhibit and explain their research work to visitors. The Royal Society Michael Faraday Award is made annually to a prominent scientist "for the furtherance of public understanding of science." The Royal Society also hosts PUS-related conferences organised by outside bodies, such as "Science Communication, Education and the History of Science" (July 2000), organised by the British Association for the History of Science.

The British Association for the Advancement of Science

The BAAS, or the BA as it is sometimes known, is the UK's largest and best established organisation devoted to the promotion of science. In addition to its annual Festival of Science, described below, the BA runs a full set of programmes and events on science communication. It also loosely coordinates and supports PUS events organised by as many as 600 organisations during National Science Week.

The Royal Institution

One of the most long-standing PUS events on the UK calendar are the Christmas Lectures organised by The Royal Institution, in which a distinguished scientist presents a special lecture for children which is broadcast on national television. These Christmas Lectures always feature visual spectacle as well as audience participation. For some British people, this annual event is as much a part of the festive season as the Queen's Christmas speech and the decorative lights of Regent Street.

The Office of Science and Technology and the Research Councils

Public funding for Public Understanding of Science activities increased noticeably in the 1990s, mainly supporting small activities organised by practicing scientists to promote and communicate their work to the public (often through schools). Roughly 1000 such grants, typically ranging from £3000 - £7000, are awarded each year.

The Research Councils have been sponsoring PUS activities of their own, most notably the Engineering and Physical Sciences Research Council, which now has an annual budget of £1.5 million for a wide range of activities on Public Awareness of Science, Engineering and Technology.

Science festivals

Two major science festivals take place in the United Kingdom on an annual basis. The larger of these is the Festival of Science, run by the British Association for the Advancement of Science, which is held in a different city in England or Wales every September. This festival is aimed at school children, journalists and the general public, and attracts thousands of people every year. The Festival features displays, interactive exhibitions, lectures, site visits, discussions and special events. It has been criticised as "preaching to the converted", but the level of enthusiasm amongst the participants does lend the Festival a highly positive and energetic atmosphere.

In 2000, the Festival of Science took place in London, under the sponsorship of Rolls-Royce. More than 400 events were offered over a full week. It featured lectures and exhibitions on some topics that would be of interest anywhere, such as advances in medical surgery, information technology and environmental protection. However, the BA Festival also featured some peculiarly British fascinations such as horticulture and animal welfare.

The British Association also oversees National Science Week, which this year (2001) is taking place from Friday 16th to Sunday 25th of March. The event is aimed at raising awareness, appreciation and understanding of science through a variety of community sponsored events taking place all over the United Kingdom.

Scotland has its own Science Festival, which takes place in Edinburgh every April.

Science museums and interactive science centres

Hands-on experiential science and technology exhibitions, as pioneered by the Exploratorium in San Francisco, have found a devoted following in the UK, where further innovation continues. In the 1990s, museums such as the Natural History Museum in South Kensington, London, have been transformed. Sterile display cases with row upon row of rocks and minerals, difficult for most adults to cope with let alone children, have been replaced by rather more exciting, dynamic displays that are more accessible, imaginative and entertaining. Interactive science centres aimed primarily at children are being set up around the country.

While few would criticise the intent, some believe that the extent of this type of public attraction may be excessive, citing the failure of the much-hyped Millennium Dome to attract the projected number of visitors. Others think that entertaining children may come at the expense of educating visitors with a more serious interest in science. To put the costs into perspective, however, consider that the Millennium Commission spent about £2 billion of National Lottery money in 2000, of which the largest share of “non-Dome” money, over £400 million, was awarded to projects with a science and technology element. Even those promoting the science centres and other S&T-related projects supported under this scheme admit that this is a risky undertaking, as the funding does not cover recurrent expenditure or operating costs.

The Parliamentary and Scientific Committee organised a discussion meeting on "Communicating Science: The role of museums and science centres" on 17 July 2000. At a reception following this meeting, several teenagers, who had sat largely in silence during the discussions in the imposing Grand Committee Room of the Palace of Westminster, were invited to offer their opinions of science museums in a more informal setting. These young people, most of whom were planning to go into science, made the point, quite forcefully, that most science museums seemed designed for kids. In other words, for children aged 15 and older, there wasn't enough of the sort of information they were interested in. What they would prefer, they said, was an opportunity to meet real scientists, to have them explain their work through exhibits and hands-on experiments, and to be able to ask them questions.

Science in the media and drama

The placement of science journalism in the same category as drama is not accidental. In the UK, science-related television broadcasting can attract very large audiences. Wildlife programming and a very successful fictionalised wildlife programme, "Walking with Dinosaurs", earn significant amounts of money for the BBC. These programmes are as much about entertainment as they are about education, and there is little attempt to distinguish between science and drama. One of the flagship television programmes, Horizon, has as its slogan "Pure Science, Sheer Drama".

A good example of how PUS in the media mobilises multiple sponsors and activities is PAWS: Public Awareness of Science and Engineering. PAWS' funding comes from major high-technology companies (such as AstraZeneca, BP Amoco and Unilever), public bodies (such as the Department of Trade and Industry, the Office of Science and Technology and the Glasgow City Council), professional organisations (such as the Institution of Electrical Engineers and the Campaign to Promote Engineering) -- and the BBC. PAWS organises major public events such as the programme "Creating Sparks", promoted as "the biggest and best celebration of the sciences and the arts since the Great Exhibition of 1851". It also provides grants of £2000 to writers to develop science-related ideas into treatments for television dramas, and confers prizes to those judged to have the best potential for success.

In some cases, science-related drama on stage in the UK achieves very high intellectual and performance standards. The award-winning play by Michael Frayn, "Copenhagen", about the relationship between Niels Bohr and Werner Heisenberg and the issues surrounding the contribution of physicists to the invention of the atomic bomb, has enjoyed a highly successful run in a London West End theatre (the Duchess) since 1998.

Consensus conferences

There have been two consensus conferences in the United Kingdom, both organised on a national basis. The first of these, on Plant Biotechnology in 1994, was sponsored by the Biotechnology and Biological Sciences Research Council and organised by the Science Museum. The second, on the management of nuclear waste, was sponsored by the Centre for Economic and Environmental Development in 1999. In both cases, the organisers were satisfied by the outcomes; the citizens' panels in both cases expressed both concerns over the applications of science and technology while supporting further research. In both cases, the House of Lords had conducted their own inquiries in these areas prior to the consensus conferences.

Some were critical of the consensus conferences on the basis that they broadly replicated the results of the Lords' inquiries, though without the detailed study and knowledge that the House of Lords was able to access -- to say nothing of the expert knowledge that the Lords themselves possess. Nevertheless those critics felt that the consensus conferences, though unlikely to influence policy, were a useful way of informing the public about a complex set of issues, and possibly building public confidence through improving transparency. Other critics, however, noted that both UK consensus conferences were very tightly controlled by the organisers, and that the time devoted to the citizen panels' deliberations was kept extremely short. Under the circumstances, they asked, how could the citizen panelists reasonably be expected to exert any true independence?

Studies, meetings, public consultations and opinion polling

Biotechnology is such a controversial topic in the United Kingdom that it is not suprising that so much PSU activity and public consultation exercises centre around issues such as human cloning, genetic testing, genetically-modified food and agricultural practices such as feeding natural herbivores animal-derived products. Some of the more notable recent examples have been:

- In 1996, John Durant of Imperial College and Martin Bauer of the London School of Economic conducted a major survey on PUS, commissioned by OST and the Nuffield Foundation. When compared to a similar survey that was conducted in 1988, they found that public knowledge of science had increased by 11%, with the most notable increase in the area of genetics (check). Public attitudes to science, however, were largely unchanged.
- The Nuffield Council on Bioethics conducted a survey in 1997 to investigate public attitudes towards genetic testing in the light of the Association of British Insurer's deliberations on using genetic information in assessing applicants for life insurance.
- A public consultation exercise on human cloning and the use of cloning technology in medical research was commissioned by the Wellcome Trust in the spring of 1998. According to the press release accompanying the report on this exercise, "The survey found virtually no support for cloning for reproductive purposes even from groups which might have been expected to support it...... Initially people were more prepared to support the idea of cloning to create tissues and organs [for research and therapeutic purposes]...... But later, having thought about the implications, they expressed growing concern.....".
- A Public Consultation on the Biosciences was launched by the Science Minister, Lord Sainsbury, in December 1998. Conducted by MORI, the exercise involved six two-day workshops and a large-scale survey. It probed both public understanding and public attitudes, finding, for example, widespread misconceptions about the presence and functions of genes.
- A major opinion poll on PUS issues, with over 1000 British adult respondents, was conducted by MORI for the Office of Science and Technology in March-April 1999.

> The survey included several questions on whom people would most trust to advise them on science-related issues such as BSE.

There have been a great many other studies, polls, meetings and smaller exercises in public consultation. References to selected books, reports and journal articles can be found in the Bibliography at the end of this report; more comprehensive listings are contained in some of those references.

The use of animals in medical experimentation is so contentious in the UK that terrorist organisations have conducted serious attacks against research scientists; some medical research facilities are heavily fortified and protected by both human and canine guards. Under the circumstances, it is not surprising that organised PUS activities in the UK tend to avoid such areas.

Although many variants of public understanding/public consultation exercises have been tried in the UK, most of them are carefully constructed and conducted according to parameters set by the organisers. Market research-led exercises and passive opinion polling are notoriously poor indicators of the public's capacity to understand complex, science-based issues. Experiments in deliberative polling have been carried out, and the broadcast media have developed successful formats where members of the public can challenge experts. Explicit efforts are made to balance the composition of expert steering groups and citizen panels, for example. But in all these examples, the terms of reference, the methodologies employed, and the selection of the participants generally remains firmly in the control of the organisers.

In general, those who organise such studies and consultation exercises express satisfaction with the outcome; some have also expressed concern that future exercises remain under careful control to prevent their "capture" by special interests. Others express concern that they have already been captured -- by those who already control science and technology in the United Kingdom: industry, government and the research community.

Citizen Foresight

In Citizen Foresight, the University of East London and the Genetics Forum developed new methodologies for public consultation, drawing in particular upon the notions of citizens' juries and consensus conferences to organise a "Citizen Foresight" exercise examining "The Future of Food and Agriculture". This exercise, held in 1998, was premised on a perceived need to remedy the inbuilt bias of public consultation exercises towards the experts, the articulate and those already in positions of control and/or with a vested interest in the outcome.

The methodology of the Citizen Foresight exercise is described in detail in the final project report (Wakeford, 1998). It was a locally-based exercise, but situated in a district whose voting patterns in national elections were nearly identical to the UK as a whole since the Second World War. Participants were selected from respondents to newspaper advertisements, which did not include any information about the topic to be addressed by the citizen panel.

The main innovation of Citizen Foresight was to adapt methodologies used for consensus conferences in such a way that as the citizens became more knowledgeable, they gradually assumed more control over the process. A Stakeholder Panel of experts was designated to provide introductory information and to recommend expert witnesses. Stakeholders and expert witnesses were drawn from organisations such as the Consumers' Association, the National Farmers Union (representing conventional farmers), the Soil Association (representing organic farmers), Sainsbury's (the supermarket, not the Minister), Whole Earth Foods, the John Innes research institute, and Monsanto. The process took place over a ten-week period, during which time the citizen panelists had time to read written documentation, undertake independent research and to think over the way in which the exercise was proceeding. The citizens' panel requested the participation of different types of expert witnesses as it sought to rectify preceived gaps or imbalances in the evidence. Ultimately, the citizens redefined their own terms of reference and asserted their independence.

The results of the Citizen Foresight process were presented at a press conference, at which members of the panel, not being accustomed to public speaking, read out selected excerpts from their final report. The organisers explained the background, the methodology, and the overall results, and handled most of the questions, although as time went on the citizens themselves increasingly joined the discussion. At a later meeting at the Palace of Westminster, at which Lords and MPs were present, a project report was distributed which included not only the citizens' report, but an explanation of the background and conduct of the exercise, plus a number of responses from the stakeholders and expert witnesses. Istead of putting the citizen panel members in such a potentially intimidating position, it was left to the stakeholders and some expert witnesses to present their responses. The floor was then opened to questions from the public.

The outcome of the process was both radical and conventional. On the radical side, the citizens came to conclusions such as "Genetically modified (GM) crops are unnecessary and may have irreversible consequences." The Westminster meeting[809] was an unusual

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[809] *Gene-Foods: The Interplay between Science, Environmental protection & Trade Issues*, Parliamentary meeting, House of Commons Grand Committee Room, 27 January 1999.

opportunity for discussion to take place between such a wide-ranging set of people -- from Lords with plummy voices to little old ladies who were concerned about the lack of organic produce in their neighbourhood markets. Some remarkable exchanges took place. For example, a representative of Montsanto argued vigorously that it was in the company's best interests to insure that their GM products were entirely safe, asking "why would we want to poison our customers?" She went on to say categorically that there was no threat to human health, safety or the environment from Monsanto's GM products, upon which a representative of an environmental organisation demanded why Monsanto was opposed to having corporate liability included in a European Directive. There was no immediate answer; she promised to investigate and to get back to the questioner.

For the UK, Citizen Foresight appeared to provide an almost unique forum, in terms of its capacity to allow citizens to become informed through briefings and documents from key experts, in terms of the degree of autonomy conferred upon the citizens, and in terms of delivering the results directly to Parliament through engaging with dialogue between scientists, other experts, companies, NGOs and the public, as well as members of both Houses of Parliament.

One could also observe that the Citizen Foresight panel resembled a very familiar democratic mechanism for conducting public inquiries: the Select Committee on Science and Technology of the House of Commons. After all, MPs are by and large lay citizens with a responsibility to represent the public. The main difference would appear to be simply the selection mechanism of the panel as compared to a Parliamentary Committee, whose members are elected. Of course, the differences are more profound. The composition of the UK Parliament is hardly representative of the UK as a whole; one has only to look at the percentage of women members. However, it is also the case that in both the House of Lords and the House of Commons, members of the Select Committees on S&T include qualified research scientists, engineers and doctors.

Websites and Internet-based PUS activities

As more and more UK residents get access to the Internet, a flourishing business related to PUS is developing on-line. There are now so many Websites with science-related information that the Wellcome Trust Information Service operates a service that vets and catalogues relevant Internet Resources. It offers guidance to the public on how to assess the reliability of scientific information posted on the Web, and makes its own catalogue available through a searchable database known as *p*UBLIC **sci**ENCE **com**MUNICATION (omni.ac.uk/psci-com/).

The *First Global Cyberconference on Public Understanding of Science*, organised by Steve Fuller of the University of Durham with the support of the ESRC, ran from 25 February to 11 March 1988. Thirty-five selected expert commentators from countries around the world were invited to make opening statements, after which the cyberconference was open for unmoderated electronic discussion. The cyberconference attracted nearly 2000 hits from 35 countries on every continent. The proceedings are posted on the Web: www.dur.ac.uk/~dss0www1/. Although this was not so much a British as a global exercise, it does demonstrate an aspect of the leadership position that the UK has achieved in PUS research. The most interesting result to emerge from this exercise was the extent to which PUS is understood differently according to the cultures in which it is embedded. Although some have long regarded science itself as a cultural phenomenon, the cyberconference extended this idea to Public Understanding of Science as well.

The cultural character of PUS was also a feature of a subsequent cyberconference, but this time as an explicit expression of British culture. The British Council, an organisation that promotes British culture, commissioned a consultancy (River Path Associates) to run a six-week cyberconference *Towards a Democratic Science* in September - October 2000. The "e-conference", as the organisers called it, covered a different topic each week:

- Perceptions of science
- Risk and uncertainty
- The need for regulation
- Ethical responsibility
- Public consultation
- Consumer protection

and the results of each week's electronic discussions were summarised and posted to conference participants. The overall results are available in two volumes on the Web (see Webliography below). While neither the content of the conference nor the conclusions were particularly original or surprising, what is striking is how Public Understanding of Science has come to occupy such a central position in British life that the British Council should choose to organise such a conference. And this was not an isolated exercise.

As a follow-up to the e-conference, the British Council commissioned River Path Associates to run an electronic *International Seminar on Democratic Science* involving scientific experts from 17 countries around the world. The week-long "e-seminar", which ran for the week of 12 March 2001, provides a daily digest of proceedings to those who subscribed to the earlier "e-conference", and offers the opportunity to respond to points raised by the seminar experts. The e-seminar addresses the complex interplay between democracy and science in the context of globalisation, examining modern science and its opponents. The UK is clearly eager to establish itself as a leader in world discussion fora on PUS issues.

A new consultancy "People Science & Policy" was set up in late 2000, to provide "support for science communication to improve relations between science and the public at local, national and international levels." It is placing an emphasis on its Website as a primary communications medium.

One of the most recent Internet-based public consultation exercises comes from the very highest place in UK Government. Under the banner "Have Your Say", the Prime Minister's office launched an Internet-based consultation on "Scientific Advice and Public Confidence" in November 2000. The home page of the Website invites public feedback as input to the development of a new Code of Practice that will apply to all scientific advisory bodies.

The 10 Downing Street Science forum Website provides links to some of the main S&T-related government departments and activities, and identifies six specific issues for public feedback. One of these relates directly to PUS itself: "How do you think the risks and benefits in science and technology might best be communicated?"

The main stated objective of the exercise is in itself is a fitting encapsulation of the state of British Public Understanding of Science:

> *"The Government wants your views on how science is handled. We want to know whether you are concerned about current developments in science and what you think about the ways that the risks are controlled."*

At the end of the Home Page, in bold type, it says "**We want to know what you think.** Click here to join in the discussion."

Whether this initiative will lead to new public understanding of science, or new understanding of the public by scientists and government, remains to be seen. Whether it genuinely improves democratic processes for public "ownership" and "management" of science is an even more open question. It does, however, convey New Labour's strong predilection for public relations.

Conclusions

At the same time that the United Kingdom has put enormous effort and resources into Public Understanding of Science activities and research into PUS, it has experienced one crisis after another in public confidence in science, technology and the ability of the government to support and regulate S&T-related industries in the public interest.

The Public Understanding of Science movement was intended to improve communication between scientists and citizens in a way that would strengthen the basis for informed citizenship and improve responsible governance. However, secularisation and post-modern scepticism characteristic of the late 20^{th} century generally has led to a self-reinforcing dynamic in which scientists increasingly need to explain and justify their activities and conclusions to the public, while publics increasingly regard both the promotionalism and the content of the scientists' messages as suspect, requiring further explanation and justification. The decline in trust between scientists and the public is a natural outgrowth of this dynamic. But is this recognised as problematic?

Sir Robert May, then the UK's Chief Scientific Adviser, in oral evidence to the Science & Technology Committee of the House of Commons on 22 June 2000, stated, "The UK is second only to Denmark [in the public's understanding of science as measured by surveys]. The more they understand, the more they question new developments -- and so they should."

It is also worth considering the British public's response to the BSE ("mad cow") affair. An article published in The Lancet, entitled "BSE inquiry uncovers 'a peculiarly British disaster'" (Vol. 356, 4.11.00), outlined how the scientific advisory system was seen to fail dismally, causing a spontaneous boycott of beef by ordinary consumers. In other words, the boycott was only partially an expression of concern over the safety of eating beef. The public were also registering their protest over the way in which the whole BSE affair had been handled by scientists, the scientific advisory system and the Government.

It would appear that the UK has wound itself into an inescapable dilemma. The British public would appear to be very volatile at present, with mass protests on "countryside issues" in 1999 and on fuel prices in 2000 both catching everyone by surprise and immobilising much of the country, albeit for a short period of time. For vulnerable science-based industries, such as the beef industry, such expressions of public frustration can be catastrophic. Will more, and more "reliable", scientific information, serve to reassure the public, or will efforts to communicate merely arouse further public suspicions and lead to further consumer and citizen revolts?

Has the recent flourishing of public consultation exercises in S&T had identifiable influence on science-related policy? Will consensus conferences come to complement other types of expert-led science advice, or will they become regarded as costly exercises that merely broadly replicate the results of House of Lords inquiries? It may be too soon to say. However, there are some indications that the current interest in public dialogue may turn out to be a passing fancy. The POST Report on "Open Channels" was launched on the same day as a House of Commons S&T Committee Report on "The Scientific Advisory System", but at a separate event. One might infer that public consultation is fine but the decision-making process will remain firmly under the control of the policymakers on the basis of expert advice, as it has been "all along".

Meanwhile, plans to massively increase investment in Public Understanding of Science activities arouse suspicion that the public will be presented with a surfeit of new museums and exhibitions. Investment of money from the National Lottery must be matched by other sources of funding and revenue, and is not intended to cover operating costs. Many people are asking what fate will befall all these new science centres, which may well go the way of the Millennium Dome. Are they merely a sponge to soak up both public and private funds for the benefit of a relatively small (and invariably underestimated) segment of the British population, and would they in reality cater to the "converted" at the expense of the "masses"? Is the balance between conveying knowledge, building mutual understanding with the public and sheer entertainment appropriate?

What of COPUS, the linchpin of the British Public Understanding of Science movement, which was so heavily criticised for its "deficit model" approach? In 2002, the three organisations that had founded COPUS undertook a review of the Committee's role. The outcome came as something of a surprise. On 9 December 2002, they announced:

> *"We have reached the conclusion that the top-down approach which Copus currently exemplifies is no longer appropriate to the wider agenda that the science communication community is now addressing. We believe it will be more effective to allow organisations to seek their own partnerships…….For this reason, we have decided not to appoint a new Chair for Copus and to stand down the Council as it is presently constituted…."*[810]

The three institutions pledged to continue their activities in promoting effective communication between scientists and the public. Copus itself continues as a "lame duck" organisation which will expire once its current commitments are discharged.

What of public funding for research, one of the primary objectives of the PUS Movement? The election of New Labour in 1997 did not result in any significant changes to the structure of the national budget. Science, and academia, continued to suffer cuts, while the national economy surged. Only in the budget year 2000-2001 has the 20-year decline in research and academic funding been reversed. Perhaps it is symptomatic of the times that most of the modest increase is earmarked for high-ranking academics rather than intended for the scientific community as a whole. Vice Chancellors of universities are being offered large salary increases, "improve the flow of talented candidates willing to do what has become a tough and unattractive job" (Guardian 'Higher' 28 November 2000 p.12). £10

[810] http://www.copus.org.uk/news_detail_091202.html

million has been reserved to boost the salaries of high-profile scientists who might otherwise be tempted to move to greener pastures, specifically in the USA. Meanwhile, unions representing university staff organised a national action (short of a strike) on pay and conditions, which have not been noticeably affected.

Since this turnaround in the fortunes of science, there have been small increases throughout the system, but actual receipts of government funding have not always matched the figures given in the budget statements, especially since the war in Iraq. Recent world economic conditions, combined with the political sensitivities associated with increasing taxation levels do not bode well for most Western governments' primary sources of income, and the UK is no exception. The political will to increase funding for education and science may have recovered, but if the tax base does not recover, political backing may be of only "academic" interest, while real-life academics and researchers themselves see little change.

Public understanding of science in the UK has become an issue of national importance. But, somewhere along the line, science itself would appear to have been forgotten.

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CHAPTER 5

Optimising Public Understanding of Science and Technology in Europe: A Comparative Perspective

Jan Nolin, Fredrik Bragesjö, Dick Kasperowski, Josephine Anne Stein

Introduction

The objective of this chapter is to offer a broad overview of overview of both the differences and similarities national features in ten different aspects of public understanding of science.

The 10 comparative aspects we have chosen are:
The Governmental Role;
Centralisation and Decentralisation strategies;
Public Understanding of the Social Sciences;
Criticism of Science and Technology;
Celebrating Science;
Public Understanding of Controversial Science;
Gender and Science;
Youth and Science;
Promoting Science;
Science as Power.

The chapter also serves as a condensed version of some of the most significant features of PUS developed more extensively in sections of this report contributed by the six partner countries. Thus, more in-depth presentations of the features discussed here can be found under other headings.
Before entering the investigation of similarities and differences under the 10 perspectives, we shortly review the STS community of the different countries and also introduce the idea of linking science to culture in various ways, which is most important for understanding the French context and how it differs from the Anglo-Saxon tradition.

The STS community

The OPUS project has been developed within the European Science, Technology and Society (STS) community, a research field that is understood and situated in widely differing ways in the six partner countries, as indeed across Europe as a whole. This is a reflection of the degree and type of discourse that exists on science and society within each country. In cross-national studies such as OPUS, one must take into account that the larger research communities in certain countries can work with richer resource material than those with a less developed research base. In addition, countries with a strong STS community are likely to have a greater impact on the public debates on issues relating to science and society. In this way we find a reflexive dimension in that STS scholars may interact with the objects of their study. There are other dimensions characterising a research field apart from size. One of these, for example, is the way in which STS research can be more or less imbedded in a policy advisory system at the regional, national or European level.

Austria

The only research institution in Austria specifically engaged in science studies in a traditional sense is the VIRUSSS working group of the Department of Philosophy of Science and Social Studies of Science at the University of Vienna. In the area of technology and policy studies there are several institutions, such as the Institute of Technology Assessment of the Austrian Academy of the Sciences, a research unit on Technology and Work in Graz or the Institute for Technology and Society at the Technical University of Vienna. In addition, there are numerous individuals spread across a variety of different scientific institutions that undertake STS type research.

The Austrian STS community is relatively underdeveloped, possibly due to the fact that STS studies originated from an Anglo-Saxon tradition. In the German-speaking regions of Europe, there is an apparent separation between three research strands with only loose connections: philosophy of science (including epistemology), history of science and sociology of science.

Belgium

It is difficult to say if a STS community exists in Belgium. On the French-speaking side, well-known STS departments have existed for a long time at the universities of Brussels and Namur and more recently in Louvain-la-Neuve. Individuals in universities and research institutions throughout Belgium are involved in science and technology studies. However, as the country is small, researchers are relatively more integrated into European or other international STS networks than at national level. Furthermore, Belgian STS researchers produce relatively few publications in the PUST area, which explains the lack of reference materials relevant to OPUS.

France

Despite the fact that French academics are becoming more and more involved in research related to risk, expertise, science in the making, communication of science and popularisation, and in the social history of science, STS research remains small and fragmented. There are in France internationally renowned scholars such as Bruno Latour and Michel Callon, and a set of small STS centres in Paris and in the provinces. However, despite a few attempts to create a French STS network, an STS research community as such is underdeveloped. This may explain in part why, for the most part in France, science and technology continue to enjoy a positive public image. The rigidity of the boundary between natural and social sciences may also be a contributing factor. In addition, French social studies remain isolated from research results and approaches developed in other countries. Furthermore, the French regard foreign literature with considerable scepticism.

Portugal

The STS community started to emerge in the late 1980s, as a network of researchers working from different backgrounds (sociology, law, social psychology, education sciences, anthropology) who have centred their attention on the study of science-based public controversies, the scientific community's representations and practices, the relations between science and economy, or science and democracy. Conferences were important to create a network between a growing numbers of researchers with heterogeneous disciplinary backgrounds. The publication in international journals by Portuguese researchers and their participation in international projects have been also been important.

The STS community in Portugal has achieved a considerable degree of coherence and a distinct presence as part of an identified research field. The Centre for Research and Study in Sociology (CIES), at ISCTE, created, in 2001, an Internet site called "Scientific Culture and the Knowledge Society" that contains data on the Portuguese research community and information on studies carried out in this field.

Sweden

In comparison with other small countries, the STS community in Sweden is quite large and has developed within the context of internationalised STS communities from all parts of the developed world. *Institutionen för vetenskapsteori* (The Department for Theory of Science and Research) was established already in the 1960s at Göteborg

University, and from the 1970s grew to be an important centre of STS scholarship. Today, the department has merged with *Institutionen för idé- och lärdomshistoria* (Department for History of Ideas) but remains an independent branch of learning.

A number of STS institutions have a focus on technology studies. These include *Sektionen för teknik- och vetenskapsstudier* (Section for Science and Technology Studies), at Göteborg university, and *Tema T* (Theme Technology) at Linköping university. Some of higher education institutes of technology, such as Chalmers in Göteborg and Kunglinga tekniska högskolan (the Royal Location of Technology) in Stockholm, have sections which do STS research. With a focus on issues of science and technology policy, *Institutet för forskningspolitiska studier* (the Institute of research policy) is a small but important actor in the Swedish STS community.

United Kingdom

The United Kingdom regards itself as a pioneering, highly innovative country in the field of Public Understanding of Science (PUS), leading the way in developing a great variety of organisations, techniques and activities associated with the promotion of science, and in parallel developing the academic aspects of science and technology studies. The STS community in the UK emerged in the 1970s from research on the economics of innovation and so-called "liberal studies". Major STS research centres exist in universities such as Brunel, Cambridge, East London, Edinburgh, Lancaster, Manchester, Sussex, University College London, West of Enland (Bristol) and York, and there are clusters of STS scholarship in Aston, Middlesex, Newcastle, Cardiff, Leicester, Durham and in other academic, charitable, governmental and consultancy bodies. Some of the more unusual, yet important centres of STS research can be found in the Science Museum in London, the Parliamentary Office of Science and Technology, the House of Lords and the Wellcome Trust, a charitable body. British STS scholars are prominent in international as well as national networks, and in the literature on PUS.

The STS field was given a boost by numerous programmes offering targeted research funding by the UK Economic and Social Research Council, and the community has been reinforced by close interaction between STS scholars and policymakers. There is a "Science Policy Support Group" that engages in networking activities, and numerous national activities that further consolidate the British STS community.

"Scientific Culture"

The concept of *"culture scientifique et technique"* (CST) developed within a French tradition, in contrast with the "two cultures" Anglo-Saxon tradition so forcefully expressed by C.P. Snow[811] in the late 1950s as a lamentable separation between science and mainstream culture.

One meaning of CST is that science should be a part of the general culture, embedded within a holistic expression of national creative identity. The idea of "putting science into culture" goes further by promoting the notion that science should not be considered a separate element of culture, but articulated with respect to other dimensions of cultural expression. The paradigm underpinning CST is that science is not an isolated activity but relates intimately to other social developments. One consequence of this conceptualisation is the idea that publics should know more about science. In this respect, CST implies democratising scientific knowledge, and – ideally – the existence of a democracy which can effect the sharing of scientific knowledge.

A second meaning of CST is to assign to science the same status as other artistic activities. In this context, scientists are regarded as artists producing marvellous knowledge and artefacts that could be admired as such. A third meaning of CST is that science should occupy a particular place in culture because of its practical usefulness. In that sense, it is considered as superior to art.

The Public Understanding of Science movement in the UK arose in the 1980s from a perceived need in the scientific community to increase public knowledge of science in order both to improve the basic competence of the citizenry and to promote public support for government R&D expenditure. By the beginning of the 21st century, PUS movement activities in the UK amounted to a national industry, with science promotionalism utilising various educational, literary and cultural forms of expression. Nevertheless, the "two cultures" tradition of separating science from mainstream culture is so deeply embedded in the national psyche that behind the veneer of democratisation, dominant social structures persist in separating the business of science from its presentation to the public.

The differing Anglo-Saxon and French conceptualisations of science and culture are among the main sources of difference in the national environments for science-society interfaces, a factor which will be reflected in the comparative analysis of PUS in the six OPUS countries.

1. The Governmental Role

Ministries and governmental agencies often develop PUS initiatives. Usually, the research-based actors take the initiative. Sometimes, however, other actors such as those working with the cultural sector control public spending on PUS activities, for instance within museums. In some countries the cultural and scientific/educational

[811] C P Snow (1959), The Two Cultures: & A Second Look (Blackie & Sons, Glasgow).

sector are seen as intimately connected. This is the case in Austria and in France, but to a lesser degree in the other countries. The case of the UK is more complicated because the promotional aspects of government involvement in PUS, which are highly visible, are distinct from the main forces at work in the governance of science.

There are also other differences that have an effect on PUS issues, such as the relationship between ministries and agencies, and the way in which research-based advice is taken up by the policy system. Below, we highlight some of the most important characteristics for the countries involved.

Austria

It is important to state that the policy situation regarding PUS-issues has changed several times quite drastically during the running of this project.

In Austria, most of the influential PUS initiatives target improving science-public relations, and are at least partially funded by the state. An important actor was, amongst others, the Ministry of Education, Science and Culture. Prior to the year 2000, most of its activities were not part of any explicit programme directed to develop the science-public relations. It was more the changes to the environment for research system which called for increasing efforts to communicate science to the public (*e.g.* the fragilisation of the university system through the numerous reforms carried out through the 1990s; difficulties in public financing of research). Ministerial actions developed from 1999 onwards pertained explicitly to public awareness of science. However, they had a more programmatic character and did not develop very concrete strategies or set many actions. Despite this some special programmes were enabled or supported by state funding (*e.g.* the Science Week, the internet science channel). More recently, the Council for Research and Technological Development is trying to become a key-player on the policy level, so far, however money has been mainly spent on a rather ill-defined PR-campaign for innovation. The logic behind these programmes is still very much directed by the enlightenment ideal of public empowerment through knowledge.

Belgium

As described in the section on “Policy context”, PUST matters (as all other cultural matters) are mainly regionalised since the last big federalisation reform in 1990. Only some “bi-cultural” institutions have kept a national character – most notably the Museum for Natural Sciences in Brussels. Although dissemination of scientific knowledge is formally the responsibility of the regional governments, the creation of ad-hoc departments or services is rather new in regional administrations for research and technology. PUST is not (and has never been) a leading policy issue in R&D policies and cultural policies, it is merely a “plug-in” without an identifiable constituency.

Funding for PUST activities do not come from cultural budgets, but from budgets for research and innovation, regional and local development, conversion of industrial zones, youth activities, and continued education.

France

The most prestigious education and research institutions are located in Paris and this affects the way in which CST initiatives are organised. In the 1980s, while the government attempted to decentralise initiatives (through the creation of Centres de Culture Scientifique technique et industrielle [CCSTI] in the provinces), the model of CST was nevertheless created in Paris: La Cité des Sciences et de l'Industrie de la Villette (open to the public in 1986). Since that time, other big Parisian CST structures were modernised (Le Muséum d'Histoire Naturelle, Le Musée des Arts et des Métiers). By way of comparison – and apart from a few exceptions – CCSTI of the provinces benefited from only limited financial support.
A true governmental policy directed at CST appeared in 1981. In the early 2000's, a thorough renewal of CST initiatives was launched by the government. This policy is visible at the national level (through the Ministries) and the local level (through the CCSTIs, the Regional structures of the CNRS, the newly created Missions de culture scientifique et technique developed in several Universities).

Portugal

A Department for Science and Technology was established for the first time in Portugal in October 1995, within the government formed by the Socialist Party. This Department introduced as one central axis of its policy the promotion of scientific culture for the benefit of the general public. This objective has been implemented mainly through the "Ciência Viva" (Science Alive) programme, launched in 1996. Moreover, every year since 1997, in November, a Science and Technology Week is organised by the ministry. During this week, which includes "the national day of scientific culture", a series of events are held, including opening the doors of some scientific institutions to the public, conferences and public seminars on different scientific topics. These events take place all over the country.
Policy and programmes for scientific culture undertaken by the Department for Science and Technology have been guided by an ideological frame of reference according to which science was essentially the search for the laws of nature and of things, based on logic and induction. The same ideology espoused the values of liberty and of democracy and thought of them as intrinsic elements of scientific practice.
In an indirect way, the Department of the Environment (established in 1990) also contributes to the penetration of scientific issues into the public realm and media discussions. This role has been played mainly through the Environmental Impact

Assessment (EIA) procedures and hearings. It is also a centralized way of connecting science and the public.

Sweden

A very important policy initiative in Sweden was the requirement for researchers to disseminate their results. In Sweden very little applied research is done in special government laboratories or institutions that fall under the direct authority of one or another ministry. Instead, ministries support special research funding agencies that receive both unsolicited and solicited grant proposals from universities. One part of this system was the creation of sectorial research councils; another is the dependence on governmental agencies for applied research. It is important to note that governmental agencies thus become involved in discussions and actions concerning the "third assignment" (discussed in the national profile section). In addition, in the Swedish governmental system the ministries are relatively small and flexible, while their agencies are much larger organisations, contrary to the system in most other countries. This gives the agencies a special position in Sweden, which must be taken into account when discussing governmental activities.

The agency "Högskoleverket" is responsible for developing and maintaining the system, the overall research infrastructure, research universities and other research organisations which in turn are responsible for providing scientific information. Other government agencies that may not be directly responsible for research and education policies are involved in questions of PUS.

United Kingdom

Since the PUS movement took hold in the 1980s, the UK Government has become a major funder of PUS activities throughout the research system, to the point where PUS has become an element of most publicly-funded scientific activity. The main emphasis of the UK Central Government policy is relatively passive support of PUS activities through its sponsorship of activities by NGOs, museums, through the Research Councils and related bodies such as The Royal Society, and by its agencies (such as the National Physical Laboratory). This is complemented by "bottom-up" PUS activities that are in practice subsidised by Government funding for mainstream science and education. A significant, though unquantifiable, percentage of public funding for science, culture and education supports PUS activities in the UK.

2. Centralisation and Decentralisation strategies

Issues concerning centralisation are often linked to PUS activities. A major issue concerns the way in which research-based knowledge is produced in central locations and how diffusion models are invoked in order to spread knowledge. Variations of "deficit models" have been thoroughly criticised within current PUS research by the STS communities in different European countries. Some of the findings of this research suggest that centralisation and decentralisation must both be considered where issues of power and knowledge are linked. The centralisation of knowledge and power may or may not be seen as a problem by governments; it carries obvious advantages by making it easy to construct and control power networks. Research on PUS, on the other hand, is typically highly critical of centralised structures on the basis that promoting citizen empowerment and democratisation of science requires decentralisation and local control.

Austria

The Austrian PUS profile exhibits a relatively strong centralisation. Governmental bodies are undisputedly the key players. Furthermore, there is a very high concentration of media power in the hands of very few players, who thus wield enormous influence over what information is given to the public. Finally, geographical centralisation, with Vienna as the focal point, is a clear feature of the Austrian PUS landscape. Centralisation is even identified as a problem in numerous policy documents, but so far there have been no clear measures to change towards a more balanced spread of activities over the regions. Recently, there have been initiatives by regional administrations to foster more science-public activities and science communication at the regional level.

There are several reasons why regional institutions are seeking to establish a counterbalance to the centralisation present around the national capital. One such reason is simply that public responsibilities in the local sphere differ from national competencies and issues. Thus, the regions try to contribute to science-public-interactions that are relevant to specific, local issues such as environmental quality, GMOs and farming.

Belgium

As a consequence of the bi-cultural character of the country and the federalisation of the State, PUST is obviously decentralised in Belgium. There is little symmetry between PUST initiatives in the Flemish and Walloon parts of the country, in the areas of media, science centres, NGOs, consultation and foresight, and events. The only broadly similar initiatives are those inherited from before federalisation and those imported from the European level (*e.g.* science week). The system of regionalised public support of museums, science centres and NGOs enhances decentralisation. The use of European Social Fund Objective-1 subventions further decentralises such activities by favouring the less-developed sub-regions.

France

Centralism is currently an important issue in France. While a few attempts are made to develop structures and actions in the provinces, the most prestigious sites related to PUS are installed in Paris and continue to exert a strong influence nationally.

Sweden

Sweden has a strong tradition of centralising governance and cultural institutions, including the mass media and centres of higher education. However, there is in parallel with this a political consensus on working with decentralisation strategies to counter what is perceived as a structural problem. There are two main decentralisation strategies, which can be illustrated by the case of science museums. The first aims at redistributing resources from the capital city Stockholm to other major cities, as exemplified by the recent investment in *Världskulturmuseet* (The National Museum of World Cultures) in Göteborg. The objective of the second order decentralisation is to disperse resources from the major cities to smaller towns and sparsely populated regions, including the siting of minor museums in rural areas.

These two types of decentralisations can also be observed in policies towards universities and colleges. The second type has grown in importance with the recent increase in resources allocated to local colleges, where earlier Sweden had a few very important universities located to major cities or important regions.

United Kingdom

During the Thatcher years, the UK experienced great tensions concerning the geographical distribution of power, resisting at the same time pressures for European integration and intra-national regionalisation. Under the New Labour Government, regionalisation was prioritised, with the establishment of a Scottish Parliament, a Welsh Assembly, a Greater London Assembly and a directly elected mayor for London. Ironically, the ground floor of the former headquarters of the Greater London Council (abolished by Margaret Thatcher) became a science museum: an aquarium; a new building had to be constructed for the revamped London government. Scotland has a high degree of educational autonomy, with all this implies for science, research and its relationship to the Scottish public.

The resistance to European integration, however, has been unchanged since then-Prime Minister Thatcher gave her famous anti-European speech in Bruges. This is not only expressed by the UK's remaining outside the Euro zone, and blocking the word "federal" from the draft constitution for the European Union, but in British attitudes towards the science/society interface with respect to Continental practices. There is a self-perception that the UK is a leading country in the development of PUS activities, in STS research on PUS and in the incorporation of at least *some* aspects of PUS research into the scientific advisory process. This has ironically isolated the British PUS community from outside influences apart from the USA, from which it imported ideas such as participatory exhibitions from the Exploratorium in San Francisco, and from other parts of the English-speaking world. Perhaps this stance explains the arrogance that is sometimes apparent in British PUS circles.

3. Public Understanding of Social Science

Social science has traditionally been used as a vehicle for addressing questions of public understanding of science, both as a resource for assessing the public's understanding of science and in order to address the problems of diffusion (*e.g.* OPUS as a project of the "Raising Public Awareness" strand of the EC Framework Programme). A more autonomous expression of social science has been the critical stance through which it questions the PUS enterprise as a legitimate project. The social sciences are in some countries seen as a part of science in general that need, in the same way as the natural sciences, public recognition and comprehension.

Austria

Most PUS initiatives in Austria were established due to an alleged lack of awareness of science and technology in the public. The social sciences play only a marginal role in different PUS initiatives. While, the Austrian Council for Research and Technological Development has come to play a central role in PUS it has no members from either a social science or a humanities background. As a consequence, there is a bias towards "hard" science and technology in PUS initiatives. However it is interesting to remark that even in settings where the social sciences and humanities find a place to communicate with wider publics – as for example during the science weeks – clear difficulties become visible in doing so (e.g. drawing the boarder-line between a cultural event and social science popularisation appears to be difficult).

Belgium

In various types of PUS activities and institutions such as science centres, science festivals, university initiatives etc, technology is usually the starting point for PUS initiatives, more often than fundamental research. Human or social aspects of technology may be taken into account or not, in a critical way or not (depending on the actors involved). In the popular press and on television, social sciences and economics have their own pages or broadcast programmes, which are distinct from the "science and technology" sections or programmes. S&T in the media have their own characteristic life and rhythm. The reporting mainly concerns the physical and natural sciences, less often anthropology or behavioural sciences, and occasionally societal aspects of S&T (e.g. sustainable development).

France

In 18th century France the understanding of the meaning of science extended to both natural sciences and social sciences. However, this broad conceptualisation of science has progressively been reduced in scope to include the natural sciences and mathematics only.

No PUS initiatives related to social sciences exist in France, reflecting a strong boundary between the natural sciences and the social sciences. In addition, representatives of both camps believe that PUS initiatives should concern natural sciences only. Social sciences are occasionally present in the public sphere as consultancy bodies in the context of public controversies or in the form of ethics committees.

Portugal

The national policy for scientific culture of the Science Ministry privileges science and technology. The dominant trend has been to exclude the social sciences from most state initiatives. However, one important role for the social sciences is to carry out Scientific Culture Surveys. More recent surveys follow the same rationale and methodology of the previous Eurobarometer ones, with minor changes in some questions.

Social scientists are in this sense an important source of the discourses that circulate through society about the extend of the public's scientific culture -- or lack of scientific culture. Critically appraising the instrument and at the same time trying to be reflexive about the models of science and the public it embodies can thus be problematic for PUS scholarship in Portugal.

In an attempt to foster a more systematic reflection about the interaction between science and society, in 1997 the STO financed a three-year multidisciplinary research project of qualitative studies about concrete contexts of interaction between science and its multiple publics. Some summary guidelines for re-thinking the science-public relationship were published as part of an official document.

Sweden

Both the humanities and the social sciences are very important components of PUS scholarship in Sweden. The split between the "softer" and the "harder" sciences that is common in the Anglo-Saxon world has not occurred. This is due to the Swedish notion of *vetenskap* (science), descending from the German concept of *Wissenschaft* and incorporating the humanities as well as the social sciences and the natural sciences. In respect of PUS, this means that there is no discrimination between any scientific activity – soft or hard – the Swedish concept of PUS is very inclusive. In theory, this means that Swedish PUS activities possibly are connected to every important societal issue within the public sphere. In practice, this broad conceptualisation means that PUS activities very much are an issue for the humanities and social science.

United Kingdom

While philosophers of science and the scientific élite in the UK debate the extent to which overcoming the schism between the social and natural sciences is important, the fact remains that it persists. The Economic and Social Research Council (ESRC) is the newest (in disciplinary terms) of the main governmental scientific funding bodies, and it is no accident that the word "economic" precedes the word "social". Quantitative methods ("hard") have traditionally been considered more "scientific", with the "hard sciences" paradoxically enjoying more "social" status. However, it was not long before the ESRC turned its attentions to PUS, with an almost inbuilt reflexivity about the role of social science in both deconstructing and influencing science/society relationships. The result has been a partial integration of the social and the natural sciences, and the institutionalisation of PUS in mainstream scientific activities. Nevertheless, as argued above, the persistence of the "two cultures" still affects the way in which science/society interactions occur in the UK.

4. Criticism of Science and Technology

The status of science varies from country to country. There are sharp differences concerning how scientific knowledge has been perceived as privileged or not when compared with other types of knowledge. Important factors here include the size and maturity of the scientific community, as well as the general state of development of the intellectual debate. In addition, various disasters and other risk-related event are instrumental in the way scientific criticism takes shape.

Austria

If one were to examine the results of survey research, the Austrian citizen would appear to be rather critical towards technology. This is often taken as an argument for the need to increase PUS initiatives, as a conservative attitude towards technology seems to be a hindrance to economic development. We do not, however, agree with this analysis as it does not take into account Austria's specific history and particular experiences with regard to resistance to technology. In that sense, certain technologies that are seen in contradiction to more general value systems (*e.g.* biotechnology and nuclear energy) are rejected in favour of organic farming and "clean" hydroelectric power. However, many other "smaller" but equally sophisticated technologies are embraced by the public with a great deal of enthusiasm.

It is difficult to speak of one clear period of general criticism towards science in the Austrian case. However, the first significant debates emerged in the 1970s, most notably within the environmental movement. The controversy reached its zenith in the second half of the 1970's, when an organised social movement resisted the construction of the first Austrian nuclear power plant in Zwentendorf. Other periods of controversy have been experience in Austria on an occasional basis, but there is a general tendency not to engage in an open public debate about certain problems linked to scientific and technological development (e.g. there has been little public debate on BSE or on many of the biomedical innovations).

Belgium

Periods of public criticism towards S&T are respectively related to those in France and the Netherlands, although attenuated in Belgium. In the Flemish speaking part, during the 1980s, there was an active section of the Dutch movement "*Wetenschap & Samenleving"* (Science and Society) in Flanders. In Flemish universities, there were several (unsuccessful) attempts to create science shops according to the Dutch model.

In the French-speaking part, during the late 1970s and the 1980s, a great many connections existed with French groups and associations. Some examples of the more significant organisational links are the Association for cultural scientific animation (get the correct French name and its translation) in Paris and the group of radical science critics around Impascience, represented by Centre Galilée in Louvain-la-Neuve and Librex in Brussels. There is no institutional continuity with the situation today. Transferring the science shop model also failed in the Walloon part of the country.

France

Soon after the First World War, French science entered a "moral crisis". It was accused of having permitted the systematisation of conducting massacres. Public confidence in science needed to be restored. During this period, there was a significant increase in the number of magazines popularising science, together with the development and promotion of technologies intended to improve working conditions and daily life. Moreover, politicians displayed an unshakeable confidence in rationality and in the beneficial progress of science.

During the Second World War, the positive, or even positivist, definition of "true" science and of "progressive" technologies was shared by the various anti-Nazi political movements. The consensus that existed between left and right over the value of science persisted and came to constitute a solid basis for CST actions after WW II. After the end of the Vichy regime, the democratic political tendencies of both the left and the right believed that scientific and technological developments would help to reconstruct France. Big programmes (*grands projets)* were implemented – nuclear, computer, etc. – that would be pursued up to the 1980s. A wide social consensus was formed on the legitimacy of science and technology.

The consensus over the legitimacy of science started to weaken with the 1968 revolt, which led to a reform of the universities. However, only possible threats linked to scientific developments – *i.e.* scientism, but also potential risks related to nuclear research and genetics – were discussed and not the essence of scientific activities *per se*. Nonetheless, while some actors of this movement launched the first critical studies on science popularisation, others inspired more recent initiatives to promote what would come to be called *Culture Scientifique, Technique et Industrielle* (CSTI).

A few months after the victory of the socialist party in 1981, the new government started to promote actions that would thereafter leave their mark on most CSTI activities of the 1980s and 1990s. These actions were aiming at putting French science "at the first place in international competition". Meanwhile, a critical debate around science and technology surfaced during the 1990s. Several scandals (such as the contaminated blood scandal and more recently the mad-cow disease issue) but also pressures coming from the public (such as AIDS activists aiming at making the patients active in decisions related to clinical trials), show that a democratic treatment of science is progressively taking root in France.

Portugal

In Portugal, the impact of critical international trends was negligible and had little social visibility. During the immediate post-War period the Portuguese regime took care to continue to maintain the university under strong centralised control. The university served mainly the function of élite reproduction and dissemination of the traditional and ruralist values of the Regimen. The university remained alien to scientific and technological research, in the areas of natural, earth and exact sciences. There were no social sciences degrees.

Some voices did of course try to defend the importance of scientific research and theoretical development for dealing with, for instance, the agricultural problems of the countryside. Some wrote about the importance of understanding science and its conduct as a product of conjectures and reflexion emerging from a community of scholars. Dissident voices had no place in the regimen. The ‘60s were not very different – even if the official rhetoric started mentioning the need to connect scientific research and the university. Only towards the late 1980s were these and other conditions consolidated enough for the wider issues of science and culture to emerge with stronger social visibility.

Sweden

For a long time, science was considered socially unproblematic and politically important. The Social Democratic governments regarded science as an essential part in their overall policies towards both higher education and adult (further) education. In academia, other ideas began to emerge and grow, culminating around the years of the student revolutions in 1968 with criticism of both the political and the rational aspects of science. These protests and debates led to some universities establishing new academic disciplines in the decades to come which could engage with the science/society debates.

The big upsurge in science criticism was, however, not directly connected to academia, but to the political debate surrounding nuclear power during the late 1970s and the early 1980s. Prior to that period, there had been practically no debate on the dangers involved in producing energy of this kind or if it was desirable for Sweden to do so. It was not until the 1970s that nuclear power started to be conceived as a possible problem. It quickly became the most important political issue of that decade. The matter of consulting lay people became urgent after the nuclear accident in Harrisburg, Pennsylvania, in March 1979.

Preparatory to a referendum, a host of study circles were organised to stimulate people to weigh expert arguments and to debate the pros and cons of nuclear power. In addition, a publication series called ”*Källa*” (Source) was launched. The aim of these publications was “not to reach an indisputable truth” but to enlighten complex question of a scientific character and to further an understanding of why experts differ in their opinions.

United Kingdom

In common with many other European and industrialised countries around the world, public criticism of science and technology first emerged in the turbulent decades of the late 1960s in response to perceived dangers of new applications of science and technology. Public concern over nuclear power has centred upon planning applications, such as for the Sizewell B nuclear plant, and radioactive waste disposal.

Science-based controversies in the UK have erupted one after another, with serious consequences for the nuclear and biotechnology-based industries in particular. Volumes have been written about the effects of the Windscale (Sellafield) nuclear accident, the Chernobyl fallout, the BSE "mad cow" affair, genetically-modified "Frankinfoods", and the (over)reaction to the foot-and-mouth epidemic, which brought not only science but scientific advice to governments into the public arena.

5. Celebrating science

An important visible element of PUS initiatives has traditionally been what can be called celebratory activities. In connection with the exploration of national identities, most countries have identified “scientific heroes”. These have been idealised together with other “great men” within politics, military and the arts. It has also been common to celebrate the scientific culture as an ideal environment and as a model for society.

Austria

National celebrations of scientific achievements do not play a very significant role in the Austrian public life, although this is in a process of change. One explanation for this absence of celebrative activities could be seen in the relationship between science and National Socialism. Austria did not only loose much of its outstanding intellectuals as they were obliged to leave the country or were killed, but it also did not undertake any measures to bring them back after the war or to debate on the role played by researchers during this period. Thus silencing science in the public domain could be seen as part of this picture. On a national level, science does not seem so far to be an element that is important in constituting national identity. The success stories about Austrian scientists who were involved in recent discoveries are starting to become a more visible element in the reporting of science. Famous scientists such as Erwin Schrödinger and Sigmund Freud appeared until the introduction of the Euro on Austrian bank notes. However, this type of celebratory expression as a part of national identity only happened in the latter part of the 20^{th} century.

In the late 1990’s, one newspaper (*Der Standard*) ran a series of biographies on major scientists working in Austria that could be seen as an effort to create public awareness about the more humane aspects of science. Recently, Austrian scientists have been gaining greater prominence in science news articles. In school curricula teachers are expected to stress the contributions of Austrian researchers and scientists. Hence, there is a trend towards promoting Austrian science through staging scientists and thus making science more understandable (human) for a wider public.

Belgium

Generally, technology is much more celebrated than science. Celebration of technological achievements is also a gateway to science communication. Some examples are:

Performances in aerospace technology (Belgian astronauts, Belgian contributions to the space shuttle, etc.) are celebrated and allow for opportunities of science communication in the area of astronomy, astrophysics, etc.

Performances in biotechnology (awards conferred to or achievements by genetic engineers) are celebrated as an economic challenge and subsequently give rise to opportunities for science communication on biology, genomics, etc.

Although Belgium has a valuable patrimony of well-known scientists in the past centuries, this does not appear to be important in the new generation of PUST initiatives in the media and the science centres.

France

France has a strong tradition of celebrating the achievements of numerous famous French scientists. Monuments, street names, portraits on bank notes and on stamps reinforce the contribution of scientists to the national heritage. Current activities also tend to transform historically significant scientific instruments (as in the CNAM for instance) and old scientific structures into patrimonial objects (such as the Montagne Sainte Genevieve in Paris).

Some Museums devote a large space for leading figures such as in the New Evolution Gallery in the Natural History Museum in Paris. Two French scientists have been particularly extensively celebrated: Louis Pasteur and Marie Curie. There is a Curie Museum and at least three Pasteur Museums (including his different living and working places). These two figures represent different values attached to science: the usefulness of science to society (Louis Pasteur as a saviour France and the French people) and the purity of science (Marie Curie, who appears almost as a Saint).

Portugal

National recognition of scientists as individuals is not very important in Portugal. The only Nobel Prize awarded to a Portuguese for a scientific achievement was presented in 1949, to Egas Moniz, for his development of the leucotomy technique. This fact is nowadays hardly celebrated at all.

The biggest celebratory issues and dates with impact upon the Portuguese national identity are connected to the past history of maritime discoveries. The caravelle, a symbol of this past maritime glory, was found on all denominations of national currency and banknotes. Around this dimension of the Portuguese identity there are important institutional structures mounting celebrations, commemorations and associated events and publications. Some of these are connected to science, since the discoveries involved a series of new navigation instruments and a set of associated scientific developments. Nevertheless, the scientific dimension is not the one most often recognised.

Sweden

The Nobel Prizes and the activities associated with them is the most important celebration of science as an expression of national identity in Sweden. Both the Nobel Prizes and the donor Alfred Nobel are an important part of Swedish culture. The announcement of the prizes in October and the prize ceremony in November are rare occasions when science and scientific work receive broad coverage in the media in a celebratory manner. These are also predictable events suitable for media planning.

Nearing its Centennial in the year 2001, the Nobel Foundation decided to do something radically different by making Nobel more public. A Nobel museum would be erected to celebrate the prizewinners and their achievements in science, literature and peace. The first exhibition of the museum had creativity as its theme, bringing together a common element of research, literature and peace work. The exhibition was produced in three copies. One of these will stay in Stockholm while the others two tour the world. There are also several other Nobel museums in the world, placed were the donor Alfred Nobel has marked his presence.

United Kingdom

Prior to the public controversies that erupted since the 1960s, the modernist "triumphs" of science, technology and progress helped to create both a strong public confidence in science and pride in technological accomplishments. The Industrial Revolution is part of the national heritage which is celebrated alongside the past glories of imperial Britain, the 1851 Great Exhibition in Victorian times being one prominent symbol celebrating British dominance. The very name of the Royal Society of London, which dates from the mid 17th century, conveys the social status bestowed upon the gentlemen scientists and those who followed in their footsteps (women had to wait until the 20^{th} century before gaining admission as "Fellows"). The names of Newton, Darwin, Rutherford, and of Brunel, Faraday and Watt, are part of the currency of British culture, literally in the case of Faraday, whose image decorated a sterling bank note. The PUS movement emerged from this august heritage, stimulated by a 1985 Royal Society report often referred to as the "Bodmer Report" after Sir Walter Bodmer, the chairman of the working party that produced the report.

6. Public Understanding of Controversial Science

The popularisation of scientific knowledge is often connected to instances of extreme events such as disasters or scandals. In addition, controversial points of policy are frequently controversial within the research domain as well. From a media perspective it is evident that controversial science sells, not only because of its dramatic value but also since it is often connected to high-stake societal issues. In these cases, research-based knowledge is often seen as more relevant and easier to absorb for members of the public. Instances of controversial science can also communicate that research is not an entirely unproblematic process leading necessarily to objective knowledge.

Austria

Controversies seem to be the most efficient mechanism through which science-public relations come to change (if gradually) in Austria. Many of the bigger non-governmental PUS initiatives have their topical origin in contested techno-scientific issues. The debate over genetically modified organisms raised in 1997 was one of the central issues which functioned as a trigger, even on the governmental level where a project was funded by the Ministry of Education, Science and Culture in order to establish "crisis-PR-work".

Belgium

In Belgium, short term and long term triggering effects must be distinguished. With respect to short term effects, it is not clear whether recent controversies (ESB, dioxins, GMOs) give an impulse to the demand or the supply of scientific knowledge through usual PUST channels or through other channels. Such controversies put scientific knowledge and expertise at the foreground of the political debate and in the news. Scientists and experts are then welcome in the broadcast media and the press, and they are invited to participate in public debates. In this case, the initiative comes from political journalists rather than science journalists or professional science communicators. Over the longer term, issues such as sustainable development, climate change, food security, genetics and health are emerging subjects in TV broadcasts, science centres, science festivals and other events. Even if they are not topically “hot”, they are attractive for the general public and science communicators use them as "hooks" to gain attention.

France

The controversies that have taken place in France since the mid-1990s have led actors to affirm their particular representations of CST and of the public, resulting in two antagonistic models of communicating science in the public sphere. On one side, we can observe a reformulation of the deficit model. At the rhetorical level, politicians no longer address the "general public" but "citizens". Institutions tend to reaffirm their legitimacy; for instance, CST has become a priority in the spectrum of initiatives by the Ministry of Research. The dominant representation of the public presents in this first model can be roughly described as an undereducated population, ignorant of science. In this context, science is perceived as neutral and objective and properly constituting common ground from which to educate the public and build up a democratic debate.
On the other side, critics force open the doors of the institutional spaces to get their points of view heard by the institutions. These spaces are colonised by NGOs involved in environmental issues, some trade unions, and also local and national associations. Furthermore, science is equated with other types of knowledge, and its status as an ultimate determinant of objective truth is contested. New activities have appeared on the French PUS landscape that permit scientists and citizens to confront each other, such as, for example, some of the *Cafés des Sciences* (Science Cafés).

Portugal

In recent years, social movements in this field seem to be followed by a greater awareness, on the part of certain sectors of the population, concerning the relevance of scientific knowledge, as well as the tensions that surround it in contemporary technological society. By the same token, the form and extent of encounters between science and the public appear to be expanding. Signs of this growth include the increase of media-driven social and political controversies where science emerges as one of the main foci of the debate, and scientists take on active roles as discussants. There are many illustrations of this trend, such as the controversies over the Foz Côa rock art engravings (1994-97), the geophysical experiment COMBO (1996), and the installation of co-incinerators of industrial waste in Central Portugal (1998-00).
These changes in the relationship between science and society in Portugal are, we suggest, the outcome of a series of convergent factors, that are not independent from political democratisation and openness of Portuguese society, improvements in the educational and cultural level of the Portuguese, a greater proportion of the population

in school and attending university, greater availability of information on science in the mass media, and the latter's more active role in the coverage of news about science and about scientific controversies.

Sweden

Environmental-based risk issues have been important in Sweden. The single most important event was the referendum on nuclear power. In addition, Sweden has had a strong research base on acid rain that for many years was reflected in public debate. Research competence on issues such as stratospheric ozone depletion and climate change has been weaker and therefore the controversies have not been debated as forcefully. Another strong research tradition within a controversial area has been the link between different types of radiation and health effects. This has been an area in which one type of controversy continuously has been followed by another. Concerns about high-voltage transmission lines and cancer has been followed by discussions of radiation from computers and currently also on mobile phone technology.

United Kingdom

Biotechnology is such a controversial topic in the United Kingdom that it is not surprising that so much PUS activity centres around issues such as human cloning, genetic testing, genetically-modified food and agricultural practices such as feeding natural herbivores animal-derived products. The nuclear industry responded to the Windscale event by renaming the facility, now known as Sellafield, and when that didn't "work", constructed a large and elaborate visitors centre which is one of Britain's major tourist attractions, complete with a museum, activities and a children's playground. The Sizewell B nuclear site also has a visitors centre, with an impressive museum, and which seems to be staffed by friendly but not particularly knowledgeable PR people.
The tourism industry in the countryside, however, was devastated by the restrictions on movement imposed by the government following the foot-and-mouth epidemic, to say nothing of the farming industry, who suffered the slaughter of millions of animals, many of whom were perfectly healthy, ostensibly as a "precaution" intended to regain consumer confidence.

7. Gender and Science

Under this heading, two related issues are discussed. The first one concerns the relative number of women involved in national research. The second concerns the way this is perceived as problematic.

Austria

The proportion of women teaching in universities was 22.2% in 1999, aggregated across all hierarchical levels. Together with Germany, the percentages of women in the scientific community range amongst the lower levels of the European Union. Amongst matriculating science students, 49.1% are women, but the proportion of women decreases secularly to 5.7% at the highest levels. For non-university research institutions there are no gender statistics for scientific staff.

The marginalisation of women in the scientific community is not reflected in the PUS activities in Austria, with the exception of programmatic policy statements and one recent initiative to bring more women into the technical professions. It is not reflected that communicating science and technology in a certain way might have a great impact on the choice of women to go into technical studies. However, universities have started to actively recruit women to study science and technology and thus also communication activities are starting to be targeted for this audience (see university chapter). This may be due to the decreasing number of male students matriculating in scientific or technical fields; women may now represent a new and interesting clientele for universities in certain areas of studies. Women have thus become a resource to counterbalance the shift of men away from studying science.

Belgium

No relevant information available for comparative perspectives.

France

In France, gender inequalities are most apparent in the natural sciences, and particularly in the medical sciences. For instance, there is a great discrepancy between the proportion of female assistant professors (48%) and female professors (11%) in the medical sciences in academia. As in most European countries, females are underrepresented in the most prestigious positions.

The Ministries of Education and of Research have recently launched several initiatives in an effort to construct a new equilibrium, including an "equality" programme. There have been calls by the Minister of Research that aim at encouraging women to enter university careers, which are often associated with the crisis which currently affects the natural sciences. Several associations such as "Femmes et mathématiques" and “Femmes et sciences” have recently been created in an attempt to change the imbalance.

Although a great number of women are involved in CST activities, those who speak of these actions in the public are almost entirely men. In addition, social and human sciences – the disciplines in which women are the most present – are hardly represented in CST actions, making women as scientists even less visible overall. One strategy to counter this has been to promote women to positions of responsibility. Another explicit strategy of the Ministry of Research is to instruct women scientists to be present in most CST actions involving the public in order to make them more visible.

Portugal

At the level of public discourse, the issues connecting gender and science are not very visible in Portugal. Overall, the proportion of women in the educational system is currently larger than the proportion of men. However, the scientific community still shows a higher percentage of men, as shown in the following table:

Table 1
Percentage of men in the three categories of university teachers

	% teachers without PhD	% teachers with PhD	% full professors
Exact sciences	53	54	76
Biology and earth sciences	57	60	82
Health sciences	45	54	71
Engineering	64	69	96
Social sciences	53	56	80
Humanities	52	56	73

Source: OCT, 1999

Sweden

Over the past few decades, the Swedish government has worked to increase the number of women in science and higher education and to improve the conditions for women already in science. In the year 2000, almost 40% of the educational and research personnel of state universities and colleges were women. However, in higher level academic positions, there are still remarkably few women: only 13 percent of the professors and 27 percent of the senior lectures are women.

The gender structure of the university student body is dependent upon the which institution and type of education is concerned: at the *Karolinska institutet*, which offers training in nursing, 64% of the students were women. However, only 32% women attended *Chalmers tekniska högskolan*, which emphasises engineering and technology. As for all state institutions, universities and colleges are required to have a plan of improving gender equality.

United Kingdom

The UK has traditionally regarded its scientific system as a pure meritocracy, so that under-representation of women in science could be seen as a failure of girls and women to engage in scientific study or to pursue scientific careers. In common with most other European countries, there is a secular decrease in the proportion of women in science by age cohort in the UK, with very few reaching senior positions in academia, research laboratories or professional bodies. The structure of career progression for women being described by Hilary Rose as a "leaky pipe".

A sign that attitudes were changing came with the appointment of an expert panel, chaired by Nancy Lane, which published the "facts" about women in science in a landmark report called "The Rising Tide". This study was largely restricted to quantitative data gathering and presentation, leaving analysis and explanations mainly unaddressed. Another study found that there was no gender bias in the peer review process, but women got fewer research grants than men because they submitted fewer proposals. Sir Robert May, in response to a question in a hearing of the House of Commons Select Committee on S&T on 22 June 2000, said that "no one knew why" this was the case. Even though the problematisation of the gender imbalance was thus implied as a female failure, that there was recognition of a problem was a first step in attempting to rectify the imbalance.

It is possible that the relative decline in salaries for scientists can be correlated with increasing attempts to recruit women into the scientific professions in Britain. An office for promoting women in science and technology was established in the Department of Trade and Industry (within which the Office of Science and Technology is located). British women scientists were recruited to some very high-level positions, in public or quasi-public organisations such as the British Institution, the Royal Society and the Wellcome Trust, giving women disproportionate visibility relative to the actual gender structure of science as a whole.

8. Youth and Science

PUS activities are frequently aimed at children and youth. The main objectives appear to be a desire to generate more interest in research as a career and to recruit students to higher education. An important instrument to do this is museums and science centres.

Austria

In theory science curricula in Austrian schools should contain explanations of scientific knowledge as well as to convey an idea about “scientific reasoning” and “typical scientific working methods". Recently, additional topic has been placed on the agenda aimed at raising the awareness of the "cultural and economic meaning of science for society and the environment". It is hoped that through this additional teaching to enhance pupils ability to "better judge scientific developments" and thus to lower critical voices towards science.

Furthermore, science education is seen as preparation for participation in social decision-making, with scientific competence as an indispensable basis for responsible governance. Therefore, issues of responsibility, norms and values emerging with the application of scientific knowledge are embedded in scientific education. Furthermore, the curriculum reinforces the concept that basic scientific literacy is essential for any form of public participation in decision making processes.

It remains to be seen how these aspirations are turned into reality in the life of school children.

In general it can also be remarked that recent PUS activities in Austria have started to be strongly targeted at children of school age. University departments organise special open day events for school children, which are designed to attract them to study science or technology. Several museums offer special programmes for schoolchildren.

Belgium

Young pupils and students have become key target publics of the new generation of PUST initiatives undertaken by public authorities, universities, science centres and voluntary associations in Belgium. Universities have started to appear as actors in PUST-activities for youth (mainly 16-18 years), from a desire to stop and to reverse the disaffection of students towards scientific curricula. The number of university students in science faculties decreased dramatically during the 90s, leading to a shortage of physicists, mathematicians, and chemists and, to a lesser extent, biologists, both as teachers and as researchers, in both Flanders and Wallonia-Brussels.

Science centres consider the school public as their basic source of income. Recent science centres such as Pass in Wallonia and Technopolis in Flanders are explicitly designed to attract school parties and families with children during the holidays. Several non-profit or voluntary associations support awareness activities within schools; the teacher invites a member of the association to visit the school and to carry out the activity, with appropriate media and didactical tools.

France

A large part of CST activities is directed towards a (very) young public, and it is in this sphere that French initiatives are the most innovative. Many activities are designed for in-school experience, such as the Main à la pâte (The hand in the Plough) or the Plan

Action Education. Children are a target public during the Science weeks. In these different examples, science education is conceived of as a way to allow children to become open to the world, to better understand it and to be better able to situate themselves within it. In most of these activities, as science is considered to be an important element of the culture of the future citizens, it is frequently linked to other subjects.

Portugal

A recurrent criticism of science teaching in schools, and of scientific curricula, is the lack of "hands on" experience and of adequate equipment and resources to anchor science teaching in experimental or observational activities. The skills required for laboratory and observation work thus have, at best, in most schools, a marginal role in science education. These skills are seen to be best acquired and developed from an early age on, starting with exposure to experiment and observation in elementary school. From its creation in 1995, the Ministry of Science and Technology tried to respond to these shortcomings of scientific education through the creation of an agency, "Ciência Viva". Partnerships were established, and science clubs formed in a number of schools in the Metropolitan Area of Porto, selected from those with relatively fewer resources, most of them located in poor neighbourhoods.

Despite "Ciência Viva"'s successful record of achievements, two weaknesses remain. The first has to do with the almost total absence of the social sciences in its overall coverage. The specific difficulties facing a "hands on" approach to teaching the social sciences are yet to be identified. Some potential for innovative experiments in this field exists, and some research institutions are already trying to explore partnerships with schools for the development of scientific citizenship.

Another weakness relates to the failure to bridge the gap between official science curricula and routine science teaching in schools and the activities of science clubs. Problems of allocating time for teachers to carry out extra-curricular activities or of institutionalising innovative activities as part of the "normal" workings of the schools are amplified by the lack of coordination between the Ministries of Education and of Science in this field.

Sweden

The main principle of PUS in Sweden is frequently expressed in official and public debate as “we have to catch them young”. Various institutions compete for the attention of children in order to prepare them for citizenship today's "knowledge society". Most PUS activities, thus, heavily target young people and schools. There is also a broad collaboration between museums and schools, through which school classes can go on visits, with guides to explain the contents of the museums and answer questions.

Sweden's main science council also supports activities of this type. The international prize-winning TV program Hjärnkontoret (Upper Storey), launched in 1995, is an example of a particularly successful PUS vehicle.
In addition to these more or less governmental initiatives, non-governmental efforts have a strong emphasis on targeting children.

United Kingdom

The PUS movement in the UK permeates throughout the research system and engages the public in a great variety of ways. However, institutionalised PUS is heavily orientated towards the education of the young (and the young-at-heart). Hands-on experiential science and technology exhibitions, as pioneered by the Exploratorium in San Francisco, have found a devoted following in the UK, where further innovation continues. In the 1990s, museums such as the Natural History Museum in South Kensington, London, have been transformed. Sterile display cases with row upon row of rocks and minerals, difficult for most adults to cope with let alone children, have been replaced by rather more exciting, dynamic displays that are more accessible, imaginative and entertaining. Museums often have special play areas for toddlers and young children where they can explore and experiment. Interactive science centres aimed primarily at children are being set up around the country. Teenagers, however, are not so well catered for; they regard this sort of thing as being "for kids". Increasingly, however, museums are experimenting with more sophisticated presentations of science in which incertitude and controversy are incorporated into special exhibitions.
Book and magazine publishers have discovered an eager audience for publications such as "Horrible History" and "Disgusting Digestion" that present science in a format that is popular with the under-tens; Children's BBC integrates science into its programming. Science in schools is taught under a National Curriculum that follows a fairly conventional format in presenting scientific "facts" and raises awareness of responsible citizenship through education on, inter alia, anthropogenic pollution, recycling, and public health. There is little inbuilt criticism of science as an endeavor; this is left to teachers, who may not be well informed on these matters themselves.

9. Promoting science

The promotion of science has always been an important aspect of PUS activities, if not the *raison d'être* of PUS. Scientific knowledge has traditionally been portrayed as unproblematic and the objective has been to equate understanding with appreciation of science. Initiatives of this kind often emanate from the scientific community and governmental institutions. However, since the mid 1980s, research on PUS has problematised the relationship between science and the public, highlighting a power gap of relatively greater significance than the traditionally held view of a knowledge gap.

Austria

Most research institutions have public relations "PR" offices to assemble information on their main outcomes or "products" and to communicate their scientific findings to the public. This service is mostly conducted by employees who specialise in this task, rather than by the scientists themselves. There are, as always exceptions to the rule. In the public debate on GMOs – for Austria a central case – one could observe for the first time a thematically focused cooperation programme between PR offices in research institutions, the Ministry of Education, Science and Culture and a private agency specialising in PR. Its main purpose was to protect the scientists who were involved in research on genetically modified plants (apricots).

Further the Austrian Council for Research and Technological Development has initiated and funded a large scale publicity campaign for “innovation” through TV spots, newspaper advertisements and posters. (see governmental initiatives) The message behind, however, remains unclear and so far no qualitative investigation has been carried out.

Increasingly, scientists are also asked to actively participate in communicating their results (science week being one good example). This is often interpreted as a trust building form of interaction (if people know the scientists, they might trust him/her as a person, and thereby their science).

Belgium

There are a number of different roles played by the various actors and stakeholders in the promotion of science and technology in Belgium. Regional public authorities play a triple role: as main authors of the political discourse, as initiators of activities and as a source of direct and indirect financial support. Universities try to improve the image of scientific curricula and have another long-term objective: to promote science communication as a “service from university to society” which is now integrated in a broader approach to the role of each university within the city and its local community (so-called “third assignment” of the universities). Universities are also, in Belgium, the main actors in the production of scientific knowledge and expertise.

Industry has been playing an increasing role in sponsoring PUST initiatives undertaken by public bodies: TV-broadcasts, science centres, technology week, etc. Some high-tech industries take part in science and technology weeks on an equal basis to universities and public research centres. They have several interests: improving their

image, expressing their own opinion about controversial matters, attracting more S&T-skilled people into industrial jobs and influencing public policy. Press and audiovisual media appear as a weak actor (their initiatives rely on external resources), but as a key mediator. Non-profit cultural or educational associations are increasingly active in the PUST area, mainly in order to develop specific tools and topics for the youth. Social movements, such as environmental groups, citizens groups and patients associations play an important part in the dissemination of knowledge and in animating thematic debates.
Relative to what happens in other European countries, some actors are nearly absent in the Belgian PUST landscape. There is no “reference report” on scientific culture and science communication put out by any Belgian institution or authority, and well-known scientific personalities do not intervene in this area. Academies of sciences are not active in the PUST area. There is no national scientific institution such as CNRS in France or TNO in the Netherlands, as universities are the main public source of research and knowledge. Although industry is an increasingly active sponsor, there is no big industry-owned PUST infrastructure, such as Evoluon (Philips) in Eindhoven, NL. Most of the popular science books and journals that are sold on the Belgian market are published in France and the Netherlands.

France

The main actors in CST are universities, research institutions, ministries, private institutions, museum and science centres, the media and citizen movements. In 1982 and 1984, two laws charged scientists and academics with a new assignment: "to diffuse CST towards the whole population, and particularly towards young people". However, the present trend is to professionalise CST actions through the creation of public relations or/and media departments in each research and education institution.
Big public and private companies such as COGEMA (responsible for exploiting nuclear energy resources), EDF (Electricité de France), the Pasteur Institute and Aventis have become active in the diffusion of scientific and technological information. These actions are part of their "R&D politics" and the communication is in the hand of professionals.

Portugal

Most Portuguese citizens are familiar with a diversity of forms of expert or professional knowledge derived from science. "Lay" citizens often identify these forms of knowledge with the socially relevant and "practical" face of science. They include all activities which relate knowledge to problem-solving applications. Medicine, engineering, computer engineering, psychotherapy, environmental management, forensic science, social work, architecture, urban planning and science teaching are just some of those activities that come to mind. These professional activities appear as crucial mediations between citizens and science. Most encounters between "lay" people and scientific knowledge on a daily basis are through these expert or professional practitioners. These practitioners are situated in an ambiguous position mediating between science and the public. While scientists often regard practitioners as mere "appliers" of knowledge developed in research units, to the public these professionals are the embodiment of scientific knowledge.

Sweden

The main actors of promoting in Swedish PUS are the government and their different councils. Many of the PUS initiatives start at a governmental level, in some cases as legislation (The Third Assignment) and in some cases as recommendations (as from the Science Council). Other very important actors are universities and colleges, museums and science centres. These are often essential to more local and regional PUS activities, as are science festivals and weeks. There are also a number of important non-governmental organisations influencing the Swedish PUS landscape: Greenpeace, *Svenska Naturskyddsföreningen* (The Swedish Society for Nature Conservation (SSNC)) and *Arbetarnas Bildningsförbund* (The Adult Education Organisation of The Workers (ABF)) are three influential actors.

United Kingdom

There is such a vast "industry" devoted to PUS in the UK that it would take a lengthy directory to list all the relevant actors. Animated by the Bodmer report of 1985, the British PUS movement grew and spread until today it permeates virtually all parts of the scientific establishment, the media and education. It is impossible to do justice to the extensive PUS movement in the UK in a short report, especially as so much activity is organised in "bottom-up" fashion by schools, universities, research institutes, companies, industrial and professional associations, museums, libraries, the media, the arts and letters, community associations, charities, regional authorities and individuals. PUS activities are mainstreamed into research council projects, funded by special programmes, included in public consultation exercises as well as built into mainstream cultural institutions and the corporate execution of public relations.

10. Science as Power

With the conceptualisation of contemporary society as the “knowledge society”, the importance of science (and technology) as a force of economic hegemony and industrial competitiveness has been accentuated. In this context, the representation of science as power has increased while the traditional picture of science as objective truth seeking has diminished.

Austria

The fact that, until recently, there were almost no PUS activities in Austria and that science was not viewed as a major factor in national power or performance, are seemingly inter-related. Science as a "national good" is only present as a peripheral idea. In the emergence of PUS initiatives there has been a quite strong connotation of enlightening the public, which has steadily grown in importance. Simultaneously, techno-scientific controversies have had a strong triggering influence on the development of the PUS landscape. Thus we are confronted with a rather contradictory situation full of tensions: On the one hand science and technology are put in question hinting at the fact that more and more refined interactions between science and society are needed. On the other hand science communication is put in place with the view of making people accept and support techno-scientific developments also as a form of social progress.

Belgium

Political discourses attribute an important role to technology in restructuring the economy and in promoting growth and welfare, in both Flanders and Wallonia. Policies of both main Regions strongly rely on new technology: synergies between industries and universities, focus on applied research, support to innovation at the enterprise level, etc. Surveys of the attitudes of citizens towards science and technology show that they are rather confident in the potential of science and technology for growth and welfare, but that they are also aware of risks or negative consequences such as unemployment or environmental damage. Confidence in scientists is tempered by the wish to impose ethical standards on the conduct of research.

France

CST became part of government policy related to science and technology in 1981, promoting actions that would thereafter leave their imprint on most CSTI activities. The general policy was aimed at putting French science technology at the international forefront. A large Ministry of Research and Technology was created and two laws were enacted in 1982 and 1984 that charged scientists and academics with the assignment "to diffuse CST towards the whole population, and particularly towards young people".

Science shops have been important in helping people defend themselves against negative consequences of scientific, technological and industrial developments. Conceived as negotiation spaces, they provided counter-expertise with which to challenge industries' and institutions' expert assertions. Science shops were rapidly replaced by other, rather uncritical structures: the Cité des sciences et de l'industrie de la Villette and the Centres de Culture Scientifique, Technique et Industrielle, products of the very same policies yet playing quite a different function. These new institutions demonstrate that science and technology enjoy a prominent place at the centre of French society, and that the promotional character of CST is still robust, despite the public controversies.

Portugal

While other European countries have used science as a tool to bolster democracy, as well as to support industrial development, Portugal has lagged behind. Modern and contemporary history has shown that the efforts of a few to promote scientific education and research, most often inspired or guided by examples or models coming from abroad, faced strong resistance at both political and social levels. Therefore, Portugal has not been a scientific innovator, but rather a receptor of models and methods created in countries better equipped and more powerful economically and technologically. Nevertheless, broadly speaking, the Portuguese scientific community has been attentive to major scientific developments occurring outside.

Though showing an upward trend since the mid-eighties, financial investments in R&D are still low by European standards. Growth has been accompanied by a change in the relative position of universities and State laboratories. Universities have in recent years acquired a large degree of autonomy and have become the most important performers of R&D.

Nowadays, the relationships between the scientific community and the State are still distant from the Northern European pattern, with its stronger reliance on scientific expertise for policy purposes. However, other aspects of the presence of science in the Portuguese society appear to be approaching the European pattern. This is the case, for example, concerning the role of the mass media in the diffusion of news about science and science policy. Science has indeed became a visible item in Portuguese society, especially in the context of some science-based public controversies on environmental and public health issues which arose in recent years.

Sweden

Science has traditionally been regarded as important in the Swedish society. One aspect is in science's relation to the role of education in Sweden and in turn education's role in democratic society. In addition, there has also been a long tradition of using science in rational governmental decision-making process. Nowadays, the position of science in Swedish society has acquired economic justification as well.

During the 20th century, Sweden was transformed from a country with a important agricultural community to an industrial society and in the last few decades industry has become increasingly dependent upon research. The growth in employment opportunities for researchers and technicians has increased the number of young people going into science. As researchers have power over the knowledge disseminated in the educational system, they are important in policy formulation, yet at the same time researchers are increasingly working in private sector.

United Kingdom

The UK has been a leading country in terms of explicitly identifying science and technology as key contributors to “wealth creation” and the “quality of life”; these two parameters in turn defining governmental responsibility for the national welfare. However, that the Office of Science and Technology, responsible for almost all funding for the “science base” (research councils etc.), resides in the Department of Trade and Industry is one indicator that S&T are viewed primarily in terms of their contributions to the national economy.

Science as power in the UK is best understood through a critical examination of the foresight process. The first Technology Foresight exercise was initiated by OST in 1993 with the aim of identifying technologies likely to emerge by 2015 that would have a significant impact on wealth creation and the quality of life.

Technology Foresight was designed to marshal the intellectual resources of UK experts in research, technology and “exploitation”, significantly broadening the range and degree of input by the expert community into innovation policymaking. As such, it was not intended to include, in a substantial way, consultation with end users or representatives of the general public. “Quality of life” issues were treated equally with those associated with “wealth creation” in the context setting part of Foresight, but tended to fade in the substantive parts of the exercise, and to disappear almost entirely in the outcomes. The most obvious of questions (How does one reconcile conflicting objectives of, say, industrial competitiveness and environmental quality?) were left unaddressed.

Although the word “technology” has been dropped from the UK’s Foresight Programme, and social actors have been increasingly consulted, the actual decision making process remains firmly in the hands of those expert, industrial and governmental actors who have traditionally shaped S&T policy.

STS and PUS

In this chapter, we have explored the ways in which different aspects of the science-society interface are expressed and understood in the six European countries of the OPUS project. By focusing on ten comparative aspects, we have attempted to illustrate similarities and differences present in the context of national cultures and national STS communities' own analyses of the science-society dynamic.

Such is the complexity and variety of the position of PUS in different national contexts that it is extremely difficult to derive simple yet meaningful conclusions. One conclusion, however, clearly emerges; that the relationships between science and society at European level will not be manageable through a single, unified approach. Greater understanding of PUS in the other nine Member States, and in the ten accession countries expected to join the European Union in 2004, will be essential if public understanding of science is to be optimised in Europe.

CHAPTER 6

"One science - many Europes?" On the difficulties of transferring experiences in science-society interactions

Ulrike Felt

The aim of this chapter is to investigate and reflect the possibilities and limitations of transferring experiences in the domain of Public Understanding of Science across Europe. I regard it as an important aspect of our work not only to analyse the different ways in which science and society meet in the various national contexts, but also to investigate how specific PUS-experiments – which were judged in one national/local context as successful – could be transferred and taken up in other countries. This is central, as the building of a European Research Area would also mean facing the challenge of communicating and interacting with broader publics in very different (and soon even more diversified) cultural, social and political settings on issues that are linked to science and technology.

My reflections will be organised around four questions. I will start by asking: Why does it make sense in an increasingly globalised world to investigate science-society interactions on the national level? Then the focus will shift to export-import relationships with regard to PUS-models and what that tells us about relationships of power in the technoscientific domain. The third aspect will deal with the question of how to understand the process of transferring PUS-models. And finally the limitations and possibilities of boundary crossing for such models will be discussed.

Why does it make sense in an increasingly globalised world to investigate science-society interactions at the national level?

The title „One science – many Europes" was indeed chosen for this chapter in order to remind the reader that we have argued right from the beginning that while science and technology have managed to construct a rather homogeneous system of knowledge production and exchange which understands itself as global, the communication of science to wider publics as well as the public up-take of science and technology remain largely tied to local settings. This statement would even hold when looking at media like the internet, TV or certain journals and newspapers that have become internationalised and are not bound to the territory of the nation state. People have to interpret the information and knowledge they are confronted with, they balance it against other existing experiences and forms of knowledge they possess and finally integrate it or not into their existing knowledge systems. In this process of interpretation and evaluation local contexts, which means the direct cultural environment people live in, the social identities they hold, and the other value systems they are part of, play a central role. In that sense of cultural diversity, multiple social worlds and different histories I speak of “many Europes” in the title of this chapter.

Indeed the national contexts we analysed are neither easily comparable nor internally homogeneous. They have different histories of the development of the science and technology system, even the word science gets fundamentally different meanings attributed, there are different cultures of public participation in political decision making prevailing and so does also the readiness of people to engage in debates over science and technology vary. Within a national context, though the situation is rather heterogeneous, one can say at the same time that a certain set of implicit understandings about science-society relationship have emerged. They find themselves framed in different notions such as Public Understanding of Science, Public Awareness of Science or *culture scientifique et technique*. In that sense any initiative aiming at interactions between technoscience and society, which takes place in a given context will be confronted with the logic, the expectations and values embedded in the respective notions.

Trust or distrust in science, what is regarded as relevant expertise or not, what seems an adequate way of treating a question or not, what gains credibility or not will thus be judged against this background. As much of the political decisions with regard to science and technology are still taken on the national level, these mechanisms become powerful there.

In order to be able to further refine the reflections I would like to introduce an important differentiation between *public understanding of science* and *public understanding of science in society*. The first notion would stand for the way people perceive, judge and position themselves towards technoscientific developments, while the second describes citizens’ perception of the role and impact of technoscience in society. Indeed the national profiles of science-society interactions did not only differ on the level of PUS activities, but also the “culture” of questioning and reflecting science in society showed large variations. Thus what people know about science and how they perceive science and society interactions are two rather distinct perspectives. Indeed in our sample we found quite striking differences in the readiness to engage in public debate about “science in society”. In the Austrian case, to take one example, over recent years one can observe an increase in the activity around communicating science, but very little that would open up the reflection on science in society. The spectrum of initiatives that was developed reflects this aspect clearly. To generalise, one can say that the readiness for a systematic reflection of the impact of technoscience on society, depends very much on how society and public discourse is

organised in a specific socio-political context and thus national differences play a non-negligible role.
Finally, one has to be aware of the fact that no kind of transnational forum exists in the European context so far, which could become the arena where the relation of science and society can be debated and negotiated. This is still the case although increasingly technoscientific developments and regulatory issues are dealt with at a level, which goes well beyond the individual national contexts. Discussion within the national settings somehow replaces these transnational mechanisms. Indeed there are debates that try to address this problem on the European level, namely those who see the internet as one possible way of realising a cross-European democracy through electronic voting and consultation systems. However so far the internet has not really managed to gain the credibility and weight in the political process which would move this idea close to a political reality.

To sum up, I would argue that the understanding of the differences and variations between and within national contexts is essential to manage the taking of a first step in the construction of a common scientific Europe.

Export-import of PUS-experiences as a mirror for power relations

In fact when studying the discourses in the six different countries on PUS we realised that we seem to have countries who understand themselves and are partly understood as "leading with regard to PUS-initiatives" while others are attributed the role as followers. To make it more explicit: the UK is often cited as an example for initiatives in other countries. The Netherlands appear as the creator of the science shop movement, Denmark stand for the consensus conferences and France is always linked to the more "culture-oriented approach". Other countries like Austria or Portugal mainly get the role of followers which try to take up the initiatives developed in other contexts. This division in leaders and followers is often also matched with the vision a country has about its science and technology system. In that sense it is not only linked to the public understanding of science, but also to the science system itself and one could therefore put forward the hypothesis that the PUS system reflects somehow the societal position of science and technology as a whole.
This idea of leading countries and followers however is closely linked to the idea of best practice in this domain. Talking about transferability often leads to a tension between a pleading for cultural diversity, different interpretations and the importance of localities, on the one hand, and normative judgements about the quality and success of the experiences to be transferred. Concerning the selection of PUS initiatives which are taken up in other contexts generally those are chosen which managed to create broad acceptance in their initial national or local setting, so to speak those that had passed the "reality test". They can thus build on a certain degree of legitimacy once transposed

into another context. The risk however remains that through these processes of transfer and through the creation of leader-follower relationships new kinds of rather rigid implicit norms are created which limit the possibilities for future development. Talking about good practice always has these two sides: one wants to make others benefit from a functioning setting of science society interactions while at the same time such an approach would tend to forget the context of its success.

Here a rather tricky question comes up: What can be regarded as a successful PUS initiative, using what kinds of criteria and defined by whom? The rendering visible as well as the reflection on such criteria seems important if one wishes to avoid a transfer of models or initiatives that may have concrete meanings at one level, while being completely unrecognisable at another. Here one should start by insisting on the fact that such criteria of success – when taking a closer look – may look quite different even in the same national context. Part of the actors in the PUS domain try to account for the success of an initiative in quantitative terms, i.e. how many people visited, read, watched, ... the public representations of science. Others want to "measure" public understanding of science in terms of increased capacity to answer to "knowledge-questions" through the use of standardised questionnaires (like Eurobarometer surveys, or visitor studies in museums). Or do we define as quality that people took their time and confronted or engaged with technoscience and thus started to negotiate their knowledge with scientific knowledge. To decide on these criteria and to operationalise them, i.e. to make them „measurable", becomes indeed a difficult if not impossible undertaking. The debates linked to the Eurobarometer results are a good example. While the communication activities of science and technology have increased strongly over the past years, the results of the Eurobarometer surveys did not change in any significant way. In a quiz-like situation as it is simulated by the questionnaire used, one mainly measures if people are sufficiently well conditioned to give the „right" answers. This clearly points to the difficulty of defining and measuring success in any straight-forward manner.

These mentioned differences in what could be used as a measure for the „quality" of a PUS initiative reflects however also the place that each actor occupies in the field and the actions they are involved in. While museums tend to measure their success in terms of number of visitors, the visitors might have very different criteria to judge the quality of the setting and finally an analyst would again formulate other expectations towards a science museum. Did it have too much or too little „scientainment" elements, do we measure it in terms of „people have changed their minds" as some visitor studies do, or do we simply want to have visitors come back as science communication has become a commercial segment as many others.

The criteria would have to shift the moment we look at initiatives like science cafés or citizen conferences. Here we are generally confronted with relatively small groups of citizens and the quality lies in the very fact that they engage with science. But how to decide if the investment in such structures „was worth while“. Critics of citizen conferences have underlined, that while this can undoubtedly be an enriching experience for the selected citizens, it remains unclear how the impact on society could be determined and who would be represented by these „ordinary citizens“. The difficulty one has to face is to assure credibility for such a setting both on the side of the citizens as well as on the political level. The success lies not so much in the method itself – which could be ever more refined – but in the fact if a PUS activity manages to become a recognisable object for policy-making and for society at large.

To sum up, we can say first that any evaluation which would justify the transfer of a concept should take the very core of an initiative as a starting point: i.e. what is the political paradigm behind the communicational setting, what are its functions, what are its embedded meanings, and many more. Second, any attempt to transfer models or initiatives should consider both the contexts in which they have first appeared and the contexts in which they will be transferred. In short, we should be modest enough to say that models or initiatives are not transferable everywhere. For instance, the importation of the model of the Science Shops to France in the early 1980s can be considered as a failure, despite the efforts made by local actors to make the meanings and interests of such initiative visible to the publics and to institutions. But it would be misleading to base any transfer only on the success that a model or initiative has had in a specific country.

Transfer as a process of reframing: The success and power of linear models

The third group of observations which will help to better understand the issue of transferability, aims at grasping the conditions under which transfer can take place successfully. Indeed when looking at our cases, one quickly realises, that all those undertakings which are constructed on the logic of the linear model, can more easily move from one context to the other, while the settings which aim at more multidimensional interactions have witnessed difficulties or underwent serious adaptations up to the point that the basic idea was not followed anymore. Why is this the case? Indeed in such linear communicational settings generally the focus of attention is directed on the production side and not on so much on the up-take side. The communication is not produced in the local setting it is only received there. In the case of more interactive settings it is the people themselves who become actors and shape the communication. This however – as we outlined above – is linked to traditions of participation, in a particular cultural context. Thus to make people engage with science, they have to recognise the setting and feel comfortable with it.

In this sense the process of transferring experiences has to be seen as an act of reframing, which has to make visible the implicit structures and values embedded in a particular procedure or setting. Notions like “consensus conferences” are thus something but “container notions”, which set a frame, but still need to be filled with meaning in a given setting. We have seen for example that the model of the consensus conference, to stay with this example, did not “survive” its transfer to the Austrian context, as the political setting was not ready to enter the same set of rules as they had been defined in the Danish case. Too little political independence, no sufficient representation of important segments of the population and virtually no attention was paid to it by the media. Similar shifts could be observed when the science shops were taken over as a concept in France.

Limitations and possibilities of boundary-crossing

Having outlined all the different limitations for successful concepts to cross national boundaries and get implemented, one could ask the question whether or not it makes sense to analyse the different structures of science-society interactions, to compare them and to destill out of that interesting concepts to be developed further on the European level. To this questions I would like to formulate two types of answers. The first would stress that through the transfer of models and the frictions that occur and the changes that are to be made in order to be acceptable for the new context, one is able to learn much about the implicit values and forces at work, both about the context where the model initially comes from, but also about the context it is now embedded. In studying these transfer problematic one gets a much more refined picture of what happens in these particular setting, the tacit dimensions becomes visible for a short moment and debate can be engaged about the political paradigms behind such initiatives.

The second type of answer would be that in fact we should speak far less about good practice, as a ready-made form of interaction, but should conceptualise it on the one hand as an understanding of the pathways that have led to the crystallisation of particular practices in the field of PUS at a given point in time and in a particular local setting, while on the other hand the initiatives carried out and the experiences made with it should be perceived as a toolbox or as a system of building blocks, which offers nothing but the necessary ingredients that would have to be put together following local recipes.

This second answer has in fact two clear consequence: first, it is necessary to investigate better the side of the experiences made, to develop open methodologies to evaluate what happens in such communicational setting and to understand the processes of how a particular constellation becomes a lively ground for engagement and exchange between science and society. Thus at the centre of our attention should be the process not the product. Second, actors at the science-society interface would have to be creative and to develop their own hybrids, adaptations or radical innovations, with the risk of not being able to easily claim credibility for a setting just because it worked out well in a different context, but with the potential of contributing to the creation of what the French call so nicely “mise-en-culture de la science”.

CHAPTER 7

Science and Citizenship in a Constitutional Europe

Josephine Anne Stein

Introduction

As Europe prepares to constitute itself as a sovereign entity with legal personality, the challenges of democratic scientific governance in Europe are compounded by the immature state of European citizenship in combination with the precarious state of public confidence in science. The implications of scientific and technological research are however so profound across a broad spectrum of public issues, to say nothing of the governance structures themselves, that it is highly important to address science/society relations in the context of the new, Constitutional Europe.

European Science

Most European citizens are unaware of the extent to which science is conducted at European level, even if they do recognise the international character of science and acknowledge the presence of "foreigners" in their universities and laboratories. Citizens may be aware of the role that the EC/EU plays in producing regulations, which are more often than not reported in a derogatory way in the national press; we have all seen the tabloid "Euro-banana" stories. However, most citizens are unaware of the scientific and technological expertise that informs the process of regulatory development; most also do not realise the extent to which European science complements and reinforces research done in their own countries on a national or regional basis. Scientific and technological research conducted at European level, through collaboration amongst laboratories almost entirely emplaced in national institutions, is practically invisible to the citizen.

What is "European science"? At its most basic, it can be conceived as the ensemble of scientific organisations, policies and programmes operating at European level[812]. It consists of European research projects and the consortia that have been brought together by the Framework Programmes and other such programmatic S&T

[812] As part of the SEGERA project, funded by the EC STRATA programme, research is currently under way at the University of East London on knowledge dynamics at European level. Part of this research includes mapping and characterising European scientific institutions and organisations.

cooperation, but also the networks, R&D facilities, the professional societies, and the various exchanges and cooperative ventures between European universities and those involving corporate and public research laboratories. It also comprises major scientific installations such as CERN, which has more of a public profile, not only for its physics but as being the "birthplace" of the World Wide Web.

But there is more to European science than institutions, organisations and official activities. These are complemented by a myriad of scientific collaborations between individuals in Europe, spontaneous mobility of researchers, coauthored publications, intra-European conferences, awards, and so forth. Many of these are bottom-up activities which are not documented, but the internationalisation of the research workforce, whether in academia or in industrial laboratories, is apparent to any participant or visitor. Scientific internationalisation of course extends to countries around the world, but with the geographic, political and administrative orientation of so much scientific activity shaped by European programmes and institutions, there is something identifiably "European" about the scientific culture in Europe.

This European scientific culture has been emerging as part of the shared experiences of researchers and students participating in all of the institutions and activities mentioned above, an experience that is aligned with the broader processes of European integration. It is shaped by the European notions of mutual recognition, common purpose, acceptance of diversity, distributed responsibility and dynamism that characterise not only scientific practice at European level, but the European governance structures themselves. With the establishment of the European Research Area and the new instruments of the Sixth Framework Programme, the institutional relations of research bodies will further evolve, which will in turn reinforce the European scientific culture. These processes are expected to intensify with the adoption of a Constitution for Europe.

Constitutional Europe, science, technology and citizenship

The history and development of the European Union has evolved through a succession of treaties, starting in 1951 with the six-member European Coal and Steel Community (now expired), and through enlargement to comprise the fifteen Member States currently in the European Union; a further ten countries are expected to accede in 2004. Science and technology have been a part of the European integration process from the very outset.[813]

[813] Stein, J.A., (2002), "Science, technology and European foreign policy: European integration, global interaction", *Science and Public Policy*, Vol. 29, No. 6, pages 463-477.

When in June 2003, the European Convention published a draft Constitution establishing the European Union as an entity with legal personality,[814] a public debate was launched on the future structure and competences of European governance. Earlier drafts, although they had been in the public domain since October 2002, had received minimal attention in the press.

The draft Constitution makes early reference to science and technology, stating in the Union's objectives: "It shall promote scientific and technological advance." (Article I-3.3.) The legal basis for European research is largely unchanged, with the exception of adding space research as an explicit category[815]. The Framework Programme remains at the heart of European RTD policy, but the provisions of ex-Articles 168 and 169, which allow for supplementary programmes, are strengthened by principle of “enhanced cooperation” (Article I-43). The EU may participate in multilateral programmes run by groups of Member States, a provision currently being tested as part of the 6th Framework Programme. Other supplementary programmes may be included within the Framework Programme, by countries wishing to “opt in” with the possible participation of the EU itself, the participating entities committing the financial resources.

Research is also built into the common European security and defence policy, in the form of a European Armaments, Research and Military Capabilities Agency (Article I-40.3), which would be open to those Member States wishing to be part of it. It would, *inter alia*, support defence technology research, coordinate and plan joint research activities, and support studies of future military operational needs.

Representative democracy is seen as a cornerstone of the Union, and under Article I-44 of the draft Constitution, “Decisions shall be taken as openly as possible and as closely as possible to the citizens.” But what does citizenship in Europe really mean?

Citizenship in Europe

European integration has been accompanied by an extremely complex set of reforms to governance regimes within and between the Member States. In Belgium, Spain and the UK, for example, constitutional and other reforms have conferred new powers to regions and/or linguistic communities. Currency unions, first between Belgium and Luxembourg, and more prominently with the introduction of the euro in 2001 in twelve of the EU Member States, have changed and complicated the relationships between

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[814] The draft version of the Constitution to which this paper refers is CONV 797/03 of the European Convention, Brussels, 10 June 2003.

[815] The articles on research and technological development, and space (Section 9 within Title III) are largely unchanged from those currently applicable (Articles 163 – 173), except for article 172, which is replaced by Article III-150; this provides for a European space policy to support research and technological development related for the exploration and exploitation of space.

citizen and government. Meanwhile, globalisation processes affect many aspects of economic and daily life. Although national systems, politics and identities dominate everyday life and discourse, the complexities that have emerged from so many different types of decision-making structures have been reflected in the changing relationships between democratic actors.

With the Treaty on European Union (Maastricht, 1993), European citizenship was established; with the new Constitution the European Union will have legal personality and European citizenship will acquire new meaning as it become more formalised. However, despite the increasing importance of European legislation in its transposition into national law, links between the ordinary citizen and European processes are practically non-existent. Knowledge of European institutions and the highly complex and arcane legal and policy processes is minimal even amongst the highly educated; all of the major European Parliament political parties are artificial constructs that bear little relationship to the more familiar politics within the Member States.

One consequence of the increasing complexity of democratic systems within Europe and the unfamiliarity of European legal and policy processes is that "Brussels" seems ever more remote, anonymised and centralised. The services of the European Commission, perceived as a huge bureaucracy, are often smaller than their counterparts in the Member States; their capacity to engage with the public is extremely limited in practice. Ironically, the only directly elected European body, the European Parliament, is currently unable to introduce legislation; its powers are restricted to giving opinions or assent in some cases, amendment in others, and co-decision with the Council of Ministers in other areas.

Despite the discourse emanating from within the European system, the state of European democracy is embryonic. The European institutions, most prominently the Commission, issue a huge volume of information in the form of free publications, Websites, press notices etc. The Commission's ethos is one of relative openness compared to most national administrations in Europe, with information officers, public discussion fora, on-line "surgeries" with European Commissioners, and other forms of public engagement in place. However, they seem to have succeeded better in attracting lobbying organisations and expert consultants to Brussels than in effecting a genuinely substantive direct intercourse with the public.

Recognising the difficulties in direct engagement with the public, the European Commission presented a report, "Democratising Expertise and Establishing Scientific Reference Systems" in 2001.[816], which focused on the role of expert advice but recognised the importance of improving "the interactions between expertise, policy

[816] Working group 1b (R. Gerold and A Liberatore, 2001) "Democratising Expertise and Estabilshing Scientific Reference Systems," report of the Working Group in area 1 of the White Paper on Governance, *Broadening and enriching the public debate on European matters*, May 2001.

making and public debate." One stated objective was "to deliver knowledge for decision making that is '**socially robust**'."; another was to achieve "**effective interface and networking between risk assessment and risk management**" (emphasis in original in both cases.) The proposals included measures to open scientific advisory meetings to stakeholders and to the general public, to explain as part of the policymaking process how expert advice was used in reaching a particular decision, to promote the use of various mechanisms, such as citizens' juries, consensus conferences and participatory foresight.

The efficacy of such public involvement clearly depends upon the extent to which the public are equipped, with knowledge, rhetorical and other skills and support mechanisms, to engage with and influence the policymaking process. Public Understanding of Science, in other words, is a precondition to effective democratic governance related to science, technology and innovation.

The state of European PUS

Until the 5th Framework Programme, Public Understanding of Science activities at European level have been very limited, and they have largely conformed to the deficit model of expert-lay relations. Eurobarometer surveys began, in 1973, to test the knowledge and opinions of European citizens. Two major general surveys on science and technology were done, in 1992 and 2001.

The Eurobarometer survey of 2001[817] surveyed over 16,000 people on their attitudes towards science and technology, covering topics such as knowledge, values, confidence, the accountability of scientists, science as a vocation, European scientific research, and GMOs as a particularly germane topic. Some of the main results were:

- Europeans consider themselves often poorly informed about science and technology, although 45.3% have an interest in S&T;
- The actual level of scientific knowledge had hardly changed in the ten years between the surveys, with the exception of a few specific questions (*e.g.* on viruses and antibodies);
- Many feel better informed about topical issues such as the greenhouse effect and BSE "mad cow" disease, while other areas, such as nanotechnology, remain obscure;
- Medicine and the environment are the topics of greatest interest, with most obtaining information from television, and only 11.3% visiting S&T museums;

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[817] European Commission (2001), Research Directorate-General, Europeans, science and technology, EUROBAROMETER 55.2, December 2001.

- While the overall attitude towards science remains positive, S&T are no longer considered panaceas; problems need to be addressed by other agencies such as public social and environmental policies;
- There is strong support for basic research, even if only to further knowledge (75.0%), support which increases to 83.2% if the aim is to develop new technologies;
- 80.3% of the respondents believed that scientists should be obliged to observe ethical rules, but were almost equally divided on the statement, "*scientists are responsible for the misuse of their discoveries by others*", with 42.8% in agreement and 42.3% in disagreement;
- Of the three S&T-related professions most highly regarded by Europeans, doctors come first (71.1%) followed by scientists (44.9%) and engineers (29.8%); however, in the event of a disaster more trust is placed in scientists (62.7%) than doctors (55.3%);
- The most significant demand with respect to GMOs is for information, both scientific and in food labelling, and almost 60% believe that GMOs may damage the environment;
- Science as a career is seen to suffer from the lack of appeal of the subject to young people, its difficulty, and poor career prospects (although just under 30% believed this was due to science's poor image in society);
- When asked what areas are covered by the EU, over half of the respondents identified agriculture, international trade and the environment, followed by foreign affairs, defence, science and technology (38.2%) and energy. Fewer than one-third identified consumer protection, employment and social affairs and regional development.
- Most respondents wanted the EU to increase its activities in consumer protection, employment and social affairs, energy and science;
- The three measures seen as most likely to improve the level of European research did not include the level of investment in science, but improving cooperation between European researchers (84.1%), coordinating research (80.4%) and improving cooperation between public research and industry (78.7%);
- While 62.7% of respondents believed that enlargement would benefit the scientific potential of the candidate countries, 53% believed that the process would also benefit existing Member States.

A second Eurobarometer survey of over 16,000 people was conducted in 2001, on behalf of the Directorate-General for Energy and Transport, on the controversial topic of radioactive waste.[818] The results were not encouraging, with for example almost half of Belgian respondents considering themselves "not very well informed." While 32% of Europeans expressed confidence in independent scientists and 31% in what they hear from NGOs, EU bodies were believed by only 11% of the population; only the nuclear industry itself fared worse, with only 10% expressing confidence in their veracity.

As part of the implementation of the European Research Area[819], the Council of Research Ministers of 26 June 2001 requested the Commission to prepare an action plan to improve science/society relations at European level. This *Science and Society Action Plan*[820] was presented as supporting the strategic European goal to become, by 2010, the most competitive and dynamic knowledge-based economy in the world. In reference to the 2001 Eurobarometer survey, the Commission recognised "that "Europe's citizens do not always have a very positive perception of science and technology, and that science is remote for some sections of the population."
The Action Plan articulated three specific objectives:

- Promote scientific and educational culture in Europe;
- Bring science policies closer to citizens;
- Put responsible science at the heart of policymaking.

which would be brought about by acting as a catalyst, using all available instruments but also seeking to work in coordination with the Member States.
The document outlined 38 specific actions covering a very wide range of approaches and objectives. It is an extremely ambitious agenda. In some respects, it "inherits" activities from existing programmes and consolidates them under a new banner. One of the main predecessors to the Action Plan was the "Raising Public Awareness" theme introduced in the 5th Framework Programme. Activities supported under this programme include, *inter alia*, the Alpha-Galileo service providing S&T-related information to the media and the Descartes Prize in scientific excellence for society, awarded to projects that both address the concerns of citizens and contribute to Europe's competitiveness – and the OPUS project, as a thematic network.

Altogether, "Raising Public Awareness" sponsored ten thematic networks, ten accompanying measures, and fourteen activities as part of European S&T Week (designed for "showing rather than telling"). Some projects succeed in establishing ongoing networks that become institutionalised. One example is "ECSITE", the European Collaborative for Science, Industry & Technology Exhibitions, which acts as a professional organisation for science communicators, mostly working in S&T

[818] European Commission (2002), Directorate-General for Energy and Transport, Europeans and radioactive waste, EUROBAROMETER 56.2.
[819] European Commission (2000), "Towards a European Research Area", COM(2000)6, 18.01.2000.
[820] European Commission (2001), "Science and Society Action Plan", COM(2001)714 Final, published as a book by the Luxembourg Office for Official Publications of the European Communities, 2002.

museums.[821] While the OPUS project would naturally applaud the types of activities being undertaken, it is worth keeping them in perspective. From the standpoint of some of the smaller, less well-developed Member States, European-level initiatives represent a significant amount of activity. However, the PUS activities sponsored at European level are roughly comparable in extent to those organised by some of the larger Member States, and are far less extensive than the activities of the "PUS industry" the United Kingdom.

Under the Science and Society Action Plan, the levels of investment are not expected to rise significantly. The Commission therefore concentrates its proposals on information exchange, including translation, discussion fora and committees, networking, internet-based activities, evaluation and benchmarking, and raising the profile of science and technology within already-existing European promotional vehicles.

In order to develop its theme of S&T-related citizenship and governance, a number of specific actions are proposed. The first is to conduct high-profile events, "European Conventions for Science", designed to bring together "the widest possible range of stakeholders interested in science and technology at European level", modelled on the annual meetings of the American Association for the Advancement of Science. Regional S&T fora will be encouraged and supported by developing a database of qualified experts willing to participate. Thirdly, the Action Plan will support the networking of Science Shops, with an emphasis on the accession states by maintaining databases and providing promotional tools.

The Action Plan also includes plans to involve civil society, and to increase the representation of women and girls in S&T-related activities. The Commission plans to conduct regular events such as public hearings, consensus conferences or on-line interactive fora, on specific S&T issues such as biotechnology, information technology and the environment, in cooperation with the Economic and Social Committee and the Committee of the Regions. Existing activities related to women and science are to be reinforced under the Action Plan, including the consolidation of networks concerned with women, gender equality and science, and the refinement and systematisation of gender statistical indicators and benchmarking progress towards gender equality in Europe. The Commission plans to convene a group of experts to investigate career patterns for women researchers in the private sector, and another expert group focusing on the situation for women scientists in the accession countries.

Ethical decision-making and risk governance are a central theme of the Science and Society Action Plan, which picked up on the themes of social robustness in the Commission's 2001 report on "Democratising Expertise..."[822]. Specifically, the Action Plan includes measures to track and document the development of S&T-related ethical

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[821] http://ecsite.ballou.be/new/index.asp
[822] Working group 1b (R. Gerold and A Liberatore, 2001) *op. cit.*

issues in Europe, and to convene groups of NGOs, scientists, industrialists, religious and cultural leaders, philosophers and other interested groups to examine the ethical implications of new technologies on future generations, human dignity and integrity. Methods might include focus groups, deliberative polling, internet-based debates and workshops, which might address topics in bioethics, "info-ethics", sustainability and resource management. Special workshops are planned to focus on problems in the developing world. Research ethics curricular material will be developed, and networks established amongst local, regional and national ethics and animal welfare committees. Similar efforts are planned in the area of risk governance, which will include work on how best to communicate scientific uncertainty and risk issues. The latter will build upon the work of the TRUSTNET project, which analysed the factors influencing the credibility, effectiveness and legitimacy of the scientific and regulatory framework for hazardous activities. Guidelines will be developed for scientific advisory activities through a set of consultative processes, networks and workshops, to enable sharing of experience and the dissemination of good practice.

The Future of PUS in Europe

The previous section outlined the numerous ways in which the European Union supports and promotes PUS at European level, including through an Action Plan that explicitly targets citizenship and governance. It is an agenda as progressive as it is ambitious in its inclusivity. However, there are certain realities about the state of the European polity and European science that circumscribe what can reasonably be achievable by way of a European PUS. This is most easily considered in spatial terms.

The OPUS national spaces range from the geographically fixed (universities, museums) to the highly dispersed (media, internet), with others occupying intermediate positions. Government and NGO initiatives may be concentrated in national capitals or major urban areas; science festivals can migrate from one city to another (BAAS in the UK) or remain fixed (Edinburgh); consultation exercises and science weeks can be widely dispersed or highly localised.

What about Europe? To some extent, Brussels is "the capital of Europe", with the European institutions' employees and their families, and the constellation of organisations that service or otherwise interact with these institutions enlarging this mixed and often transient European population. The Borschette centre and similar venues cater to numerous conferences and committee meetings that convene in proximity to the European institutions, attracting a large though even more transient population. The architecture of European buildings such as the Berlaymont, the Justus Lipsius building and the European Parliament complex, the mix of shops and restaurants in the "European district", the international schools and the variety of community-based cultural activities, convey this sense of "Europeanness". Brussels is the site of other European fixtures, such the model Europe at Brupark, and a terminus of the "Eurostar" train.

From the OPUS perspective, it is the Atomium that is the most relevant as a symbol of European scientific prowess – and it became a rather decayed symbol of the nuclear optimism of the early 1960s. There is precedent for European PUS on a massive scale in Brussels, which could be done on the model of *La Cité des Sciences et de l'Industrie de la Villette* in Paris, and a case to be made for updating how Europe showcases its scientific activities in this "capital" city.

However, Brussels is also the capital of and an administrative region of Belgium, as well as being the seat of NATO and a great many multinational companies whose reach extends far beyond Europe. It is also home to thriving non-European communities, from places such as North Africa and the Congo. Apart from Brussels, and to a certain degree Luxembourg and Strasbourg and some border regions like Maastricht or Basel, there is little evidence of a European culture per se; cosmopolitan life is expressed through national identity of peoples from around the world. The transferability of national experience of fixed-site PUS to "Europe" is thus likely to have its limitations, even in considering Brussels as the most obvious locale.

Universities can also be quite cosmopolitan, and with EC funding, mobility programmes and curricular harmonisation (the Bologna process) some Europeanisation is apparent in academia. There is a European University in Florence, and research organisations such as large European scientific centres (European Space Agency, CERN, the European Centre for Medium-Range Weather Forecasting, JET and the Joint Research Centres), that could conceivably host science festivals or localised PUS activities with a genuinely European flavour.

At the same time, European culture is emerging in other areas, through for example the European Champions League annual competition in football, Grand Prix motor racing, the techno-music of the “Ibiza culture” and the Eurovision Song Contest. To the extent that “science as culture” informs the conceptualisation of Public Understanding of Science in France and other European countries, it is important to consider in how PUS could contribute to the construction of a European identity.

Europe could, like the UK, support science festivals in different cities in different years, possibly by incorporating PUS activities into the existing peripatetic "European City of Culture". NGOs like the emerging EUROSCIENCE organisation, the European Science Foundation, the Academia Europaea, and standing European bodies such as research associations that are outgrowths of COST, Framework or EUREKA activities could contribute a European component to such localised activities.

However, it is in dispersed activities that Europe is probably best able to absorb and/or to develop its own PUS profile. There being very little by way of a specifically European media, it is through the internet that European PUS may best be able to develop a profile. In this regard, an interactive virtual space may prove interesting; it could accommodate the different European languages through translation more easily than spoken communication through interpreters. The Commission already holds "surgeries" in which a Commissioner surrounded by terminals and translators is available to respond to e-mail inquiries for a couple of hours -- much like the OPUS virtual meeting. What about advertised Internet chats with eminent European scientists (including winners of European prizes)? Other ideas include:

- The UK national lottery has raised a very large sum for a national network of science centres – John Durant claimed this is 'the largest and most important experiment in science communication ... [the UK] ... has ever undertaken'; what about a European lottery for PUS?
- European consensus conferences modeled on *national* precedents, perhaps to include an element of internet-based citizen research, expert input and deliberation?
- Internet-based discussion groups on the public acceptability of new technologies (learning from the difficulties encountered by technologically deterministic, economically-driven producer attempts to market HDTV, 3rd generation mobile phones, wind power)?
- Promotionalism of European research news through the mainstream, national media in addition to the sorts of Commission-produced publications (such as CORDIS *focus*) that are not widely read?
- A more interactive scientific advisory system based on Websites inviting public questions and comments?
- Sponsorship of S&T discussions in pan-European fora such as trade union conferences?
- Sponsorship of European citizen initiatives related to S&T issues?

Many of the above ideas already fall within the scope of the Science and Society Action Plan; others are natural complements to its coverage. There are undoubtedly a great many other gaps to fill. But political realities will limit the extent to which the Commission, the European Parliament and the other EU institutions can become involved, most obviously through control of the European budget.

The challenges of PUS, science and citizenship in Europe will be even greater in the enlargement process, as so many new languages, national systems and cultures will need to be accommodated.

At a more fundamental level, there are potential pitfalls in invoking an inclusive, comprehensive consultation strategy when, realistically, limited resources also necessarily limit the extent to which consultation can reasonably be expected to work as advertised. "Short cuts" inevitably introduce compromises, as timeframes needed to reach "socially robust" conclusions often exceed the pace of scientific, technological and even social change.

Those who have spent time organising or participating in science and technology policy debates have recognised, but not solved, the problem that when a forum is organised, the desire to invite "the best" people results in a collection of familiar faces around the table time after time. A second well-recognised pitfall is in balancing the need for representational authenticity with the pragmatics of interpersonal and group interactions, which limit the numbers of participants in deliberative exercises. Thus, surveys can be used to poll large numbers of people, with accurate representation of a population, but the difficulties in interactivity or learning activities limit the usefulness of such exercises. In contrast, deliberative bodies, whether juries, committees or panels, appear to function best when between ten and twenty people interact intensively over a period of time; this limits the scope of representation and can result in imbalances and/or tokenism, whatever the selection mechanism. In the first case (conventional polling), the design of the questionnaire is all important and can either greatly influence outcomes or introduce a great many distortions. In the second case, deliberation by small bodies, problems in the selection of participants can result in the same problems manifesting themselves.

Even more fundamentally, there is a risk of over-reliance on any form of surrogate decision-making. Sequestration of deliberation and removal from the public sphere can be problematic, whether done in administrative, democratic or consultative mode.

Engaging in dialogue and/or public participation activities can also be used as a substitute for action, whereby policymakers in effect abrogate their responsibilities. Public engagement activities can also consist of pandering to the public through consultation while keeping decision-making firmly in the hands of those traditionally "in charge". Public Understanding of Science activities, if conducted on the deficit model, may have features that may seem superficially attractive but may undermine the entire enterprise if European citizens are not able to influence the outcomes of public policy decision-making.

This leads to the difficult question: how can science and citizenship co-evolve in a European democracy that is well-informed, dynamic, accountable and effective?

Political theory and S&T-related governance

The ideal of European integration arose from a determination to secure peace and to develop economic and social progress through pooling sovereignty amongst nation states and peoples that had experienced so many centuries of bloody conflict. Whilst political theory can be applied to identify elements of federalism, functionalism and transactionalism in European integration processes[823], the fact of a Constitutional Europe necessarily focuses the mind on the practicalities of implementation.

Despite the absence of the “F-word”, largely at the insistence of the British, the draft European Constitution has unmistakeably federalist characteristics. Europe will not resemble a Swiss-style multi-lingual confederation in which the principal unit of governance will be the component part (canton or Member State), however the "subsidiarity” principle is to be interpreted in practice. European legislation is already the driving force behind much national legislation in even in the biggest, most highly developed countries, and it already largely dominates legislative development in the ten countries due to accede to the Union in 2004. Europe will have a President and a Foreign Minister, each having not only the power but the responsibility for leadership of the European Union as a Constitutional entity and as a major actor in world affairs.

Those who argue that European integration has followed a primarily functionalist trajectory will see little reason to expect major changes from the technocratic approach that has characterised the operational side of European governance so far. Policy making and legislative processes in the European Union are so enormously intricate and complex, and evolving so rapidly with the negotiation of each successive treaty, to say nothing of the challenges presented by enlargement from Six to Twenty Five Member States, that decision-making is almost completely, and necessarily, dominated by experts and professionals. The draft Constitution is itself a major step in defining European union, which introduces radical new concepts with immensely important implications for European governance. Yet it is being presented to its citizens almost as a *fait accompli*.

Most political analysts would agree that the transactional characteristics of European integration, as a socially-based expression of community or society (*Gemeinschaft, Gesellschaft)*, are more of an aspiration than a reality. There is no significant European-level press or broadcast media, virtually no European-level political debate and indeed, no real European polity.

These conclusions have serious implications for the realisation of a citizen-based, truly democratic European-level system of governance, at least over the short-to-medium term. The powers of the European Parliament, the only directly-elected European Union body, are still severely restricted under the draft Constitution. This must be the only Parliament in the world which cannot itself initiate legislation (apart from invoking a new, more formalised procedure for making suggestions to the European Commission). The technocracy is not particularly adept at engaging with the public, despite the official rhetoric and the best efforts of the European Commission and occasionally other EU actors. And the, yes, federalism of a system in which the citizen cannot vote for his/her President is democratically deficient.

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[823] Rosamond, B., (2000), *Theories of European Integration*, (Palgrave, New York).

So how can one optimise the Public Understanding of Science in order to empower the new, Constitutional European citizen under this sort of regime?
It is impossible to avoid the home truth that there is a knowledge deficit about European science in the public sphere. Thus, there is a legitimate case to be made for classical, deficit model-style promotion, education, celebration, and exhibition of European S&T; the citizens have a basic right to know what research is being done in their name, with their money and on their behalf, and a basic right to information about how this research is organised and used. "Raising Public Awareness" activities at European level and the specific actions of this sort outlined in the Science and Society Action Plan are commendable so far as they go. However, with the limited resources at the Commission's disposal, there is only so much that can be accomplished. The resources of the European Parliament are even more limited.
Beyond classical PUS, however, citizens need democratic instruments with which to interact with the European science system in such a way that proper representations of social values and priorities are conveyed, heard, and acted upon.
If we look to the six Member States of the OPUS consortium which illustrate a range of science/society interactions intended to improve the democractic functioning of S&T-related public policymaking (*inter alia*), numerous examples of good practice can be identified. However, a clear outcome of the comparative analysis of national practices is that they are culturally embedded in *national* forms of understanding and social organisation. The OPUS analysis of the science/society interactions in each of the six countries has found as much to criticise as to celebrate; there are inadequacies, structural deficiencies and limitations to what is accomplished at national level. Those instances of good practice that have contributed to socially robust, democratic decision-making can and do function well, but necessarily require adaptation if they are to be transferred successfully to different national environments.
Looking again to the Science and Society Action Plan, the emphasis on consultative fora and the explicit inclusion of so many different types of stakeholders goes well beyond what is currently available and influential in the six OPUS countries. The problem here is not in the conceptualisation of science/society interaction; it is the near absence of a European *Gemeinschaft* or *Gesellschaft* with which to interact. Thus, the European system falls back upon its customary approach to representational inclusivity by nationality; to this it has, to its credit, added gender inclusivity, for example in its explicit targets for the representation of women in scientific advisory committees. The effectiveness of these discussion fora, even with the diversity of approaches included (workshops, on-line dialogue, conferences etc.), is likely to be, as in the case of classical PUS, similarly resource-limited.

Conclusion

It is a paradox, but the understanding of science and governance issues within the European technocracy may be more advanced than in any of its Member States (if we were to extrapolate OPUS results to Europe as a whole) -- yet at the same time, the capacity for this understanding to diffuse and to be taken up in democratic mechanisms supporting S&T-related governance in the European Union is minimal.

One obvious response to this situation would be to increase the resources going into implementing the European Science and Society Action Plan, both those "classical PUS" actions that respond to the real knowledge deficit that exists about European research and technological development, and those that employ tools to improve democratic participation in S&T-related public policymaking.

It would be particularly important to increase the capacity of the European Parliament to engage in these processes, as the only democratically elected institution of the European Union. This can be done in at least two ways. The most obvious approach would be to increase the European Parliament's resource base so that it can employ the staff and the expertise necessary to implement actions of its own.

A less obvious approach, but potentially a more effective one, would be for the European Parliament to join with the Commission in the implementation of all parts of the Science and Society Action Plan. This would necessitate overcoming the huge inter-institutional barriers between the Parliament and the Commission that currently exist, but it would at the same time help to overcome the constraints on the European Parliament that are still present in the Constitution. It would also bring representational democracy into the European science/society interface in a systematic way.

A central theme of European integration is overcoming barriers and differences for the common good of the peoples of Europe. If this could be applied not just to the Member States but to the institutions of the European Union itself, the combined forces of the Commission, the Parliament, and other bodies such as the Economic and Social Committee and the Committee of the Regions, the European Union could create a powerful means to effect change in Europe.

Another approach to overcoming the "democratic deficit" in S&T-related public policymaking would be to focus not only on the Public Understanding of Science in the European context, but on the Public Understanding of *European Governance,* to enable citizens to participate more effectively in dialogue and decision-making fora. A precondition for this is that the technocracy itself must improve its own understanding of these two, complementary approaches to the democratisation of science and science-based policy in Europe.

This is why better communication and cooperation between experts in Science-Technology-Society (STS) interactions and those in Science and Technology Policy (including policy practitioners) will be essential to progress in democratic governance related to science and technology. The OPUS project has, in its profiles of national

STS capacity in six Member States, demonstrated how academic knowledge can be quite isolated from real-world processes that actually shape the science/society "contract" through policy and legislation (with some notable exceptions). This is a significant barrier.

At the OPUS conference in Vienna in November 2002, "Envisioning Scientific Citizenship: Science, Governance and Public Participation in Europe", it was clear that almost none of the experts present (mostly drawn from STS and related disciplines) had more than a cursory knowledge of European decision-making bodies or processes, even those with arguably the most influence over European science and S&T-related policy[824]. There was some evidence of academic disdain for descriptive, practical knowledge (for example about European institutions and processes) over theoretical conceptualisations (such as the citizen as consumer) or more philosophical questions about the meaning of Public Understanding of Science in different cultural contexts. But if even the experts in science/society interactions don't understand European governance, how could one expect to have an informed, democratically-empowered citizenry?

Given the reality that Europe as a legal entity is evolving much more rapidly than the construction of a Euro-social culture or a European polity, it is clear that special efforts need to be made to overcome democratic deficiencies and knowledge barriers. Certainly, the many actions reinforcing European integration as an exercise in building *Gemeinschaft* or *Gesellschaft*, or in constructing a European System of Innovation, will enable the "society" element of science/society intercourse to function more democratically as time goes on. However, more radical measures are needed if the European Union is to succeed in gaining the confidence of its citizens in its legitimacy as a democratic form of governance capable of valid decision-making on S&T-related public policy issues.

The Single European Act of 1986 was a catalyst for accelerating European integration, most famously with the "1992" programme for completing the Single European Market -

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[824] Participants in a plenary session of the OPUS conference were asked about their familiarity with the "Groupe Recherche", the Conciliation Procedure and the preliminary draft Constitution for Europe, which had been published on the Internet one month prior to the conference. In each case, only three or four hands went up (one individual, a legal expert, being the only person who was familiar with all three). For the benefit of readers, the "Groupe Recheche" is an informal group of diplomatic staff in the Permament Representations of the Member States to the European Union in Brussels, who are responsible for their countries' S&T portfolios. In the runup to the Commission's preparation of the draft Framework Programme in 1997/8, this group met as often as every week to scrutinise progress on the development of the proposed legislation. The Conciliation Procedure, introduced in the Maastricht Treaty as part of co-decision between the Council of Ministers and the European Parliament, is how differences between these two institutions are resolved, in order for European law to be enacted. These are examples of highly influential, largely invisible processes in the development and finalisation of European legislation, respectively. The preliminary draft of the European Constitution, at this stage, was little more than an outline with main headings. However, the principle establishing the Commission as having a "monopoly" on initiating legislation (European Convention, 2002, "Preliminary draft Constitutional Treaty", CONV 369/02, 28 October 2002) already signalled the exclusion of the European Parliament from assuming this power.

- but also in a great number of other areas, including science and technology (through the establishment of an explicit legal basis for the Framework Programme).

A Constitution for Europe provides a fresh opportunity to give impetus to European integration. This requires vision, courage and the investment of time, money and creativity, and perhaps most importantly the transcendence of inter-institutional rivalries amongst the European institutions. But by promoting Public Understanding of European Science, Public Understanding of European Governance and scientific citizenship as the key concept linking the two, science and democracy can flourish synergistically in a Constitutional European Union.

CHAPTER 8

Concluding remarks

Ulrike Felt

We have started three years ago with the goal of exploring the idea of similarities and cultural differences in the way issues of public understanding of science or public awareness of science and technology were dealt within six European countries. Our examples were probably as divers as it could be in the European context: we had the Anglo-Saxon model present, the fundamentally different French approach, with Portugal a small southern European country on its way to catch up, Belgium as an excellent example of a national setting were the cultural boarder runs right through the country, Sweden somehow stands for the Nordic type model and Austria as another case of a small country however with a rather different cultural and a political history with clear ruptures also with regard to science and society.

What can we learn from this exercise? What are the conclusions one could draw?

These concluding remarks will only try to address a number of major issues, smaller, but also more detailed observations can be found right through the chapters and in particular also in the comparison between the national settings (chapter 5). The following reflections will be organised around five topics which seem central for further debates in the field of Public Understanding of Science and Technology in particular with regard to the European dimension of the issue.

The first aspect to discuss in some detail is whether or not, and up to what degree our basic assumption that the *local cultural contexts play a dominant role in the communication and public up-take of science and technology* can be regarded valid after our analysis and how this became manifest in our investigations. To start with one should point out that the phenomenon of migration of concepts for PUS-activities across Europe, but also between Europe and the US has been rather important. Examples for such favoured “migrating concepts” are among others Science Weeks, Science Shops, consensus conferences, but also science exhibitions. At the same time our analysis has pointed out very nicely that these concepts – if they proved to be successful – needed to be adapted to the local contexts, to be filled with cultural meaning and as a consequence to take a shape different from its original. In that sense these concepts for PUS activities behaved like classical "boundary objects" – a concept we have developed earlier (chapter 1) – which are sufficiently malleable to adapt to the local settings while at the same time being also robust and structured enough to be identified as a common object.

When observing the phenomena of transfer, the fundamental differences between the national contexts become most clearly visible. They manifest themselves in the ways in which the public sphere is organised in general and has developed over the decades, in how science and technology are embedded in the cultural terrain (e.g. do they play an important role in national identity building), but also in the place science and technology manages to occupy in the political and economic system. Further trust relations towards the political actors and the expert systems that are at the basis of decision-making appeared of rather different quality and stability, the experiences in implementing or resisting to technological change varied largely and the national traditions of preparing and disseminating information in general and on science and technology in particular were rather divers. And, not to forget, there are even fundamental differences in the meaning attributed to notions like science and technology, which needed to be considered.

In that sense one can ascertain that while there is an increasing homogenisation of the discourses around science, technology and society, which are reflected in EU documents like the Action Plan on Science and Society, the concepts had to be translated in quite different ways into concrete measures. This makes it difficult and complex to compare national contexts in a very direct and quantitative way (as it is done in the survey research, but partly also in the bench-marking exercises), but much more the fine-grained articulations have to be investigated and understood.

Two cases of transfer of concepts for PUS-initiatives can be mentioned as examples. The first would be the consensus conference, a setting developed and being rather successful in the Danish context, which is meant to allow for direct engagement of members of the public with topics of science, technology and society. One can nicely see that neither in the French nor in the Austrian case this setting managed to be implemented with success. It did not gain sufficient credibility, neither in the political nor in the public domain and thus could not develop the momentum and occupy the place it did in the Danish case. An example for a rather more successful exchange of experiences would be the case of science centres where through the building of networks one is trying to accelerate positive developments.

These examples but also the many other cases presented throughout the report hint us to the fundamental differences that cannot be neglected. First we have seen that PUS-initiatives were closely tied to other more general national problems such as the crisis of the national press in Belgium, the years of Thatcher's science policy in the UK or a lack of culture of public debate in the Austrian case. These special settings transformed the way in which issues of science, technology and society could be and were addressed. Then, to give a second example, there are countries with a stronger tradition in public participation in politics than others, and this obviously shaped also the possibilities of integrating the public in decisions with regard to technoscientific issues. A third point would be linked to the question whether PUS-issues were centrally dealt with or where much more left to the regions or to local players. Such a regional model would be the case of Belgium, where the two language communities would go quite different ways and would be submitted to different influences; cases of more central steering forces would be France and Austria. Fourth, we pointed several times at the fundamentally different meanings of the notions used to describe the equivalents of "science" in the different countries. Sweden, the Dutch-speaking part of Belgium and Austria would subscribe to the notion of "Vetenskap-Wetenschap-Wissenschaft", while the others would more use the term in the English meaning. This divide is however not reproduced in the divide with regard to the labelling of science-society initiatives. Here France and Portugal (and partly Belgium) use the term "scientific and technological culture", while the others have imported the UK notion of "Public Understanding of Science". Finally, the presence of strong industrial partners for science and technology would also have an influence on the way science communication as a whole is taking place.

As a consequence thinking of PUS on a European level, poses a number of problems. First, implementing mechanisms of science-society interactions would need a rather differentiated approach. While it seems less difficult as long as one works in the classical linear model of information dissemination, the moment public engagement is aimed at, things become more complex. In particular the language barrier and the system of cultural values that goes along with it, poses a major challenge to any attempt to open a debate on science and technology issues across all European countries. In many of the discussions on European PUS initiatives the internet and the possibility of using the different national languages is suggested as a way out, but even if such an approach works out, one would have to be reflexive about the origin of the communication models used and about the language the basic information and concepts to be discussed are translated from. The PUS-debate as it takes place right now is an excellent example for this problem. In the German language the English term *Public Understanding of Science (and Humanities)* is used although it completely contradicts the very meaning of *Wissenschaft*, which would embrace all the different scientific disciplines. With the use of the English term however also the debate and some of the implicit preconditions are imported along with.

The second concluding remark touches upon the *important gap between the rhetoric and the concrete realisation* which became visible in many contexts. We address here explicitly the increasing call for more participatory and interactive aspects in science-technology-society relations and the aim to develop something one could label “scientific citizenship”, while at the same time the deficit model and linear communication are present in the public arena stronger than ever. In fact this tension is felt all along the spaces, contexts and actions we have described in this report. Science and technology have come under a certain pressure and are forced to engage in new ways with the divers publics, on the other hand the “political paradigms” behind the actions taken clearly aim at consolidating their position as authority in the societal sphere. This tension leads in fact to two categories of reactions: For the first category one can observe a certain increase in engagement with the public while at the same time there are efforts made to channel and to a certain extend to control this “new freedom” for the public. The second category separates the different initiatives and runs in parallel classical PR and information campaigns while also performing more interactive PUS-initiatives. The relation between the two often remains unclear and so does the role of these actors in the public arena. A good example for such a case of rather ambivalent positioning would be the Austrian Council for Research and Technology development, who launched on the one hand a huge PR-campaign (see chapter 3.6.) while on the other hand also financing a citizen conference.

The third concluding remark is linked to the apparent difficulties to *conceptualise the public with regard to these PUS initiatives*. This perspective has two rather different levels, which need to be discussed separately. The first level is linked to the questions of who is in more concrete terms “the public” that should be reached, of how is the access to communication about science assured and finally of how exchange between science and society is possible overcoming the classical hierarchies between scientific and other forms of knowledge. The second level then addressing more explicitly the question of mass-communication of technoscientific issues, representative democracy and the realisation of the idea of scientific citizenship.
Indeed when looking through the seven concrete settings we have investigated in the six countries one quickly realises that with a few exceptions the majority of initiatives is not having any direct contact to the public they are addressing their representations of science to. There is a kind of technical rupture in this process of communication, i.e. the person who produces the element that is to be communicated never directly meets the individuals or social group to whom it is addressed. In that sense one mainly works with *projections of “the other”* and these imaginations about the expectations, interests, capabilities and necessities of “the other” would have with regard to science and technology to be built into this communication. This means the majority of what is handled as daily communication of science and technology, only takes place in form of an *imagined encounter*, which never finds its realisation. The consequences for the way science and technology are embedded into contemporary societies are wide-ranging, as we know extremely little about how technoscientific information is received, interpreted and used in personal and professional decision-making contexts. Thus also

the pretended open access people would have to this information does never have to stand any reality check. As a consequence of the power of these public discourses lies precisely in the fact that the underlying concepts and values attributed to this imagined public do not need to be made explicit.

The second level then addresses the idea of the scientific citizenship and representative democracy in contemporary knowledge societies. Indeed we have seen that consultative procedures which involve members of the public start to play an important role besides the classical forms of democratic representation. To clarify the precise nature and role of these new “added on” arenas where technoscientific change of science should be negotiated is an urgent need. While public participation is generally greeted as positive change as a broader spectrum of vision finds its place and thus any decision taken would better fit with the societal context, at the same time the questions about the persons that will get voice and in the name of whom they will speak become an issue. Indeed we have seen that in those interaction-oriented settings that are closely linked to the sphere of politics there is an apparent need for clarification. Here it is up to the organisers, but above all also up to the political system to make such interactive, participative PUS settings legitim “objects” in the public as well as in the political arena.

The new figure that enters the stage is the “scientific citizen”. Living in/with knowledge societies/economies creates not only new rights, but above all new needs expressed towards those who live in these societies. Thus the scientific citizen can claim voice in taking decisions on technoscientific issues, can claim that his/her know-how, experiences and values are considered, but is at the same time also requested to engage in a new intensity with science and technology. In a highly individualised society this figure of the citizen however is not a homogeneous one, but needs to be realised in its differences, contradictions and changing positions. Thus also new forms of expression of political action need to be though about.

Taking this again from the national settings to the European level, the issue gets even more complex. How would in a European context with such big differences in past experiences, value systems and priority setting such a citizen become a representative of others? Who will be those that formulate what is often labelled “social demand”, or to formulate it differently, who will speak in the name of the others and how will this figure gain the necessary credibility and trust in order to be able to do so? These will be one of the most important challenges for building also a technoscientific Europe in the years to come.

The forth perspective to be considered are the *reasons for increasing the public engagement with science and technology*. Based on our reflections made in chapter 1 and the large evidence in the empirical parts we could at least mention two major reasons. The first is closely linked to the apparent loss in attraction of some of the core fields in science and technology from the side of students. Here it is interesting to remark that the overall number of students has not decreased, but their centre of interest has shifted away. Before looking at the reactions developed to this "problem" one could ask why we identify it as such. What are the hidden values behind this overwhelming attention that is given to the natural sciences, whereas other scientific fields – social and cultural sciences and humanities – are only treated as being of secondary importance? Thus children and in particular women should be attracted to these fields of studies, without however questioning the implicit values that are embedded in the image of science and technology which is transmitted.

The second reason is closely tied to the fact that we do not only speak about knowledge societies, but above all about knowledge economies. Much of the communication is aiming at building the ground for a far-reaching acceptance of technoscientific innovations, at underlining the benefits of technological progress and at fostering trust in those who define the possible paths to take. They are meant to act against the dismissal of the ideal of social progress through technological advances. Of course the more negative consequences of technological change are also addressed, but often in such a way that concerns can easily be eliminated rhetorically.

Finally, and this is the last issue to be touched upon here, one can observe in many countries that through this political discourse on the importance of structuring the interface between science and society a professionalisation can be observed in this terrain. Numerous actors who had before done other communication activities now perceive science and technology as a new market, which can be conquered by them. While there is nothing to be said against making science communication more professional one has at the same time to be aware that with every layer of mediating actors and institutions the distance between the science system and the public sphere is also reconstructed. In that sense scientists as human beings, but also science-in-the-making, as a cultural practice, get alienated from the public. The direct interaction with all its limitations and its limited professionalism from the communication point of view gets lost and is being replaced by a number of displaced interactions that translate and reshape the representations about science present in the public sphere. But it also takes away from scientists the possibility of encountering the publics and confronting the social worlds into which they intervene with the technoscientific knowledge they develop. In that sense making science and technology communication uniquely the task of professionals and understanding it as a market to be conquered, will hinder to develop what we claimed would be essential for any further development, namely to build a scientists' understanding of the public along-side with a public understanding of science.

In that sense optimising public understanding of science and technology in Europe would call for more experimenting in the different settings, which of course would also need the corresponding budgets, for learning from each others experiments without falling into the leader/follower dichotomy, for developing a clearer vision of what we define as quality (and not in terms of quantity) for interactions between technoscience and society, for diversity and complementarity of actions in order to enable a large diversity of citizens to engage with technoscience, for understanding differences in order to cultivate the cultural variety and for actually encountering and engaging with the different publics as they are and not so much imagining how one would like them to be.