公众科学知识的缺乏、教育水平以及对科学的兴趣是科学传播的主要障碍。另外，1/3 的科学家认为媒体在科学传播中也存在一些问题。

3. 被访科学家认为，公众对科学研究的主要信息来源应该是报纸和电视。科学家认为，公众对媒体、慈善机构工作人员、各种运动团体非常信任，认为这些机构的人能够提供准确的科学研究信息，但是，科学家们却更相信科学界的研究人员。

4. 绝大多数科学家认为，向决策者和普通公众传播他们的研究成果及其社会和伦理意义是他们的责任。多数科学家还认为，在他们发表自己的研究成果的时候，应该同时说明他们研究工作的社会和伦理意义。许多科学家认为，科研压力太大，使得他们几乎没有时间进行科学传播活动，每日其他工作的压力甚至影响到他们的研究工作。

5. 被访科学家在谈到科学传播最重要的人群的时候，认为大多数普通公众是潜在的受众。大多数科学家认为，他们自己应该肩负起向普通公众传播科学研究的社会意义和伦理意义的责任。但是，比较少的人认为科学家具有这种传播能力。

6. 稍过半数的科学家在过去的 1 年内，参加过调查表列出的 15 种科学传播活动中的 1 种或者几种活动。科学家是否参与科学传播活动取决于他们的能力和信心。那些认为自己具有传播自己科学事实和研究的意义的科学家和接受过培训的科学家最有可能参与科学传播活动。同样，不仅从事教学，而且也进行研究工作的科学家，以及那些有传播经验的科学家在过去的 1 年内参与科学传播活动更多。

7. 大约 3/4 的科学家认为自己具有传播的能力，1/5 的人认为自己具备很强的传播能力。但是，他们认为在传播自己的研究工作的社会意义和伦理意义的时候信心不足。在认为自己的研究工作具有社会和伦理意义的科学家中，62%的人认为自己有能力，1/10 的人认为自己具有非常强的能力。

8. 绝大多数科学家没有接受过与媒体和与普通公众交流的训练。大多数科学家意识到他们的研究机构已经给他们提供了传播的机会和服务。比例较小的科学家认为经费提供方没有提供任何传播服务。

9. 被访科学家谈到最多的是，应该采取多种措施激励科学传播活动。科研经费提供机构应该设置奖励，鼓励科学家投入更多的时间进行科学传播。他们还谈到与媒体合作的培训，以及研究机构应鼓励他们将更多时间用于科学传播。

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Publicizing Science! To What Purpose?

(Revisiting the notion of public communication of science and technology)

Bernard Schiele

Without an informed public,
scientists will not only be no longer supported financially,
they will be actively persecuted.
Asimov, 1984

(Continued from previous issue)

The State gets involved

Starting in the early 1980s, the valuing of SL and PCST – more precisely the form this valuing took – was seen as a societal issue. Governments were on the right path and very quickly they made publicization their business. Up until then, while not uninterested, they had essentially left it up to the actors to speak out as needed. What Louis Cros had hoped for in 1958 (cf. supra) happened: the decade became one of State commitment.

"At the beginning of 1981", said Jean-Pierre Chevênement at the opening the Colloque national sur la Recherche et la Technologie in January 1982[17], "it was not apparent that a year later scientific research and technological development would be considered to be a national ambition"[18]. Preceded by 31 Regional Assises, sector-based study days, of broad national mobilization of research organizations, universities, companies, unions, professional organizations [19], and the announcement of numerous measures: "to create a large Ministry of Research uniting the disparate and fragmented means among various ministries", "to restore fundamental research", "build mobilizing programs, clarify and rationalize the relations between research and industry to reconquer the interior market and preserve our national independence", "cultivate the taste for research and ensure the scientific information of the French", and "to establish new European programs", the national conference was seeking a "crisis exit", marked by a "renewal" of research, an "opening of the world of research to the economic world", and to "society in its democratic expression" [20]. Francois Mitterrand's announcement of a policy "able to create the intimate insertion of research and technology into our society, into its culture and into its choices"[21] made it possible to tangibly envisage a culturation of science [22]. (Today, a simple rereading of the proposed objectives shows the extent to which this discourse is rooted in the same substrate of meanings that I evoked).

The very first CCSTI [23], just created in Grenoble, would include them. They generously proposed: the encounter and dialogue of scientific, industrial associative and cultural partners with the public; to develop the circulation and exchange of scientific information; to foster the initiative and coordination of scientific knowledge dissemination efforts and to highlight them; to promote awareness-raising and training of local actors in disseminating scientific knowledge; to develop actions favouring better irrigation of territory especially for the specific areas of the rural milieu; to participate in the development of a European and international dynamic[24]. The associations and groups (AMCSTI, APISP, ASTS. CIRASTI...) benefiting from increased support did not remain inactive [25]. The Cité des sciences et de l'industrie [26], a leading establishment for renewal, created in 1985, was given four converging missions: "elicit the meaning, provide reading material and understand the contemporary world and its trajectory, enable access to information and knowledge, and contribute to the evolution of individual and collective mentalities".

This will to acquire the tools and means to bring science and society closer together is not exclusive to France, far from it. The Bodmer Report published in 1985 in the United Kingdom deplored the poor level of understanding of science and encouraged scientists to communicate with the public. The Committee for the Public Understanding of Science (COPUS) was set up in 1986 (at the initiative of the Royal Institution, the Royal Society and the British Association for the Advancement of Science). Its mandate was to pursue greater visibility of PUS (PUSET — and Technology). It was very influential in enabling scientists to learn about the various forms of media, to deal with questions of public interest (Media Fellowships, Media Training Workshops, Westminster Fellowships, Women's Institute Courses), and to support PCST events (Seed grants, Development grants, National Science Week grants), etc[27]. In addition, COPUS contributed enormously in legitimizing the dissemination activities of the general public enterprises for researchers in the scientific fields. Beginning in 1994, the OST (Office of Science and Technology) pursued and broadened the objectives of COPUS. In pell-mell fashion, it sought: to demonstrate the relevance and importance of science and technology in daily life and business; to stimulate young peoples' interest to promote careers in these fields; to learn about scientific developments; to foster rapprochement and dialogue between scientists and the public on ethical, moral and social questions through these developments and their spinoffs; to raise the level of public knowledge for a more fruitful dialogue; and simultaneously to sensitize the scientific community to public concerns... In 1997 Science Connections surveyed 49 scientific organizations engaged in valuing and promoting PCST in the United Kingdom.

A couple of words on the United States. The same PUS objectives have been pursued in the United States by a plethora of organizations[28]. "However, given the local independence and spirit of initiative that characterizes American life, there was never a systematic attempt to coordinate, or even to catalogue, these activities. There is no national policy for public communication of science and technology, any more than there existed an information base or political will to create it [29] This doesn't stop the federal government Ministries or the national agencies from actively promoting PCST [30]. I must also mention the AAAS (American Association for the Advancement of Science) (141,000 members and 300 affiliated organizations) which includes the promotion of PCST in its constituting act, and because it is present throughout the United States; and the ACS (American Chemical Society) which annually organizes National Chemistry Week with the participation of its 200 local sections. At the time of the appearance of Halley's Comet in 1985, the AAAS launched Project 2061. This, on the one hand, defined national PUS standards – in a country where the educational system is completely decentralized – and, on the other hand, aimed for their achievement by 2061, the date the Comet will reappear[31]... Europe, since 1993, the date when the Semaine Européenne de la Science et de la Technologie was launched, has followed suit.

I could continue at length but I think this suffices to remind us that PCST has long been the focus of a social project. All the countries[32]– to varying degrees of course – have subscribed to it. To raise the level of the public's scientific information, to revalue the sciences, involve the public in debates, and commit young people to pursue careers in science... That's the mandatory theme for all policies and measures adopted!

Today, 20 years later...

What did this mobilization yield? Certainly, of all such endeavours initiated in France, some remained relatively neglected: the popularization initiatives still have only marginal impact on the advancement of researchers' careers, and the science media professions don't lead to careers with the same benefits as those for researchers and teachers. But the French situation is not necessarily typical. In Australia, for instance, the professionals of CSIRO (Commonwealth Scientific and Industrial Research Organization) are responsible for communicating the scientific aspects of their work to the public. And the United Kingdom has a well-established science communication profession. In any case, in terms of what's offered, there is more equipment, there are more projects, those involved have become professional, and budgets, grosso modo, have been maintained.

However, there seems to be a need to revitalize the enthusiasm! Roger-Gérard Schwartzenberg[33], Minister of Research, declared at the launching of the Assises de la culture scientifique in November 2001: "I had hoped that an overall reflection on scientific mediation would develop, with everyone involved in the production and dissemination of knowledge" to "strengthen the dissemination of science and technology culture" since "despite what has been accomplished", "today we must, 20 years later, move on to a second stage, to enlarge and renew this effort. ... How can we bring science and society closer together, when nowadays they are tending to move farther from each other? How do we reduce this distance and how did it come about?"

The national plan for disseminating PCST, unveiled on February 25, 2004 by the minister delegate for Research and New Technologies, takes the same tack. The plan, like the Assises, observes that citizens are "curious" and have an "interest in science" but at the same time show a "certain scepticism" and "mistrust". They "lack reference points to understand the world around them". How, then, can we promote science vocations and direct "young people to science and technology career paths"? The issues must be "debated" and "reference points given". Since the "vital roles of science and technology in our society, and also in our daily lives, increasingly structured by innovation, demand an operative relay adapted to the general public. This entails disseminating information, reference points, keys to understanding the world for a diverse public". PCST must be recast by a new approach: concluded the minister, "we can broaden access to science culture... only if we renew and modernize the ways to transmit it and to make the general public aware of it"[34]. It is not only France that harbours the hope of a renewal of the science-society relationship. Tony Blair declared in 2002 : "... But there are three main reasons why I want to address the potential of this new age of discovery. First, science is vital to our country's continued future prosperity. Second, science is posing hard questions of moral judgment and of practical concern, which, if addressed in the wrong way, can lead to prejudice against science. Third, as a result, the benefits of science will only be exploited through a renewed compact between science and society, based on a proper understanding of what science in trying to achieve"It is st riking to note just how much the arguments of past years recur today. Why act as if everything must be redone, to better propose the same thing ... or virtually the same thing. Why the alibi of a recasting? The argument, as I've noted, is the knowledge gap between science and society, which, far from diminishing, continues to widen; that the efforts haven't proven fruitful enough, that there's a periodic need to revive interest, to relaunch a mobilization. And whether the real challenge isn't so much PUS itself as the cyclical appeal for a renewal of the science/society pact? But before examining this hypothesis, I must briefly present the results of various studies on the dissemination of PUS.

Evaluating science and technology culture

I had thought to deal with the evaluation of science and technology culture dissemination according to the usual breakdown for a study of cultural practices. The question would have been: "Who's interested in science?", "In what way?" By reading (*Science et Avenir, La Recherche, Discover, Scientific American...*), by visiting science museums (*Palais de la Découverte, Cité des Sciences et de l'industrie, Muséum National d'Histoire Naturelle*), by participating in events (*Semaine des sciences, Université de tous les savoirs, journées portes ouvertes...*) ? "How often?", "For what purpose? To be trained, informed, cultivated, entertained?", "To what effect? To awaken interest, stimulate curiosity, participate in debates?", and so on. All of it nuanced, of course, by reference to socio-economic indicators and other pertinent variables [36]. Such an overly specific approach would have prevented me from isolating the overall trends. It seemed to me more relevant to outline the major features of a synopsis [37], on the one hand, to show what we learned about public practice from these trends and what came out of this, and on the other hand, to examine both the effectiveness and scope of the actions undertaken, dictated by necessity.

The state of PUS

The simplest notion we can have of PUS is to define it as a knowledge of basic facts, elementary concepts, and a general understanding of the scientific effort [38]. Determining the science literacy of a population therefore means measuring – by survey, inquiry, etc. – the rate of correct answers to these three indicators. Below a certain threshold deemed minimal, we consider that the individuals pegged as scientific non-literates lack certain skills required as citizens in a modern post-industrial society. The National Science Board (NSB) in the United States and the European Commission regularly conduct surveys of this kind to collect comparative data and analyze trends. The most recent one (NSB – 2004) revealed that U.S. respondents [39] on average correctly answered 8.2 questions out of 13 designed to measure the level of scientific knowledge, i.e., a success rate of 63%, compared to 7.8 for Europeans (60%). Compared with earlier surveys, this rate has remained constant in the United States since 1990. The NSB pointed out several changes: more people today know that antibiotics do not kill viruses (this result is attributed to media coverage of ailments causes by drug resistant bacteria); and for the first time more than 50% (53%) of U.S. respondents answered "true" to the statement that "human beings developed from early species of animals[40]" (69% in Europe), while the previous rate was 45%.

The answers received to the question "in your own words, what does studying something scientifically mean?" – a more abstract question than those dealing with specific information knowledge[41] – indicating a strong majority of U.S. respondents (two out of three in 2001) don't clearly grasp what "scientific process" means. Which implies that it is difficult for a large portion of the population to distinguish science from non-science [42]. The NSB suggests that this lack of knowledge could explain the rise in the pseudosciences: 60% believe in extrasensory perception, and 41% consider that astrology is "at least a little scientific" (in Europe, 53% consider astrology to be "fairly scientific").

PUS measurement also takes two other factors into account: attitude and interest. A positive attitude towards S&T, combined with a basic scientific knowledge, appears to determine an individual's capacity to take part in the democratic discussion. The perfect inverse appears true too, with the expectation that raising the level of PUS for the public favours a positive attitude, enables citizens to understand science and technology issues, and encourages participation in discussion and decision-making since they are aware of the impact of S&T on society and the choices that inevitably ensue[43]. A higher proportion in the United States than in Europe considers this impact to be beneficial [44]. Thus 86% of U.S. respondents, as against 71% of Europeans, agree with the statement that "science and technology are making our lives healthier, easier and more comfortable", and respectively 72% compared to 50% of these feel that "the benefits of scientific research outweigh any harmful results"[45]. The NSB takes special care to emphasize that the proportion of Europeans who strongly disagree is higher than in the United States (in Europe one in four, compared to one in ten in the U.S.); that the percentage of U.S. respondents who consider the spinoffs to be mostly beneficial has remained above 70% since 1988. But the European percentage fell by 11% between 1992 and 2001. In this regard, the NSB suggests that the probability of showing a positive attitude increases as a function of correct answers to the knowledge test, while in the United States the link is weaker. In other words, unlike Americans who are naturally more inclined to see the good side of science, having a certain scientific knowledge serves to foster a positive attitude among Europeans. What is verified then is the initial statement that knowledge, a positive attitude and interest form a whole. Which brings me to interest.

A person may have a positive attitude without any real interest in S&T. Or he or she may have little interest yet feel well-informed, just as another may be quite interested yet feel poorly informed. One thing is certain though, confirmed by all the work: the primary factor in predicting interest – and PUS competency – is having learned science. A solid education in science and mathematics induces an ongoing learning. The second factor is to increase the amount of education, whatever the field of training.

Informal learning is not as structuring. The public that shows interest in science and technology is generally distributed in three categories: "attentive", "interested", and "residual" (this is Jon D. Miller's well-known typology: it measures in all cases the degree of voluntary exposure to scientific information). The "attentive public" refers to a public that is very interested, very well-informed and a regular reader of specialized journals and magazines; they visit museums and are interested in scientific cultural events. The "interested public", while calling itself "very interested", does not feel very well-informed. The proportion of "attentive public" is significantly lower than that of the "interested public". This is valid for all countries, which suggests that few actively seek out information, to understand the issues, or to participate in debates, even though they may say they are keenly interested. This is true even if both observe that an omnipresent science and technology revolutionizes the present and overdetermines the future. As for the "residual public", without actually being indifferent to science, they express very little interest. It happens occasionally when something catches their attention, so they only pick up a little news by chance. This partly explains why the residual public's information is so sparse and random. In this perspective, may I add that to the observer the public's knowledge appears to be a mosaic of decontextualized bits and pieces. This public voluntarily declares itself willing to know more about science and technology, but is constantly distracted by other things. Science and technology centres, for example, have thoroughly grasped the implications of this ambiguous relationship. They exploit it systematically, knowing that visitors generally gauge their visit by the interest it sparked for them – the feeling of having learned something or not – and they judge the quality and impact of an exhibition or other activity by how stimulated they felt.

Finally, the recurring mobilizing themes, from one study to the next, are health (medical implications and research, new treatments, risk factors, biotechnology spinoffs...) and, in recent years, environmental questions (health and environmental questions being spontaneously linked in the public mind). The impact of scientific discoveries, inventions, innovations – from nuclear to space – that don't directly affect their daily lives, elicit little interest unless a news item appeals to public attention. It is interesting to note in passing that television is far and away the leading information source indicated in the United States and Europe. After TV, in order, are: the written press, radio, school or university, scientific journals and the Internet. However, between 1998 and 2000 the audience for TV information programs has continually declined, to stand at 37% in 1998, 31% in 2000 and 24 % in 2002.

From a review of major studies, Jon D. Miller concluded that the number of scientifically literate adults has doubled over the past 20 years [46] and is now close to 17% in the United States, the United Kingdom and France. He notes, however, that this level is "is still problematic for a democratic society that values citizen understanding of major national policies and participation in the resolution of important policy disputes [47]". Assuredly, there will always be a keen journalist intent on reminding TV viewers or readers that only 41% of European respondents consider as "true" the statement that: "electrons are smaller than atoms" (48% in the United States, 46% in France [48]), thereby reinforcing those already convinced that not enough is being done to alleviate science illiteracy, and we've got to beef up publicity efforts.

Revisiting the idea of science and technology culture

All of these surveys invariably reassert that the likelihood of contact with scientific culture, when it is not specifically encouraged at school, undertaken systematically in a spirit of self-learning or sparked by a chance encounter, essentially devolves from a higher level of schooling, in science as in other fields. While tacitly pleading for greater publicizing of science among the public, these surveys consistently show that only a minority, namely those with the most schooling, develop the desired interest or skills needed to help bring science and society closer together. Amid all this, I would like to point out that the artistic, literary and economic cultures, basically in the same boat, are also poorly shared. The S&T situation is neither unique nor new. I think it is readily illustrated by recalling the debate of the 1970s criticizing the dire lack of public introduction to economic culture. Largely demonstrated by studies that have nothing to envy of today's studies, they systematically denounced this lack and feared for the consequences [49]. Surveys certainly seem to indicate that the media has a limited impact on the acquisition of new knowledge and the development of the scientific mindset. But there is a knowledge transfer nonetheless since, on the one hand, for all its deficiencies the media serves as an information source and, on the other, learning is a process: we don't learn in one shot, nor from just one medium. We learn by repeated hits, multiple stages, successive corrections, and from different sources. This goes for all learning. The public understands and retains despite the distortions, incomplete information and lack of training. These efforts therefore emphasize the role of schools and media. Schools are expected to provide a formal introduction to science, which it's hoped will engender a sustained interest, while media – understood in the broad sense – should abet this interest by according more attention to the sciences and, for those showing less interest, increase points of potential contact so as to inform them, stimulate, involve and engage them. Consequently, achieving the true scientific and technical culture, while desirable and desired since it's considered essential for the enlightened participation of citizens in the debates of the day, hinges on training for some, and on everyone's exposure to random and diffuse information. Is this not the persistent push-pull that surveys measure?

How to escape the paradox of a periodic reassertion of the need to publicize science, each time with the attendant wait for the science and society pact to be concluded, and finally renewed, yet we have lingering doubts about the actions, their scope and effectiveness. We understand the intermittent need to revive interest in order to keep PCST on the agenda of immediate social concerns. But this is not what it's about when we hear solemn appeals for the need to regenerate the science/society alliance, the general mobilizations and measures that result. I think (or at least it's my working hypothesis) that these cyclical reactivations have little to do with the rapprochement they advocate, or at least, not in the way they're conceived.

Being in the forefront of society

To resolve this paradox, one must deal with the question of actions operating over a span of time rather than at specific moments. To know when, and especially how, PCST took centre stage in society. On this topic, the British and American work has shown four successive expansions in media coverage of science, each time coinciding with a transformation of the science/society relationship, and each time followed by a sharp decline in PCST coverage[50].

I will summarize them. The first expansion, which began in 1840 [51] and reached its peak in 1875, was that of the social affirmation of science at the expense of religion. It was also that of professional research, with the amateur progressively giving way to the researcher. The press and the book were the main vectors of dissemination. During the second expansion, 1900-1925, science was institutionalized and gradually revealed its potential: scientific development, whose economic spinoffs quickly became evident, was quickly corralled to serve the national interest and has remained that way since. Radio was gaining popularity and began to include PCST (afterwards called popularization). The third expansion, 1940-1962, corresponded to the advent of pure R&D research with its step-by-step planning. The scientific model reigned. The Palais de la Découverte and CNRS in France, like the famous Vannevar Bush report, Science, The Endless Frontier, published in the United States at the end of the war (which spurred the American program of fundamental research concentrated in the large universities and funded by the State) focused on developing pure research, and advocated the same vision for the role of science in society. Television became a global phenomenon. The fourth expansion, beginning in 1975, sprang from the economic crisis, triggered by the energy crisis (1973), and marked by doubt and growing concerns. The anti-nuclear movement, first, and then environmental questions galvanized a radical critique. There was increasing privatization of research while at the same time the techno-sciences were coming into their own. The public relations discourse encroached upon that of journalism (scientific or other).

There are a lot of nuances in all this. But what this work highlights first is that contrary to what the solemn appeals suggest, science returns cyclically to the centre of the social debate. And second, the times when PCST is in strong demand, when its social necessity is most insistent, are precisely when it is very active in fully exercising its role. This dual observation makes one wonder about the true function of PCST. Even more, this work shows that, grosso modo, the phases of expansion and compression seem to parallel the major economic cycles and the structural adjustments that accompany crisis, when the potential for science and technology innovation propels its revival. In this perspective, the PCST discourse serves a twofold purpose. On the one hand, it destabilizes the knowledge and skills that held sway up till then (a critical step in deconstructing the knowledge relationship) and, on the other, it highlights the emerging attributes (a positive step in establishing a new relationship). The invitation to share knowledge, to understand the science effort, to participate democratically... become the practical alibis. In other words, the social actors are periodically invited to change their role. But they must first anticipate their new character, and a scenario and a decor are then very useful. Two examples from the French context will allow me to illustrate that the effort of publicizing consists mostly of reconfiguring the representations of science (while deconstructing others still operating); to transform their relationship to the field of knowledge; to force, so to speak, the social actors to rethink how and in what way the sciences "make sense" for them. What's important is to internalize the new relationship, much more than to master a particular knowledge. Since potential is realized through dispositio, the way of imagining and thinking in a situation of appropriating, producing and using knowledge.

(To be continued)

Notes and References

[17] Jean-Pierre Chevênement, Ministre d'Etat et Ministre de la Recherche et de la Technologie, launched the Etats généraux de la culture scientifique in 1981. (freely translated)

[18] Ministère de la Recherche et de la Technologie, (1982), Introductory speech by Jean-Pierre Chevênement, Paris, La Documentation fran?aise, p.55. (freely translated)

[19] Ministère de la Recherche et de la Technologie, (1982), Préface by Jean-Pierre Chevênement, Paris, La Documentation francaise, p.5. (freely translated)

[20] Ministère de la Recherche et de la Technologie, (1982), Speech by Francois Mitterrand, Paris, La Documentation francaise, p.67 -74, passim. (freely translated)

[21] In italics in the text. Ministère de la Recherche et de la Technologie, (1982), Speech by. Francois Mitterrand, op. cit., p.69. (freely translated)

[22] According to the well-known expression by Jean-Marc Lévy-Leblond: "mettre la science en culture" ("putting science into culture").

[23] Today the network has 52 CCSTI. Twenty-nine are included in the Réunion des CCSTI, recognized by the State.

[24] Add to this PCST actions by the Ministry of Culture and Communication, the Ministry of Youth, the Ministry for National Education and Research.

[25] It may be useful to recall that, amid all the events at the 1982 conference, two laws were adopted: the Loi d'orientation et de programmation de la recherche et du développement technologique de la France {An Act respecting the orientation and programming of research and technology development in France] (no 82-610, July 15, 1982), the Loi sur l'enseignement supérieur - dite Loi Savary [An Act respecting higher teaching - called the Savary Act] - (no 84-52, January 26, 1984), which assigned several missions to higher teaching, among others the diffusion of knowledge and research results. A

coordinating body, the MIDIST (Mission Interministérielle de Diffusion de l'Information Scientifique et Technique), oversaw the actions of the various ministries. I might also add that the Loi relative aux droits et libertés des communes, des départements et des régions [An Act respecting the rights and freedoms of commons, departments and regions] (no 82-213, March 2, 1982), that gave autonomy to regional and departmental councils, served to decentralize PCST activities. This helped the developing CCSTI by giving full play to their relay role. The empowerment of all aspects pertaining to PCST was affirmed by the Loi d'orientation pour l'aménagement du territoire pour le schéma des services collectifs de l'enseignement supérieur et de la recherche [An Act respecting orientation for development of territory for the plan of collective services for higher teaching and research] (dite Loi Deffere [called the Deffere Act], no 95-115, February 4, 1995), notably for establishing contracts between the State and the regions, and the regions and the universities, etc.

[26] Jantzen, Réal, (1996), op.cit., p. 12. May I point out that Cité – created by decree no. 85-268 of February 18, 1985 – is one of the four great national PCST establishments. The other three are the Conservatoire national des arts et métiers (renovated and reopened in April 2000), the Muséum national d'histoire naturelle – which includes the Grande galerie de l'Evolution (remodelled and reopened in 1994), the Galerie de Minéralogie, the Comparative Anatomy and Paleontology galleries, the Jardin des Plantes, the Musée de l'Homme, the Parc zoologique de Vincennes, and other sites in France – whose amended status in 2001 assigned a third mission to receive the public at their sites – and the currently operating Palais de la découverte.

[27] For an evaluation of the impact of COPUS, see: http://www.evaluation.co.uk/pus/copus/COPUS.html, and http://www.evaluation.co.uk/pus/evaluation/Ukevaluations.html.

[28] It would take a complete book to cover the American initiatives. For an overview (which must however be updated), see: Lewenstein, B., (1994), "Enquête sur les activités de communication publique de la science et de la technologie aux Etats-Unis", in Schiele, B., (éd.), Quand la science se fait culture – La culture scientifique dans le monde, Ste-Foy, MultiMondes, Lyon, Centre Jacques Cartier, p. 129-194. (Lewenstein, B., (1994), "A Survey of Public Communication of Science and Technology Activities in the United States" in Schiele, B., (Ed.), When Science Becomes Culture. Boucherville, Quebec, University of Ottawa Press, pp. 119-178.)

[29] Lewenstein, B., (1994), op. cit., p 129.

[30] Lewenstein's compilation, largely inspired by the FCCSET/CEHR PUNS report of 1993 (PUNS – Public Understanding of Science), lists the programs of the Ministries of Defence, Education, Energy, Environment, Health and Social Services, of NASA, the NSF (National Science Foundation), and the Smithsonian Institution.

[31] See: http://project2061.aaas.org; AAAS, (1993), Benchmarks for Science Literacy, New York, Oxford University Press; and Rutherford, F. J., Ahlgren, A., (1990), Science for all Americans, New York, Oxford University Press.

[32] For an overview of the development of CST in Germany, Australia, Austria, Belgium, Cameroon, Canada, Denmark, Spain, Finland, France, Greece, Italy, Japan, Mexico, Norway, The Netherlands, Portugal, United Kingdom, Sweden and Switzerland, see: Schiele, B., (1994), op. cit.

[33] Speech by Roger-Gérard Schwartzenberg, Minister of Researcg, CNRS, Paris, November 12, 2001, http://www.recherche.gouv.fr/discours/2001/dass.htm.

[34] See: Plan national pour la diffusion de la culture scientifique et technique, http://www.recherche.gouv.fr/discours/2004/dplancs.htm, and Press Conference of February 25, 2004 by Jean-Jacques Aillagon, Minister of Culture and Communication, www.culture.gouv.fr. A series of measures followed: to launch large public meetings and to mobilize the associations, create a foundation for science culture, mobilize the teachers and the scientific community, coordinate the institutions throughout the territory, develop tools for scientific culture.

[35] Science Matters : http://www.number-10.gov.uk/output/Page1715.asp.

[36] The well-known work by Donnat on Les francais face à la culture, and Les pratiques culturelles des Fran?ais give an idea of what I had in mind. Donnat, O., (1994), Les francais face à la culture,

Paris, Editions La Découverte; – (1998), Les pratiques culturelles des Fran?ais, Paris, La documentation Francaise.

[37] This synopsis comes from the compilation by: Miller, J. D., (1991), "Attitudes Toward Science and Technology : The United States and International Comparisons", Science & Engineering Indicators, Washington, DC, Government Printing Office, p. 165–191 ; Miller, J. D., (1996), "Public Understanding of Science and Technology in OECD countries: a Comparative Analysis", communication, Symposium on Public Understanding of Science and Technology, Paris, OECD; Miller, J. D., Pardo, R., Niwa, F., (1997), Public Perceptions of Science and Technology – A comparative Study of the European Union, the United States, Japan and Canada, Bilbao, Fundación BBV; National Science Board, (1986), Science Indicators, Washington, DC, U.S., Government Printing Office ; National Science Board, (1988), Science and Engineering Indicators, Washington, DC, U.S., Government Printing Office; National Science Board, (1990), Science and Engineering Indicators, Washington, DC, U.S., Government Printing Office; National Science Board, (1992), Science and Engineering Indicators, Washington, DC, U.S., Government Printing Office; National Science Board, (1994), Science and Engineering Indicators, Washington, DC, U.S., Government Printing Office; National Science Board, (1996), Science and Engineering Indicators, Washington, DC, U.S., Government Printing Office; National Science Board, (2002), Science and Engineering Indicators, Washington, DC, U.S., Government Printing Office; National Science Board, (2004), Science and Engineering Indicators, Washington, DC, U.S., Government Printing Office; Commission des Communautés Européennes, (1989), Eurobaromètre No 31 – L'Opinion Publique dans la Communauté Européenne, Bruxelles, Direction générale de l'information et de la communication et de la culture; European Commission, (2001), Eurobarometer 55.2 – Europeans, science and technology, Research Directorate–General. The work in this area is as legion as it is repetitive: to be convinced of this, consult the directories of government publications (EC), the major associations (AAAS, AAM, ASTEC, NSF...) and the international organizations (OCDE, UNESCO...).

[38] The question of measuring STC receives so much attention from researchers that governments take note. Among the numerous works see: Durant, J., (1993), "What is Scientific Literacy", in Durant, J., Gregory, J., (Ed.), Science and Culture in Europe, London, Science Museum, p.129–137; Bauer, M., Schoon, I., (1993), "Mapping variety in public understanding of science", Public Understanding of Science, 2 (2) : 141–155, Laugkscsh, R. C., Spargo, P. E., (1996), "Construction of a paper–and–pencil Test of Basic Scientific Literacy based of selected literacy goals recommended by the American Association for the Advancement of Science", Public Understanding of Science, 5(4):331–359; Jenkins, E. W., (1997), "Scientific and Technological Literacy for Citizenship: What can we learn from research and other evidence?", in Sjøberg, S., Kallerud, E., (éd.), Science, Technology and Citizenship – The Public Understanding of Science and Technology in Science Education and Research Policy, Oslo, NIFU – Norsk Institutt for studier av forskning og utdanning, p. 29–50; Miller, J. D., (1998), "The measurement of civic literacy", Public Understanding of Science, 7 (3): 203–223; Miller, J. D., Pardo, R., (2000), "Civic Scientific Literacy and Attitude to Science and Technology: A Comparative Analysis of the European Union, the United States, Japan and Canada" in Dierkes, M., von Grote, C., (Ed.), Between Understanding and Trust – The Public, Science and Technology, Harwood Academic Publishers, p. 81–129.

[39] Unless otherwise indicated, the data is taken from: National Science Board, (2004), Science and Engineering Indicators –2004, http://www.nsf.gov/seb/srs/seind04/c7/c7h.htm.

[40] Freely translated in the French version of this paper.

[41] Questioned as part of a survey, 43% of U.S. respondents and 37% of Europeans answered correctly; and on their understanding of probabilities, 57% of U.S. respondents and 69% of Europeans got the right answer. The questions were as follows: "Now please think of this situation. Two scientists want to know if a certain drug is effective in treating high

blood pressure. The first scientist wants to give the drug to 1000 people with high blood pressure and see how many experience lower blood pressure levels. The second scientist wants to give drug to 500 people with high blood pressure, and not give the drug to another 500 people with high blood pressure, and see how many in both groups experience lower blood pressure. Which is the better way to test this drug? Why is it better to test the drug this way?", "Now think about this situation. A doctor tells a couple that their 'genetic makeup' means they've got one in four chances of having a child with an inherited illness. Does this mean that if their first three children are healthy, the fourth will have the illness? Does this mean that each of the couple's children will have the same risk of suffering from the illness. Does this mean that if they have only three children, none will have the illness", NSB, (2004), op. cit., chap. 7, p.17.

[42] In 1993, the United States Supreme Court established the standards (falsifiability, error rate, peer review, general acceptance) for admissibility of court experts (Daubert vs Merrell Dow Pharmaceuticals). Research carried out, based on 400 cases to determine if the judges clearly understood these standards showed that only a fraction had mastered the concepts of falsifiability and error rate. NSB, (2004), op. cit., chap. 7, p.18.

[43] On this point, see: Miller, J. D., (1983), "Scientific Literacy: A conceptual and empirical review", Daedalus, 112 (2) : 29–48, passim.

[44] For a comparative analysis, see: Banchet, J., Schiele, B., (2003), "Comparaison de quelques enquêtes nationales et internationales sur la compréhension et la perception de la science par le public", in Schiele, B., Jantzen, R., (éd.), Les territoires de la culture scientifique, Lyon, Presses Universitaires de Lyon, Montréal, Les Presses de l'Université de Montréal, p. 95–114. In the same work, see also: Miller, J. D., (2003), "Culture scientifique dans un monde de communication à large bande", p.79–93.

[45] From: NSB, (2004), op. cit., chap. 7, p.23.

[46] The plateau covered by the NSB spans some 10 years (1990–2001), which would have implied, if the trend is correct, that the increase noted by Miller would have happened before 1990.

[47] Miller, J. D., (2004), "Public understanding of, and attitudes toward scientific research: what we know and what we need to know", Public Understanding of Science, 13 (3), p.273.

[48] For the United States: National Science Board, (2002), Science and Engineering Indicators –2002, National Science Foundation, NSB–02–1, for France: Eurobaromètre 55.2 http://europa.eu.int/comm/public_opinion/archives/eb/ebs_154_en.pdf.

[49] To have an idea of earlier issues, see, among others: Lacout, A., (1976), "Représentation économiques et formations d'adultes", Pour, 49, p.45–63 ; Albertini, J.-M., et al., (1974), L'initiation économique des adultes, ATP, no 4 des sciences humaines, CNRS; Verges, P., (1976), Les formes de connaissances économiques – Eléments pour une analyse des raisonnements et connaissances pratiques, thèse d'état, Université de Lyon II. On another level, but noting a decline, consult: Bloom, A., (1987), The Closing of the American Mind, New York, Simon and Schuster.

[50] Unfortunately, it was not possible for me to give all the references I would have liked as part of this conference. However, I would like to mention the best known: Hinton, D. A., (1979), Popular Science in England, Bath, Université de Bath, Thèse; LaFollette, M. C., (1991), Making Science Our Own, Public Images of Science, 1910–1955, Chicago, University of Chicago; Bauer, M., Durant, J., Ragnarsdottir, A., Rudolfstottir, A., (1995), Science and Technology in the British Press, 1996–1990, London, The Science Museum.

[51] I take the delineation proposed by Bauer (1998). Bauer, M., (1998), "'La longue durée' of popular science, 1830 – present", in La promotion de la culture scientifique et technique: ses acteurs et leurs logiques, Paris: Université Paris 7 – Denis Diderot.

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