Publicizing Science! To What Purpose?

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

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

A [1] common lament in the realm of science and technology culture (SL and PCST [2]) is the scant regard for publicizing science and technology. Similarly decried is the chronic lack of knowledge of science and technology by a high proportion of the general public, who are said to be de facto deprived of the right to speak on issues concerning them since they cannot grasp the real impact on society of the spinoffs from science and technology development. PCST actors reiterate that the real challenge is to maintain our individual and collective capacity for intervention in a knowledge society that is ever more complex to decipher and master. A constant theme in France, as elsewhere, is the plea to recognize and value the publicizing of science and technology (S&T), to acknowledge its need and support the means its mission requires.

This discourse has taken various forms. An example from the late 1950s, followed by a rerun of the mobilization movement in the 1980s, and its current revival today, allows me to show that the successive reformulations of the publicization project all draw on a stable core of meanings. Secondly, I concluded from a synopsis of surveys conducted in the United States and Europe on the development of science and technology culture that despite the considerable means and resources received, the anticipated collective increase in science and technology culture from this mobilization has yet be demonstrated. And thirdly, this brings me to query the true function of publicization, and fourthly, its origins. It seems clear to me that the notion of publicization poses a problem, that it must definitely be re-examined, and perhaps even revisited.

Shake-up in Science and Technology Culture

Beginning in the 1960s-1970s, sparked by a disenchantment with Progress, people began questioning the relationship between science and society (and this questioning continues unabated). It would crystallize around the conditions and means of accessing and sharing scientific knowledge, and how to bring science and society closer together.

Palais de la Découverte, February 26, 1958

The *réunion -débat* (" meeting -debate") chaired by Francois le Lionnais, then President of the Association des écrivains scientifiques de France (AESF - Science Writers Association of France), held at the Palais de la Découverte on February 26, 1958, was exemplary in its choice

of the topics (cited *in extenso* below) and the arguments advanced during the discussion[3].

First the themes:

A. – *Qu'entend–on par "Vulgarisation Scientifique [lire : publicisation]?"*

(What does "Scientific Popularization" mean [read: Publicization])?

B. – *La vulgarisation scientifique est –elle une? uvre d'intérêt national?*

(Is science popularization an effort of national interest?)

C. – *Les grand problèmes théoriques. (The major theoretical problems):*

1) Diversité des publics et des formes de la vulgarisation scientifique. Des analphabètes aux grands savants, en passant par les enfants, le public de la grande presse, les cadres administratifs et techniques, le Parlement et le Gouvernement.

Diversity of the public(s) and forms of science popularization. From non –literates to the great thinkers, via children, the general public and big media, administrative and technical bodies, Parliament and Government.

2) Les relations entre les savants, les vulgarisateurs [lire: communicateurs scientifiques, animateurs, médiateurs...] et les informateurs. Respect de la vérité et nécessité de la rapidité. Le problème du sensationnalisme. Le problème de l'an onymat médical. Le " rewriting". Nécessité d'une double conversion mentale: chez les savants d'une part, chez les journalistes et les vulgarisateurs d'autre part.

Relationships among the learned, the popularizers [read: science communicators, animators, media specialists....] and informers. Respect for the truth and need for speed. The problem of sensationalism. The problem of medical anonymity. Rewriting. Need for a double mental conversion: among the learned on the one hand, and among journalists and popularizers on the other.

3) Vulgarisation scientifique et enseignement des sciences.

Science popularization and science teaching.

4) Vulgarisation scientifique ou culture scientifique [lire: CST]?

Science popularization or science culture [read: SL]?

5) Le role des moyens audio–visuels, les bandes illustrées. La vulgarisation scientifique par les musées et les expositions. Les conférences. La radio. La télévision. [L'Internet aujourd'hui]

The role of audio–visual, comic strips. Science popularization by museums and exhibitions. Conferences. Radio. Television. [The Internet today].

6) La lutte contre les fausses sciences et l'occultisme.

The fight against the false sciences and the occult.

7) Valeur de la science–fiction

The value of science fiction

D. – *Les moyens pratiques. [Practical means]*

1) Comment augmenter le crédit et améliorer l'influence de la vulgarisation scientifique en France. Liaison avec les pouvoirs publics et les puissances de diffusion. Organisation d'enquêtes et de sondages d'opinion, etc.

How to increase credit and improve the influence of science popularization in France. Liaison with public authorities and the means of dissemination. Organizing surveys and opinion polls, etc.

2) L'amélioration de la vulgarisation scientifique en qualité. La "vulgarisation originale" et la "vulgarisation de la vulgarisation". Objectivité na ve et objectivité scientifique, etc.

Improving quality science popularization. "Original popularization" and "popularization of popularization". Na ve objectivity and scientific objectivity, etc.

3) Le recrutement des informateurs et des vulgarisateurs scientifiques et la valorisation de leur profession. Création éventuelle d'un Centre de Formation Universitaire. Fondation éventuelle d'un prix national, etc.

Recruiting informers and science popularizers

and valuing their profession. Possible creation of a University Training Centre. Possible founding of a national award, etc.

4) Un organisme officiel et un Statut de la vulgarisation scientifique sont-ils possibles?

Is it possible to have an official organization and a Satute of Science Popularization?

By substituting "publicizing" or "publicization" for "science popularization", these themes, with a few minor adjustments such as the addition of the Internet to audio-visual means, could very well figure entirely on an AMCSTI meeting agenda, for example, since they are still just as topical. And the discussion report itself could easily pass for the debates of an expert panel meeting on the occasion of the Etats Généraux de la Culture Scientifique et Technique:

Francois Le Lionnais pleaded for the recognition of popularization which he felt is of national interest since it serves national independence by helping to develop science:

... [T] here is no lack of tasks of national interest right now .... There is ... atomic energy, ICBMs, housing problems ...; isn't it somewhat childish here to want to include our problem - [popularization] - among these enormous problems? .... Well, I don't think so. Will you allow me to quickly express a syllogism: if we French wish to ensure our national independence (the problem occurs similarly in other countries in the same way) we won't do it, that's well-known, without adequate development of science, pure research, and applied research. (freely translated)

But he points out that the development of science demands high quality science teaching. Ours had to be reformed while keeping in mind that the pace of science development quickly renders it obsolete, and hence the need for popularization. More flexible and directly focused on current events, it will compensate for an inevitable delay:

.... Also recognized is ... that a country can only have adequate science development if there is proper teaching, which, at least here at home, is referred to as educational reform; this has also been discussed and admitted .... Science advances quickly; ... faster than teaching does ... ; whatever the educational reform, no matter how good, science will quickly move past it. So we need a complementary mechanism. We need, if you'll pardon the awful expression, a "rattrapeur de vitesse" ("a quick catcher-up"); where national education is concerned, we need a scientific popularization that provides the speed and flexibility necessary for teaching. .... (freely translated)

Jean-Louis Crémieux-Brilhac (Secretary General of the Comité Permanent pour l'Expansion de la Recherche Scientifique, Associate Director to the President of the Conseil) has denounced the lack of knowledge of the role of science in economic development, and saw popularization as the means to remedy this, while also fostering vocations in science:

.... It is quite extraordinary in a country, which is that of the Encyclopédie, of scientism and of scientific research policy, that a mere one percent of the population gives science and technology research this determinant value as the motor of economic progress. Undoubtedly, an ample reason in itself for developing science popularization is to consider that it has a role to play and a national importance. On the other hand, concerning the training of people, the development and improvement of the nation's level of science, we know that a major research policy is necessary. .... Popularization makes it easier to attract the researchers and scientists we need..... (freely translated)

Henri Longchambon (President of the Conseil Supérieur de la Recherche Scientifique et du Progrès Technique) stressed the improvement of the quality of life that we owe to science:

... I therefore think it would be in the national interest ... to have us ... understand the practical value [of science], its impact on this raising of the quality of life that has to some extent become the

test of the value of a social organization in all countries. .... (freely translated)

Louis Fran ois (Secretary General of the Commission Nationale Francaise for UNESCO), taking the same tack, emphasized the acceleration of progress, the adjustments it imposes on societies and the need to make the public aware:

May I be permitted to add two things. We see ever faster progress in science and technology that is transforming the world. But, at the same time, we observe how slow are the transformations in the political, economic and social structures. ... And, it is good that we show everyone these great developments in science and technology that impose profound changes on the political, economic and social structures of our diverse societies. They must absorb its problems by transforming themselves. (freely translated)

Paul Ostoya (Editor in Chief of "La Nature") recalled that science is too important to be purged of culture:

... [An] important role of science popularization consists of remedying this [the fragmenting of culture], by providing ... the means to catch up in this field [science] and not to remain completely ignorant about something as important as the development of science, in a word, to remake a popular culture. (freely translated)

Finally, Louis Cros (Director of the Institut National Pédagogique, Director of the Ministry of Education's Office) remarked that the artisanal phase is over, and that the State should now be committed to:

[In response to a question from Mr. Le Lionnais on the status of popularization] .... I believe like yourselves, that the artisanal stage is behind us; obviously the public authorities must be concerned with giving the organs of science popularization the means justified by their important scientific and social mission. (freely translated)

May I state here that this would be heeded by the State, as we shall see later.

A permanent hardcore of meanings

I wanted to recall this debate, now nearly 50 years old, because it dealt with various questions that included: national independence being guaranteed by science and technology development, since it helps maintain the collective competitive capability; the teaching of science, since the PCST debate is never separate from the issue of teaching, they go hand in hand; the structural backwardness of the school, which is seen as too inflexible to react quickly to circumstantial fluctuations; the lack of knowledge of the beneficial effects of science and technology, which are vectors of economic progress; the promotion of research careers; improved living conditions; political, economic and social adjustments to irreversible changes; the "dignity of man" today; the responsibility and support of the State...

We find here, condensed into short statements, nearly all the key ideas [4] that today still underpin the consensus uniting all the actors in the PCST movement. Some terms have become generalized, others have been added, which would permit this discussion to figure very honourably in our contemporary debates, their statements being just as relevant today. These key ideas are rooted in a hardcore of meanings that I summarize as follows:

– Science and technology "great actors and catalysts in transforming the world, are at the centre of the system of production, of daily life and the reflection on the contemporary world"[5]; to maintain this dynamic they presuppose the perpetuation of values which, from scientific rationality and the concomitant mastery of skills, form the foundations on which our modern world is based. The contemporary expression of rationality happens through an assimilation of the modes of reasoning inherent to scientific thinking: this responsibility is first and foremost incumbent on schools, supported by S&T communication. The challenge is to transmit the values and abilities that build our society.

– Maintaining the collective economic capacity of the nation demands a rapid and flexible adapta-

tion to change; this adaptation relies on a constantly renewed mastery of scientific knowledge and its areas of application. Raising the SL threshold helps maintain the nation's prosperity. The rapid adaptation to scientific, technological and industrial changes, key to improving competitive capability, happens through the development of new competencies, based on understanding and mastery of the fundamental principles of science and technology. The challenge is to maintain, even increase, the margin of economic competitiveness.

– Advances in science (in biotechnology and genetic engineering today, hot topics that grab media attention, as physics was at the time of the réunion-débat) that revolutionize our understanding of the living world, challenging our very concept of life, and progressively deconstruct the complex system of ideas, concepts, and representations, slowly formulated and shaped by history, enabling us to perceive and think of ourselves as "human". The monument erected by science expresses one of the greatest achievements of the human mind. Science takes its place alongside the other components of culture like music, literature, and the fine arts. The challenge is participation in contemporary culture.

– The democratic resolution of environmental, societal and philosophic debates sparked by these upheavals demands everyone's enlightened commitment. Access to SL for the greatest number guarantees collective and individual integration into an increasingly complex society. Science and its achievements constantly revolutionizing the relationship to the world and society require that everyone be able to act with understanding in making ethical, strategic, ecological and technological choices that prescribe the future or, that they at least understand the implications, to be acknowledged as full citizens. The challenge is democratic empowerment.

Up to now, these four key-dimensions have formed the cornerstone of all efforts to publicly communicate science and technology. They have made it possible to develop and carry out projects; to fully or partially orient the actions of those engaged in these projects; channeled the content strategies and choices; and guided the ways to treat, present and develop them. By invoking the Enlightenment and the popularization of science in the second half of the 19th century, the preamble to this conference strongly recalls the well-known but oft'neglected fact that the "public presentation" of science is not recent. On the contrary, it has a long and storied history which the contemporary desire to publicize science is part of. It is in the course of this history that the dimensions I've just referred to emerged and took shape. They are worth mentioning, if briefly.

Two sides of the same history

The question of knowing who in the social community will also reconcile the scholarly and secular discourses by reformulating for everyone what has been said in the language of a few, arose at the end of the 17th century, at the time when "sages" were busy inventing their own language in order to converse amongst themselves through specialized journals [6]. Fontenelle, with the publication of *Entretiens sur la pluralité des mondes* (1686) [Bernard De Fontenelle, *A Plurality of Worlds*, translated by John Glanville, 1688] adopts the role of lawyer for the community of sages, for whom he is the mediator and interpreter with the cultivated public. For all intents and purposes, what would become the "public presentation" of science developed in its general form as a collective project in the mid-18th century. It coincided with the development of positive scientific thinking and the Salons [7]. The field of application expanded during the century, the number of publications burgeoned as they became ever more popular, and the cabinets of curiosities that had appeared at the end of the 16th century [8] progressively transformed: the collections had to be both "seen" and "understood". Their inherent and singular knowledge had to be revealed at the time and place where their

self-defining objects were being contained. Thus other places and practices to publicly communicate science came into being. It should be remembered that this movement to reveal knowledge to the public was part of a wider movement that wrested science away from occultism, astrology and alchemy, and especially away from the "mysterious". The announcement that the Rings of Saturn had been discovered by Huygens in 1656 was circulated by means of a indecipherable anagram, accessible only to the initiated. The 18th century sages resorted to secrecy, first amongst themselves and later with the general public. They opted for the multiplier effect to spread knowledge in the vernacular language. Thus, the idea that science is universal, but also practical and useful, gained ground. However, dissemination of knowledge also took place to demonstrate the power of reason and hence that of man over nature. And the Salons supported, publicized and legitimized this movement affirming the independence of reason. The 18th century was "infused with faith in the unity and immutability of reason. Reason is one and the same for any thinking subject, for any nation, era and culture. From all of the variations of religious dogma, the maxims and moral convictions, ideas and theoretical judgments, there emerges a firm and immutable content, a consistency, and its unity and consistency are the expression of the true essence of reason"[9]. No terrain is prohibited from it. And most of all, what is different from the great metaphysical systems of the 17th century that still adhered to the realm of revealed "eternal truths", the reason of the Enlightenment was "the original and primitive power that leads us to discover truth, to establish and ensure its presence. This operation of ensuring the truth is the germ and vital condition of all genuine certitude" [10] Reason is liberty in action - made manifest through the exercise of the critical spirit - opposed to blind submission to authority and the guarantor of tolerance against dogmatisms. This is the meaning of Kant's *sapere aude* [11]. The Enlightenment entails a going beyond, a voluntary tearing away from one's condition. It entails implementing a true secular process of transcendence to attain the Universal. And this ideal of perfectibility, of progression, of going-forward, represented in the scientific project, is expressed tangibly by Progress, the promise of betterment for everyone.

In the 19th century, the pace of scientific progress accelerated as work became better organized. The self-employed "amateurs" of the 18th century, few in number, and often using rudimentary tools, were replaced by "professionals" trained by regular teaching of science, provided by a network of specialized institutions that possessed libraries, collections and laboratories. Better organized, by means of specialization, a prototype for the division of labour, and better equipped, research then progressed rapidly. The disciplines expanded their own language - formalization, symbolization, quantification - emphasizing the enclosure of their own knowledge. To this was added the growing importance of industrial spinoffs, which explains why the application of scientific knowledge to agriculture, industry and transportation in the 19th century progressively transformed economic life, ultimately leading to the emergence of big industry. These social transformations were depicted in such revues as *L'Echo du Monde Savant and La Science Illustrée* which were the forerunners of true popularization magazines, vigorously defending the cause of progress. In disseminating science to a larger audience of all classes of society, they perceived the conditions of a potential universal instruction and well-being which are the hallmarks of progress. In short, a broad movement of dissemination wherein Auguste Comte, the accomplished representative of scientism of that era, saw the means of a universal education to achieve a positivist philosophy. This 19th century thrust, characterized by the "affirmation of the social necessity of science"[12] continued into the early 20th century and up till the 1960s (when the *reunion-débat* took place at

the Palais de la Découverte).

Two ruptures occurred in the 1960s and 70s. The first was characterized by a growing independence of popularization, a coming into its own. This bolstered its legitimacy. Popularizers, until then merely auxiliary to the scientific community, demanded to be the exclusive mediators with the general public. They justified this demand by denouncing scientists as lacking the capability to address the public, decipher its expectations and share the "immense power that knowledge gives" [13]. While they made a huge contribution to the dissemination of the scientific thinking and spirit of the 19th and early 20th centuries, a "third man" had to be substituted who was neither scientist nor layman, an intermediary between the scientific community and the public at large. The two would be brought into contact with each other, filling the knowledge gap that had opened up between science and ordinary knowledge. In hindsight, we now know that the denunciation of an ever-widening gap helped the media's movement toward a more independent role. The arrival of an intermediary, just when the scientific community and general public were quite distant, served to define the conditions of this media role, affirming the thrust for autonomy. The most obvious and spectacular manifestation was the redeployment of science museums reinvented as "Science Centers". The Exploratorium in San Francisco and the Ontario Science Centre in Toronto both opened in 1969 and served as reference points that have left their stamp on all museums that have opened since. They were the first to definitively make communication with their visitors the primary objective of their mission. (Using the same logic in another context, it goes without saying that the learning spinoffs from these media messages, measured by the expectations of the scientific and academic fields, would quickly be judged unsatisfactory. This didn't bother the media for whom the question of relating to the academic field was easily resolved by making entertainment the given *modus operandi*, each time seeking the largest possible audience – with the possible exception of school and university programs broadcast on some stations, but this is another debate.)

The second rupture was marked by an increasing awareness that Progress always brings problems and risks. In the 1960s – to be brief – came the stark realization of a progressive intrusion of science and technology, their ramifications on the smallest details of daily life, along with social transformations and particularly their impact on the organization of work. This intrusion was of course accompanied by accidents of dire consequence, such as the oil spill from the shipwrecked *Torrey Canyon* in 1967, and the accident at the *Three Mile Island* nuclear power plant in March 1979 (the explosion at a pesticide plant in Bhopal, India in 1984, Chernobyl in 1986, among others, and the list goes on...). Add to this, and denounced since 1962, are the persistent pollutants such as PCBs, dioxins, furans, DDT, and numerous pesticides present everywhere in the environment whose effects represent serious and insidious threats to public health (and the balance of ecosystems) [14]. Too many such incidents sparked a backlash against scientific development and the attendant notion of Progress. A systematic doubt progressively took hold in people's minds and became a fact of society. The public became cautious, mistrusting and critical. People questioned the Utopia of a society transformed by the rationality of the Enlightenment, represented by science and materialized through scientific Progress.

To this I must add that the 1970s marked the turning point of a Kondratieff cycle [15]. The *Trente Glorieuses* [16] came to an end and the ensuing economic constraint, amid a Utopic morosity (among other factors), prodded the State to a new concern with publicizing science, which began to take shape in the 1980s.

(To be contitued)

Notes and References

[1] This article was first published in Pailliart, I. (éd.), (2005), La publicisation de la science, PUG, p. 11–51.

[2] The reference is to science culture, scientific and technical culture, science and technology culture, science literacy, or public understanding of science (PUS) as it is now generally referred to... To me these terms seem equivalent, and so I use them interchangeably. But it is sometimes useful to distinguish the means PCST (public communication of science and technology) from its purpose PUS (public understanding of science).

[3] Association des écrivains scientifiques de France, (1959), La vulgarisation scientifique – Réunion–débat, February 26, 1958, Paris, Palais de la Découverte. Other participants in the debate: Louis de Broglie, Secrétaire Perpétuel of the Académie des Sciences, Nobel Prize, Honorary President of the AESF, Jean Eparvier, Directeur Général –Adjoint of "France –Soir", Dr. Paul Milliez, Tenured Professor at the Faculté de Médecine de Paris, Member of the Science Committee at the RTF, Jacques Moreau, Editions Larousse, and Jean Rostand.

[4] For an overview, see: Schiele, B., Jacobi, D., (1988), "La vulgarisation scientifique – Thèmes de recherche", in Jacobi, D., Schiele, B., (éd.), Vulgariser la science, Seyssel, Champ Vallon, p. 12–46.

[5] Jantzen, R., (1996), La Cité des sciences et de l'industrie –1996–2006 – De la décennie de la floraison..., ... vers la décennie de la raison, Paris, Cité des sciences et de l'industrie, p. 14.

[6] The Journal des scavans appeared for the first time on January 5, 1665. In March of the same year The Philosophical Transactions was published in London in the form of a monthly revue. It should also be noted that the fledgling scientific community, by producing specialized revues, instigated a device that "at once assures the circulation and validation of information by forming a consensus dealing with scientific facts among members of the learned community". Kaufmann, A., (1993), "L'affaire de la mémoire de l'eau – pour une sociologie de la communication scientifique", Réseaux, 58, p. 79.

[7] Among others, to note the most important: Chambers published the Dictionnaire universel des arts et des sciences (Encyclopedia) in 1728, Abbey Pluche presented the Spectacle de la Nature in 1732, Voltaire published the Eléments de philosophie de Newton in 1738. Then, inspired by Chambers, Diderot and d'Alembert, surrounded by collaborators, issued the Encyclopédie.

[8] Mauriès, P., (2002), Les cabinets de curiosités, Paris, Gallimard.

[9] Cassirer, E., ([1932] 1997), La philosophie des Lumières, Paris, Fayard, p. 41.

[10] Cassirer, E., ([1932] 1997), op. cit., p. 47–48.

[11] Kant, E., (December 1784), "Qu'est–ce que les Lumières ?", Berlinische Monatsschrift.

[12] See: Eidelman, J, (1988), La création du Palais de la Découverte – Professionnalisation de la recherche et culture scientifique dans l'entre–deux guerres, Thesis, Université Paris V – René Descartes.

[13] Moles and Oulif, (1967) condensed the vision of this period: "A new function appears in society: that of mediation. The intermediary will be responsible for the communication of elements of thought among those that make them, in an abstract but necessary language for a highly coherent system, and those that may after information have right of regard on ensuing decisions, be they space policy or new theatre, decisions that too often are made by remote authorities, for whom only those said to be infallible oracles have access to the dossier". Moles, A. A., Oulif, J.–M., (1967), "Le troisième homme, vulgarisation scientifique et radio", Diogène, 58, p. 33. (freely translated)

[14] A primary work: Silent Spring. Carson, R., ([1962] 1987), Silent Spring, Boston, Houghton Mifflin Company.

[15] The oil price hike by OPEC is generally considered as the turning point.

[16] Fourastié, J., (1979), Les Trente Glorieuses, Paris, Fayard

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