

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

(Continued from previous issue)

The Palais de la Découverte, inaugurated in 1937 in Paris, like most museums designed in this era, was structured around the idea of basic science. Its objective was – and still is – to recreate for visitors the moment of discovery by reproducing milestone experiments that demonstrate the advancement of knowledge. Jean Perrin gave the best synopsis of the project: “we first wanted to familiarize our visitors with the fundamental research that creates science, by repeating on a daily basis the great experiments that underpin this research, without lowering the level, and in a way that many could grasp. We wanted to introduce people to science culture along with the qualities of precision, critical probity and freedom of judgment that this culture develops and which is useful to everyone, no matter what their career”^[52]. Discovery is the miraculous moment that rewards the researcher’s long and patient work conducted over long years. Pierre and Marie Curie, among others, working with selfless passion, represented the perfection of this ideal. A single desire: to advance science and humanity. No restraint in application, innovation or results interfered with their quest. It was up to society

to find the potential industrial and economic spinoffs, to make it useful for itself. This was not the researchers’ responsibility. In this context, we might wonder how faithful are the experiments reconstituted by the Palais, just as we might question how valid are the deliberations of the Académie des sciences reported in 19th-century newspapers, and just as we nowadays question the media coverage of our scientific conferences. What was expected of public presentation of science was to evince the qualities set forth by Perrin, such as critical attention to detail, much more than any particular fact. What was sought was a certain way of being in the world, by forming a habitus, as Bourdieu would say, that predisposed the social actor to think (and to project) in a relationship of quest of knowledge and simultaneously to be part of a social relationship in quest of knowledge (since the two are inseparable). The notion of epistemological obstacle elaborated by Bachelard at this time was a good illustration of what this dispositio implies for the subject: a surpassing, something must be forgotten in order to achieve a condition of learning, and perhaps one day be able to discover. In short, it demands a

continual lay pursuit of transcendence that I've already evoked in respect to the Enlightenment.

So that's why the errors, the simplifications, the reductions, presented in any and every message, are secondary (which doesn't mean they are insignificant), just like the problems of understanding and resistance to discovery that occur during all learning. Bachelard writes that this resistance is overcome only with a honing of the apparatus of reasoning. He feels that knowledge is clear only afterwards, at the end of the inherent effort involved. "We know," he wrote, "against former knowledge, by destroying misleading knowledge, by overcoming something that, in the mind itself, is an obstacle to spiritualization" ^[53] (my emphasis). From then on we understand why the quest for knowledge is also an initiatory effort: to find "the truth in a true intellectual repentance ... is to accept an abrupt change" ^[54], to reshape one's identity. But it is also to be able to project oneself through all time, to be dedicated solely to a quest whose outcome is uncertain, with selfless patience, as Perrin said. The scientists on display at the Palais de la Découverte, heirs of the spirit of the Enlightenment, represent reason dedicated to pure and disinterested research. Thus they played a role as frontline propagators, which they only relinquished to science journalists during World War II. The physical and abstract universe reigned. Discipline doubly emblematic through its formalization and its applications, notably in the conduct of war through invention of radar and fabrication of the atomic bomb, could no longer be decoded from common experience. There had to be someone to describe this formal universe and explain its impact. The audience for science in the public sphere had to be expanded because traditional knowledge and know-how proved inadequate to confront the new intellectual tasks^[55].

This is the perspective in which the Palais de la Découverte took shape. On the one hand, it was a dissemination project designed to transpose the paradigms structuring the scientific community, and on the other, to show the conditions of access to the cultural legitimacy of an ascendant social fraction, namely the scientists and more particularly the physicists. (Since, as Duby points out "the dissemi-

nation of a type of culture takes place synchronistically with the formation of a social group" ^[56].) For France the founding of the Palais de la Découverte coincided with the beginning of the third phase of expansion (1940–1962). It is a marker of an ascendant mode of relationship to knowledge – that of disciplinary knowledge and fundamental sciences, briefly described earlier – just as the meeting of February 26, 1958 is a marker of the end of this expansion and the start of the destabilization of this same relationship to knowledge.

The second example is that of the Sciences Centers. The context has completely changed. No longer is science on stage, but rather its spinoffs. The recently opened Montreal Science Centre goes even further. Innovation alone holds centre stage, and science itself is only incidentally evoked, as a distant reference. While the Palais de la Découverte left it up to others to transpose the discoveries of science, as vector of progress and change, the reverse process is now taking place. Innovation has replaced fundamental research as the motor of change^[57]. This shift in consensus on the role of science was reflected in the advent of Science Centers in the 1970s. The change was more profound than it first appeared. Why? Fundamental research valued and gave value to knowledge in itself, as something revealing the world's intelligibility through the unconstrained exercise of reason. Today the relationship has changed. It is less about understanding the world than transforming it. Maintaining economic development, bolstered by an endless renewal of consumption, demands a constant input of new ideas and products on the market. In other words, innovation presupposes a systematic obsolescence as a productive force. Knowledge is subjugated to it. I'm not saying that there is no longer any fundamental research being done. That would be absurd; I am simply saying that a rule of necessity reigns: research takes place in contexts validated by potential uses^[58]. More than ever, this knowledge is being produced collectively in a context of application. The process is transdisciplinary. Skills are committed to heterogeneous and diversified means of production, determined by social as much as financial accountability^[59]. (To be related to the disenchantment

with Progress accompanying the rise of the fourth phase^[60].)

In less than 50 years the relationship between society and science has changed completely. The presentation of S&T to the public as done by the Sciences Centers not only reflects but also promotes and promulgates. Instead of the image of researchers engaged in individual quests, highlighted by the Palais de la Découverte, we now have teams united around a project to which each contributes their knowledge and skills. The relationship to knowledge is no longer the same. In the first instance it represents a discursive space within which the knowing subject is there to think and act – knowledge is constitutive of the effort in which the researcher, as subject and social actor to this knowledge, is engaged. In the second case, illustrated by the Science Centers, knowledge, mobilized for a specific purpose, is dissociated from the subject's heuristic quest. Knowledge only happens through this mobilization. So it is a constant matter of seeking new information, upgrading knowledge, recycling... In this regard the successive recastings of school programs here in France, elsewhere in Europe, and in America leave no doubt: that schools too are being reshaped around a few key-ideas: to acquire skills, to constantly update this knowledge, to learn to resolve problems in a group, handle various communication situations, etc. In short, accommodate the collective resolution of problems by mobilizing the necessary skills, and mutually determine the strategies, the means, and the information required, immediately available or obtainable through research. A good illustration of the new relationship with contemporary knowledge is the Science Learning Network (SLN Alliance) of Unisys Corporation in the United States, which brings together Science Centers and schools so that that they function as data banks and resource centres for each other^[61].

Essentially, it seems to me that there's a cyclical recurrence of the discourse on the need to again publicize S&T, and this occurs simultaneously as new conditions of production are implemented – sparked by a succession of notable innovations – and demands a rapid acculturation by the social actors. The publicizing of science (all media together) then functions

like a symbolic operator, an active benchmark, enabling them to think in a new role, justified by the acquisition of new abilities and skills, and a renunciation of the old, deemed obsolete. What could be more legitimate than a society-driven work accompanied by the desire to share knowledge (or “knowledges”) and reforging the science/society pact (desirable in all respects)? But without forgetting nonetheless that these desiderata reactivate the core of meanings of all discourse on PCST, to better incorporate into a new context. With the British and American work as a backdrop, I noted that the relaunch of this publicization is triggered by two groups of external factors: economic growth and innovations. This work also suggests that the role of publicization has progressively come into its own, and now operates as an adjunct, a catalyst to economic development. (Which would explain the State's involvement beginning in the 1980s).

Before concluding, I would like to call your attention to an effect of this work of recomposition, the redistribution of the right to speak that attends each recomposition.

Social spaces and communication devices

What researchers and scientists say about their activities, how they conduct them, the results obtained, the desired spinoffs, all these certainly contribute to the transformation of what “makes sense” for the actors, and how the relationship of society and S&T is represented. But, in giving researchers and scientists the right to speak, who is it that puts science on display? To answer this question I return a final time to the famous réunion-débat.

The February 26th discussion made clear that the written word – the press and magazines – largely dominates the popularization practices. However, what was then called audio-visual, before simply becoming today's media, already had a considerable influence on the evolution of disclosure practices. The potential of this media, especially the power of the image that it showed and crystallized, was not lost on those involved. They emphasized the visual memory of children, and how effective popularization could gain from it. They realized the necessity to adapt to the preponderance of the image, and clearly antici-

pated that they would have to allocate a place for it in their activities. After doing so, they fully grasped the structuring effect of media on cultural practices, and consequently the necessary adjustment to the popularizing practice. “[W]e must ask ourselves,” concluded Crémieux-Brilhac, “if, in the 20th century, the most effective popularization, whatever its attributes, or how much we like the printed page, is not that of radio and television” ^[62].

We know what ensued. In the next 20 years, the media’s ever-growing influence on the imaginary and cultural life would reinforce a process of media autonomy begun well before. The idea, advanced around the 1960s, of a “third man” ^[63], an intermediary between the creators of knowledge (highly specialized scientists, using esoteric and certainly effective language but known only to themselves) and the public (which had another language, other preoccupations, and other recreations), clearly reflected the growing independence of the media field, showing it to be the natural place that could reach out to the scientific community to ask for information, to receive and process the answers, and retransmit to the public. It was no longer a question of popularization but scientific mediation. Hence, the scientific field ceded the initiative of publicizing science to the media field. In other words, the focal point of the S&T discourse moved from the scientific field to the media field, just when “discovery” gave way to the applications and economic spinoffs it could anticipate. Suffice to recall how the technical and technology culture, with its know-how and its tricks of the trade, till then considered to be inferior to scientific culture (itself idealized by the apparent absence of constraints), suddenly gained enormous credibility. In this context, the independence of the media field offers a relatively free communication space where discourse can take place without being shackled by existing devices. The media therefore offered a potential for redeployment of the publicization discourse that it quickly became part of. I use these two examples to emphasize that publicizing S&T, in a push-pull with society, cannot consider itself independently of the roles of the actors involved in a dynamic of deterritorialization / reterritorialization, constantly at play. This dynamic opens

up the communication spaces where the discourses and the publicizing practices are reconstituting, and it incorporates others – or, at least, adds them to the periphery. This dynamic reinforces the roles of some actors and weakens others, which is why the science/society evolution during the various phases of expansion is accompanied by different and changing places to speak out from.

I will give you a second example of change or displacement. As I’ve already noted, between 1960 and 1980 the museology of science experienced a “cultural revolution”, from which the Science Centers emerged. These establishments stood apart from the preceding generation by the primacy accorded the public (or “publics”), and their separating the research aspect from dissemination. The focus was on the communication relationship, much more than on a “screen of concepts” where visitors “project and discover their perceptions” ^[64]. Publicizing then opted for interactive devices, intended to be both recreational and didactic in order to captivate, fix and retain visitor attention. Changes in the process of disseminating S&T that formed the basis for the Cité des sciences et de l’industrie’s dissemination project ^[65].

But the rise of interactivity only partially explains the profound movement of recomposition then taking place. The externalization of certain traditional museum activities was more radical, though rarely perceived as such, because it was taken for granted in terms of effectiveness and performance. Most museums up until then had part- or full-time resources, staff (researchers, technicians, graphic artists, display people ...), and the infrastructures they required (laboratories, libraries, workshops...) to design, develop and produce, *intra muros*, the mock-ups, assemblies, installations and exhibitions they presented to the public. These realizations, specific to each institution, were almost always designed and developed according to the inherent needs and constraints of each project, and sometimes took several years to complete. In a way, these unique productions, virtually non-reproducible, were their own model. The museum network therefore showed a wide range of particularities, each with its own configuration. Each museum formulated its own objectives and working rules, and

defined the terms and conditions of the relationships it wished to establish and maintain with its environment. In short, each element of the network was part of, and interacted with, an open milieu. This is why the network, understood as a system to highlight and disseminate science, imposed its rules, norms, expectations and finalities, which is to say its internal coherence, on an outside environment which had not yet produced its own.

With the arrival of the science centres, everything changed. First of all, a displacement of the pole of legitimacy, which Cameron (1971) reported in regard to the Ontario Science Centre:

[At] the end of 1966, the government and several members of the Board of Directors decided that museums were no longer with it at all. The word 'museum' therefore became unacceptable. They felt the public no longer had any interest in a museum with collections and a research program, a conservation laboratory and a library. As well, after a few months, all qualified personnel in museology experience had left the institution. The planning and development then devolved to a group of museographers, to specialists in public services and a staff dispatched by the Ministry of Education, so there was no longer any museology expertise and the Centre could no longer be a museum in terms of its mandate^[66].

Cameron notes, and rightly so, that the planning and development changed hands. This led the teams in charge, who were laypersons in the reference areas, to surround themselves with specialists but without, justifiably, binding them to their recommendations. This is now common practice in the museum world. Consequently, the management, coordination and control functions increased while the externalization, up until then occasional, but thenceforth more flexible, would become generalized, thereby opening up a more or less closed market in the museum field of subcontracting services and expertise. This was equivalent to privatization since externalization implies a major redistribution of the establishment's own staff and resources. This privatization movement had a profound impact on the museum field. For example, the twofold and constant constraint of visitor attendance – the contemporary/benchmark of museum

productivity – and, consequently the systematic renewal of museum offerings, imposed new functions (management, coordination, cost control, schedules...), a standardization of procedures (design protocols, development and production of exhibitions, educational activities, publications, commercial cultural products, etc.). The providers of specialized services also imposed their own logics, constraints, and standard. The result was the strong trend to uniformization that Crozon had already noted in 1981 upon return from a mission in the United States, Japan and Europe where he visited some 50 S&T museums. The museums "fully reference science and technology activity. This translates into a great unity of language, the same borrowings in scientific language, the same diagrams or curves, graphics or formulae, ... the same subjects chosen in the same sciences (the inevitable pendulum of Foucault, or "the same chicks being hatched" ...) leading us to observe that we only show what we know how to show" ^[67]. May I add that this trend has continued. Doing only what we know how to do, doesn't that guarantee efficiency and performance when we have to produce something quickly and frequently? The arrival of the science centres, as much through their instituted dissociation from the fields of reference, the search for ways to compensate this, the emphasis on the public, and so on, force a realignment of the museum project and an organizational transformation that prefigures the even more radical changes that a burgeoning neo-liberalism would impose on the next decade. The outcome was an alignment of the museum field – not yet completed – to fit the logic of the cultural industries^[68] (an alignment that is characterized today by museum offerings focused around cultural products created for the consumer market), and in regard to my statement, one that desolidifies science networks and museum diffusion networks^[69].

If today's question, especially at this conference, is "popularization" (or "publicizing"), and no longer the "mediation" of S&T, the "communication" of S&T, the "popularization" or even "vulgarization" of S&T, so many terms, each expressing a recent history of modalities (in the sense of convergent communication devices) of S&T socialization, it acknowledges the succession of social factors

to reformulate the “public presentation” of S&Ts and their inherent spaces. While, in creating the Palais de la Découverte, scientists sought to establish a direct relationship between the producers of knowledge and the public^[70], the arrival of media professionals and science centres, has desolidified this to the benefit of the public scientists. The science journalists’ right to speak, like that of museum professionals, is today in turn threatened by the growing impact of public relations’ specialists^[71].

Conclusion

I have tried to show three distinct yet related aspects of publicizing science. All the reformulations of the “public presentation” of S&Ts have up to now reactivated the same hardcore of meanings although each time they are part of a different context. In a way, this is the most profound level, the most entrenched, and one which spontaneously attracts a large consensus. However, this consensus obscures the real work of recomposing society’s relationship to S&T, to which publicizing actively contributes through the reconfiguration of the social actors’ relationship to knowledge. Finally, this recomposition is accompanied by a shift of communication spaces which includes a right to speak. And which brings me to two concluding remarks.

First, I feel I must return to the critique by Philippe Roqueplo^[72] on the role of media. Roqueplo concludes that the media systematically reproduces the gap that it denounces. Rather than achieving the rapprochement that it lays claim to, it substitutes a “window dressing”. Roqueplo maintains that the appropriation of scientific know-how basically depends on practice: scientific knowledge is first and foremost know-how. Consequently, “the experience recounted is not the effective experience”. And for non-scientists who lack the practical aspect, the account of the experience does not represent reality, it remains on the level of discourse since they have no way to do it. This “window dressing” is activated through a seeming “show of content” of science provided for the science discourse and through the “show of au-

thority that legitimizes this content and its integration”. In short, a show about and on science, relegating and confining each to their role of scientist or non-scientist. At best, there will be representations of knowledge but no genuine appropriation. Roqueplo, true defender of a science that answers only to itself and symbolized by the Palais de la Découverte, theorized the science/society relationship that prevailed during the third expansion. It was suddenly impossible for him to conceive that media’s main symbolic operation was on a level other than disseminating knowledge. He remained enclosed in a model where science and society are two distinct entities; as if there’s a wide gap between science (and of course its researchers), on the one hand, and society, on the other, with the residual question being the extent of this knowledge gap. In his model the referential is knowledge produced uphill by scientists. This can only be degraded or weakened when media plays its hand (deficit model).

Second, at the other end of the spectrum, closer to us, Jean-Marc Lévy-Leblond^[73] points out that “the level of ignorance of a specific area is nearly as high in the scientific community, most of whom work in other areas, as it is among lay people. So we’re not dealing with a single large gap separating scientists and non-scientists, but a multitude of distinct gaps, separating specialists”. Moreover, to defuse once and for all the question of science illiteracy, he recalls a survey conducted in a large circulation magazine revealing that while “30% of people believe the Sun goes round the Earth^[74] ..., 60% do not know who painted the Mona Lisa, 56% did not know when Charlemagne became Emperor, 35% could not name the city where the Parthenon is found”. Not without humour he observes that such a survey conducted in England showed that more citizens were able to name a few of the Seven Dwarfs than could name a few current prime ministers! So much for that! The illiteracy in science and technology, pervasive worldwide, can only continue to worsen in future. Whatever the amount and range of knowledge mastered by whatever people in a given field (if the specialists can agree amongst themselves on the knowledge they consider

essential), it can only be out of sync with other fields and out of touch with new knowledge produced in each area. The gap is structural. In the “science archipelago” the gaps can only widen between the scientists themselves, between scientists and non-scientists, and between non-scientists. Looked at this way, the question of science and technology culture is again stymied. Why? Because Lévy-Leblond starts from the same premises as Roqueplo, revisited by the surrounding relativism of the fourth expansion.

If culture can be defined as a complex of signs and meanings – including language – woven, combined, intertwined within devices for transmitting values and meanings^[75], we understand that cultural practices convey meanings because they depict the society they are part of and return to^[76]. Practices, representations and behaviours interact with matrices of relationships and meanings. We therefore understand that publicizing science, at a moment marked by a given society and its crystallized practices, anchors and consolidates shared meaning. It therefore behooves us to grasp the transformations in the practices of science publicization to try to apprehend the matrices of emerging relationships and meanings. We should not be deceived: it is the consolidation of meaning that produces the culture and not the reverse^[77].

Notes and References

- [52] Quoted by: Rose, A. J., (1967), “Le Palais de la Découverte”, *Museum*, (20)3, p. 206.
- [53] Bachelard, G., ([1938] 1970), *La formation de l’esprit scientifique*, Paris, Vrin, p. 14. [Formation of the Scientific Spirit, Clinamen Press (2001)]
- [54] Bachelard, G., ([1938] 1970), *op. cit.*, p. 14.
- [55] Meadows, Jack, (1986), “Histoire succincte de la vulgarisation”, *Impact: science et société* 144, p. 395–401, *passim*.
- [56] Duby, G., (1967), “La formation des modèles culturels dans la société féodale”, in David, M., et al., (Ed.), *Conference Proceedings*, May 7 to 9, 1966, Paris, Mouton.
- [57] Castells, M., (1996), *The Network Society*, Cambridge, Blackwell.
- [58] An indicator of this trend in the museum field: museums increasingly develop their research according to the exhibition projects, while not so long ago, it was the reverse.
- [59] Limoges, C., (1995), *L’université entre la gestion du passé et l’invention de l’avenir*, Symposium de la Commission de planification, Québec, ronéotypé p 8–10, *passim*.
- [60] See: House of Lords, Select Committee on Science and Technology, Third Report, Science and Society, February 23, 2000. This report observes that a crisis of confidence today characterizes the relationship between science and society. For the Lords, this critical situation demands the application of correctives which satisfy the public’s demand for the transparency from scientific and government authorities. Very pragmatic, they declare: “public hostility to a product or process may drive industrial investment in production or research overseas”, p. 1.12. I recall in passing that the NSB survey of 2004 refers to this critical relationship.
- [61] Helfrich, P. M., (2000), *Building On-Ramps to the Information Superhighway: Designing, Implementing, and Using Local Museum Infrastructure*, in Schiele, B., Koster, E., (éd.), *Science Centers for this Century*, Ste-Foy, Multi-Mondes, p. 87–123.
- [62] Secrétaire Général du Comité Permanent pour l’Expansion de la Recherche Scientifique, Directeur-Adjoint à la Présidence du Conseil. Association des écrivains scientifiques de France, (1959), *La vulgarisation scientifique – Réunion-débat*, 26 février 1958, Paris, Palais de la Découverte, p. 35.
- [63] The primary article is of course that of Moles and Oulif (1968), *op. cit.*
- [64] Moles, A. A., (1967), *Sociodynamique de la culture*, La Haye, Mouton, p. 28.
- [65] See: Decrosse, A., Landry, J., Natali, J.-P., (1987), “Les expositions permanentes de la Cité des sciences et de l’industrie de la Villette, Explora”, *Museum*, 155, p. 176–191; for a critical perspective, Chapter 4 – Les silences de la muséologie – in Schiele, B., (2001), *Le Musée de Sciences*, Paris, L’Harmattan.
- [66] Cameron, D., ([1971] 1992), “Le musée: un temple ou un forum”, in Desvallées, A., (éd.), *Vagues – une anthologie de la nouvelle muséologie*, Savigny-le-Temple, M.N.E.S., Vol. 1, p. 78, (from: “The Museum, a Temple or the Forum”, *Curator*, XIV (1), p. 11–24).
- [67] Crozon, M., (1981), “A quoi servent les musées?”, in Groupe de liaison pour l’action culturelle scientifique, (éd.), *La science au musée: sur les musées des sciences et des techniques*, Paris, Groupe de liaison pour l’action culturelle scientifique, p. 81. Cameron (1997), describing the contemporary evolution of museums, writes: “Should it surprise us if museums are becoming indistinguishable

from shopping malls, or that collections are being viewed less as a public trust and more as fluid assets to be sold to offset deficits? Should museums profiting from each other through fees and charges for services, or public exhibition galleries closed to the public for a wedding reception come as a shock? No. Consider this line of argument. The museum is competing in a free market for its customers' entertainment dollars not their minds. It is offering products, not ideas". Cameron, D., (1997), "Closing the Shutters on 'The Window on the World': Museums and the Future", in Coté M., Ferera, L., (Ed.), *Perspectives nouvelles en muséologie / New trends in Museum Practice*, Québec, Musée de la Civilisation, p. 172.

- [68] Works on the cultural industries have developed significantly over the past 20 years, one might say at a pace where they were restructuring the market of symbolic goods. The effects of these industries on STC are considerable, especially in annexing of the museum field. See: Miège, B., (2000), *Les industries du contenu face à l'ordre informationnel*, Grenoble, Presses Universitaires de Grenoble, and Miège, B., (1989), *The Capitalization of Cultural Production*, New York, International General.
- [69] On this point, see "Producteurs et consommateurs", in Bensaude-Vincent, B., (2000), *L'opinion publique et la science - A chacun son ignorance*, Paris, Institut d'édition Sanofi-Synthéabo.
- [70] Eidelman, J., (1992), "La création du Palais de la Découverte: idéalisme corporatiste et matérialisme politique", in Schroeder-Gudehus, B. (éd.), *La Société industrielle et ses musées: Demandes sociales et choix politiques - 1890-1990*, Paris, Editions des archives contemporaines, p. 161-169.
- [71] On the development of public relations vs. science journalism, see: Gregory, J., Bauer, M., (2003), "'PUS inc.': l'avenir de la communication de la science", in Schiele, B., Jantzen, R., op. cit., p. 41-65; Gopfert, W., (2003), "Une vue déformée des sciences: de la faiblesse du journalisme et de la force de relations publiques", in Schiele, B., Jantzen, R., (2003), op. cit., p. 67-78.
- [72] Roqueplo, P., (1974), *Le partage du savoir*, Paris, Seuil, passim.
- [73] Lévy-Leblond, J.-M., (2002), "Science, culture et public: faux problèmes et vraies questions", *Quaterni*, 46, p. 95-103, passim.
- [74] To return again for a moment to *Terre et le Soleil*, here is what Lévy-Leblond says about it: "à la question "lequel tourne autour de l'autre i", je ne peux, en tant que

physicien, offrir une réponse sans ambiguïté que si l'on me dit à quel système de référence elle est censée se rapporter. Car le Soleil, vu depuis la Terre, tourne bien autour d'elle ! Et affirmer le sérieux d'une telle réponse n'est pas argutie provocatrice : les calculs très sophistiqués des trajectoires suivies par nos sondes spatiales se font effectivement dans ce cadre où la Terre est (à bon droit) considérée comme immobile, cinq siècles après Copernic. (...). La description du mouvement peut se faire dans n'importe quel référentiel". ["to the question 'which turns around the other?', as a physicist, I can only offer an unambiguous answer if I'm told what the reference system is. Since the Sun, seen from Earth, turns around it! The seriousness of such an answer is not mere quibbling: very sophisticated calculations of trajectories followed by our space probes are made taking as framework that the Earth is (deservedly) considered to be immobile, five centuries after Copernicus The description of the movement can be within any reference"].

- [75] Harvey, D., ([1990] 1995), *The Condition of Postmodernity*, Cambridge MA, Oxford UK, Blackwell, p. 299. The quotation reads as follows: "[I]f we view culture as that complex of signs and significations (including language) that mesh into codes of transmission of social values and meanings, then we can at least begin upon the task of unraveling its complexities under present-day conditions(...)".
- [76] Linton, R., (1959), *Le fondement culturel de la personnalité*, Paris, Dunod.
- [77] Castells, M., (2000), "Material for an exploratory theory of the network society", *British Journal of Sociology*, 51(1), p. 5-24, passim. Castells' core argument reads as follows: "[B]y meaning, I understand the symbolic identification by an actor of the purpose of her/his/their action. The consolidation of shared meaning through crystallization of practices in spatio-temporal configurations creates cultures, that is systems of values and beliefs informing codes of behaviour. There is no systematic systemic dominance in this matrix of relationships. There are all layers of social structure and social causation, folded into each other, distinguishable only in analytical terms. Thus, meaning is not produced in the cultural realm: it is the cultural realm that is produced by the consolidation of meaning" (p. 7).

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