Participative Science and its Epistemological Implications: A Contribution to Science Communication

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Abstract

Science and society relate to each other through a communicative interface whose existence is both subtle and real. This interface is materialized through practices that bring together scientists and laymen and it can be described by analyzing such practices, its agents and other ways to establish or hinder dialogue. This paper intends to make use of the panel with three coexisting categories proposed by Michel Callon (2000, 2001), incorporating contributions from Bernadette Bensaude-Vincent (2003) (and other authors) in order to identify some of the interface possibilities and their repercussions in society as well as in science. Next, with Ludwig Fleck's epistemology (2010) as a reference, the paper discusses how science is affected by these issues. Last, some specific aspects are approached, including the role played by the diversification of science communication practices in the construction of more democratic societies with people implicated in science decision or the impact of these ideas in science teaching.

Callon's 3 models

A sociologist and an engineer, Michel Callon is known as an analyst of the relationship between science and society. To describe this relationship's different forms, he resorts to three models, which are the basis of this paper's discussions and will be detailed in the present section.

The first and most common model (Callon, 2000) is public instruction. It comprises science as universal, stable knowledge, ready to be applied to a variety of real life situations through adjustments in context features. Science is a source of answers that are produced away from society and are conducive to human progress. It must be explained to those who do not take part in its production, i.e., laymen. The public instruction model is characterized by the need to educate society, to disseminate the knowledge produced in scientific circles. Thanks to the knowledge that is disseminated, popularized, publicized, it will be possible to fight against obscurantism, beliefs and passions of the layman that materialize in subjective fears and risks, inherent to the ones who ignore science. The recognition of scientific facts lead to the construction of a rational mode of thinking whose levels of elaboration will allow for an informed opinion about the issues that implicate science. While this does not happen, people put their trust on scientists and specialists of various horizons, as they can explain, justify and decide whenever needed. The layman's knowledge is science's reverse and it disturbs the comprehension of science, so it must be destroyed. As for the public, it is characterized as a mass of citizens (or consumers) distinguishable only through their level of knowledge. In this model, controversies are also the manifestation of a science which is still immature and did not reach consensus. In this stage, contact with the public is nor desirable.

In Callon's second model (2000), the situation changes. As in the first one, science constitutes a knowledge which is essential to society but which is not enough as a reference to describe the questions of the world that surrounds us. In the case of scientific conclusions, precision and the possibility of generalization are attained through validation criteria that are too strict for the knowledge to extrapolate to real life situations. Callon (2000, 2001) resorts to an example that has become a classic and was used in the 70s by Brian Wynne to explain the concept. It focuses on the interactions between scientists and shepherds living around a reprocessing nuclear plant in England. After some episodes of contamination in the region, specialists responsible for monitoring the population during decontamination used laboratory data to inform the elaboration of advice and directives.

From error to error, the specialists analysis got dangerously close to the absurd, showing that precise measures and careful sample collection do not guarantee that conclusions will match the local context. Eating and living habits of the sheep – about whom a specialized opinion should be issued, geology and morphology of the soil where the sheep used to graze, history of previous instances of contamination (invisible to the city officials but well known by the population), the amount of rain and the water flow on an uneven terrain, etc. should have been incorporated to the reflection. Therefore, there are no doubts raised about what science knows but only the desire to define an appropriate way to understand real situations using scientific knowledge as well as local knowledge. The layman emerges here as someone who knows situations that are unique, not ideal, complex and teeming with "external parameters" that, at least most of the time, cannot be changed. Regarding the decisions, they must be made by laymen in conjunction with scientists, in a process which is demanding for both: the scientist must know profane local knowledge and take it into consideration as much as the profane needs to know scientific thinking and take it into consideration. But here, in contrast with the previous model, the focus is not on the technical aspects of knowledge but on the complex fabric they compose, along with other kinds of thread. Some dialogic practices are becoming popular in Europe.

Science appears here as certainties and uncertainties, benefits and risks that must be evaluated and assumed. Controversies are social as well as scientific and can be described as situations in which scientists cannot be left alone to ponder and decide. As for the laymen, they are different according to their circumstances and their way of living and learning about the world: their professional activities, their geographical location, their age and gender. Their potential contribution derives from all the specific knowledge and abilities that come from their own experience and observations.

The third model (Callon, 2000) is the co-production of knowledge. Here, the limits that separate scientists and laymen are definitely erased to the benefit of collaborative work and hybrid teams. This is not the same as attributing scientific work to laymen; instead, it aggregates the contributions of all subjects actively engaged in the process. One example is Genethon, a worldwide leader in developing biotherapies against rare diseases (Callon 2001). Located in France, the laboratory was recently recognized as the first non-profit organization authorized to produce pharmaceutical drugs. Its history encompasses the creation of the French Myopathy Association by the parents of children with neurodegenerative muscular diseases. Unreconciled with the absence of an effective therapy and information about the condition of their children, these men and women decided, despite their lack of scientific education, to get together and do something. At first, they engaged in what could be called a primitive accumulation of scientific knowledge: patient identification and recognition, systematic drawing of blood and DNA samples that were analyzed by medical doctors who were partners in the initiative, photography and film making as tools for observing and monitoring the disease's development, assessing and comparing the effects of particular therapies, recording personal accounts and interviews about the experiences of patients and relatives. In some cases, they have culminated in the publication of papers in scientific journals. As the work evolved and those who were once regarded as laymen accumulated scientific knowledge, participation expanded to contribution in therapeutic experiments and result evaluation. Eventually, the parents came to contribute to and organize events that were neither science nor scientific communication, but an opportunity to share information with anyone with interest in these issues. Side by side around the table, scientists, parents and all the people who take part in the process of knowledge production. In the audience, parents, patients, scientists searching for information about the theme and, from time to time, would interrupt their colleagues to provide the latest data or some precious insights.

The next move for the association was to raise the necessary funds through Téléthon. They hired researchers and students, built and equipped laboratories that follow the guidelines developed jointly by this hybrid group. The good results multiplied and, little by little, a scientific research corpus was built, bringing about innovations that proved to be of great interest and scientific quality. Such positive outcomes were made possible by the reinvention of the whole science production structure. Agents and interests that would disrespect or disregard the conventional model for research and for the organization of knowledge played an important role in the process. Despite its clairvoyance, this is not the only example.

Regarding the different models for the relationship between science and society, it is important to highlight that Callon (2001) reckons the principle of complementarity. It is not a question of instating systematic and collaborative dynamics, which are not feasible because the scientific research field is not restricted to the issues that are prone to originate concerned groups. Traditional actions of scientific communication (like the ones described in Callon's first model (2000) definitely play a role, and not only a historical one. As for the public debate model, it comprises subjects that explicitly imply society, but how can we deal with the activities about the Higgs boson in this context? This is clearly an “affaire” that will tend to remain internal to science.

In line with the ideas presented here, Bensaude-Vincent (2003) dedicates a book to the study of the role played by opinion in science. By means of historical examples and a precise and well reasoned analysis, the author states consistently that the dichotomy “inside” / “outside” of science has evolved throughout the centuries. For her, there were moments when the public (or at least part of it) interfered and actively contributed to the deployment of the deepest layers of science.

Regimes of science, regimes of dialogue

Ludwik Fleck (Delizoicov, 2002), a Polish physician and epistemologist, wrote in 1935 about the genesis and development of a scientific fact. For him, the process that leads to the construction of science is closely related to the social and historical assumptions of the subjects who take part in it by searching for solutions for each problem. The author postulates the existence of such groups, which bring together people who share the same scientific notions. Because of this collective structure, the circulation of ideas inside and between groups turns out to be very important. This exchange is a relevant part of the interaction between subject and object of a given knowledge in scientific problematization. Delizoicov (2002) reminds us that, for Fleck, the cognoscitive relationship that allows for men to build knowledge about an object cannot be simplified to the point of becoming a game between the subject who wants to know and the object of knowledge. The context, composed by social, historical and cultural relationships, is definitely ingrained in the resulting knowledge.

Fleck's conceptions indicate an epistemological foundation which admits that the science produced by hybrid groups, like in the examples above, is different from science produced only by specialists. This is particularly clear when we consider the demands of the laymen and their engagement in formulating the problems that are investigated.

Extrapolating this conclusion, we can also say that the facts, processes and products of science will do better ex situ if they carry the germ of plural thinking, which is typical of groups that include scientists and laymen. The knowledge produced here will not be worse or slower, as one could expect, but integrated in the context to which sooner or later it must return.

Conclusion

It may be inferred from the discussion above that, in an ideal model for the relationship between science and society, there are in fact three coexisting models (Callon, 2000). From society's point of view, this solution would be more democratic, once the decisions would consider a variety of interests and worldviews. The construction of possible futures, the risks and benefits deriving from the process would then be shared. From science's point of view, there is also a lot to gain. .

Finally, from the point of view of the relationships between science and society, it seems like there is no better way to make people feel implicated in science and technology related issues than to have them participate in the process. If the knowledge production structure would accommodate more than research and teaching institutions, laymen could play a role. They are expected to have at least an informed opinion in order to participate in the debates that take place in the public sphere. In the best case scenario, they are expected to engage in the productive processes, whenever possible. This model comprises complex relations that have a direct impact on all the phases of the production of knowledge. Once the public wants to know, the materials needed to communicate this knowledge becomes a demand. To make this material possible, the education of scientists for communication and dialogue becomes a demand. Once the relationship between science and society reaches a higher level, the participation of the citizens becomes a demand. For all these reasons, the engagement of laymen in socio-political-economic decisions becomes a demand, including when they must defend the interests of science. Society can, for instance, choose to allow for more freedom for research, separating scientific production from the creation of consumer goods or publishable results, when they fail to correspond to the real interests of the citizens as it used to happen with Genethon.

It is important to remember that in Europe, a reference in terms of academic and scientific production in general, this complex fabric that encompasses citizen participation is already a reality. There is a National Committee for public debate in France, systematic Citizen Conferences in Northern Europe and Switzerland, massive presence of authentic debate in the media, citizen science foundations, science boutiques and other dialogical practices throughout the continent. In this context, a considerable quantity of high quality scientific results is produced. Fleck (2010) argues that it contributes directly to the production of science.

In Brazil, this discussion also shows relevance, when we assess the nature of the teams engaged in activities that bring together science and society (rede-pop members, institutions that figure in the guide elaborated by the Brazilian association of science centers and museums). All of them (or at least almost all of them) can be described as belonging to the public instruction model (Callon, 2000). When the practices proposed by the aforementioned teams or even the activities for the science and technology national week come under scrutiny, identical features are identified.

Finally, the discussion in this paper has a direct impact on (and is affected by) another issue yet to be mentioned: science teaching. How can education contribute to this? Callon (2000, 2001) gives out some clues when he describes cross collective learning in the co-production of knowledge models. The self-responsabilization in knowledge construction can find excellent grounds for flourishing inside the school. Beyond the preoccupation with school subjects and suitable didactics we find a teacher who is an enabler, kids making research, searching and evaluating resources and shared projects. The public debate model, with its dialogical practices, is also a storehouse of ideas for formal scientific teaching. Actions that integrate different groups, collaborative work, features that raise the educational situation to moments of shared responsibility regarding the decision that needs to be taken as well as the road leading to it.

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