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Science in a cultural key*

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Science in society

Nowadays, science is in fashion. It pervades society, the media and even domestic spaces. However, being in fashion has its price, which, in the case of science, is manifested by the excess of science articles and reports in the media but also by the absence of both standard criteria and control of content. Everybody seems willing to give his or her scientific opinion in order to justify a position. Widely distributed magazines tend to use and misuse science. Advertising agencies employ it in order to guarantee and certify the excellence of many products, to back up claims regarding the benefits that some habits or products can provide to the population and to warn of the dangers of others. In short, science serves as a measure of everything.

The public perception and acceptability of science has been accompanied by cultural discourses, either explicit or implicit, which suggest that science, being objective, predictive and beneficial to humans, should also incorporate the values of welfare, tolerance, love of the truth and cooperation. These kinds of statements are projected into the future to predict that science will be able to solve any kind of problem, including famine, poverty and diseases. Thus, we could say that the future has been placed in the hands of science.

This aura of popularity promotes the radicalization of science, either negatively or positively . By associating science, in the public mind, with the maximal expression of rationality, utility and security, any breach in these expectations inevitably shifts the discussion towards the realm of risk, uncertainty, confusion, distrust and even a sense of economic and political conspiracy. For example, following an accident or hazardous situation with a potentially widespread, serious impact, scientific experts in the field are frequently called upon to reassure the public, especially if politicians and industry related technicians are unable to provide satisfactory answers.

Lack of solutions is translated into disappointment among the population, not only because apparently there is not any control over the particular problem at hand and its side effects, but also because the public realizes that, in everyday life, so-called progress tends to be an illusion. This feeling reinforces the conviction that the driving force of science, as an institution representative of the rational instrument of capitalism, depends on the impersonal laws of marketing, on pharmaceutical and armament industries, and on powers working on behalf of national and international security interests. For this reason, critics and anti-system movements consider science to be domineering, bourgeois, masculine and white. By convincingly stating that the purpose of science is not truth but power, the gap between science and society ends up linking the idea that science has no limits with that of the limitation of human freedom.

Certainly, science is not only in fashion, but is also the focus of public debate. Apologists for the purity of science claim that it can be kept free of the prejudices, interests and irrationalities of politics. In addition, they argue that science is independent of its technological applications. But how does giving science this unquestionable status help to dispel public ambivalence? How can we counter the defensive attitudes of scientists regarding the neutrality of their work, as well as the claim that rigor, high standards and excellence are inherent features of science? How can the liberal political vision of the expert, that converting knowledge into power will create a political order supporting unlimited material progress, be conveyed? How can we best confront the crucial issue of recognizing or determining how culture–that constant process of choices that is called the Western World-influences the construction of science? Therefore, how can we educate the public so that it acquires a better understanding of science?

Science in a cultural key

Replacing ambivalence and mistrust with transparency and an appreciation of the educational benefits and practical applications requires an understanding of science in a cultural

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key. This requirement is not new, In fact, it is a constitutive aspect of the history of science in the Western World; it is also part of the systemic nature of science and has laid the foundations of epistemology. Science promotes the acquisition of knowledge about the so-called material world. What it says about the world itself and how it works, is not so simple, however. It is not just a question of accumulating data, magnifying observation and experience, and making more precise instruments. Science is a mirror of what we call reality. But it is not a flat mirror, rather one shaped by a certain set of expectations and by the insight provided by a scientific process that uses precise measuring instruments as well as conceptual devices. The questions asked of science and how they are framed depend the historical, social context in which hypotheses are formulated and experiments are carried out.

In that sense, science is a cultural system that is invigorated by: (i) activating criticism, (ii) removing boundaries between disciplines, and (iii) providing a context for itself, both ethically and socially. Regarding the first point, there is no need to worry. In fact, epistemological criticism systematically denies science its mythical hiding places, i.e. the reverent idealizations and images of science and scientists as the discoverers of nature and the revealers of the underlying structure of all knowledge. It also denies a closed, static and homogeneous concept of scientific rationality which is not compatible with the fact that, in science, the progressive accumulation of generally accepted truths is based on a stepwise process of observation and discussion, and that there are other sources of knowledge over which science has no authority. These statements are based upon the intellectual exploration of scientific ventures [2,3,5]: clarification of concepts, criteria for selecting the study object and aims, influence of procedures and measurement tools, logic and methods used in the process of justification and validation in order to formulate a paradigm or recognize a paradox, and tension between continuity and innovation.

Taken together, these constraints form a set of internal rules of thinking and applied action, but at the same time it can be readily appreciated that the critical consideration of science provides us with many intellectual tools, even for use in every-day life. To think scientific ideas allows potential limits to be recognized and certain concepts or methods to be ruled out so to avoid to think exclusively through categories and dichotomies derived historically and transmitted by educational means. Never, then, methodologies, standardized protocols, and statistical resolutions can serve as a justification for neutrality and objectivity neither can be analytical reliability a substitute for consensus.

Some forms of feminist criticism [4] have attempted to provide an intellectual defense of the viewpoint which states that there are no innocent powers representing the world. Thus, objectivity is nothing but knowledge that is both temporary in its use and in its contextualization of facts. It is necessary to redefine the meaning of objectivity so that it provides us with the tools to avoid the subjectivity of intentions, beliefs, aims and values in order to be able to capture the nature of things. While subjectivity currently serves as part of the dichotomy subject-object; it must be introduced into the «objective» processes of observation and construction of data, not in a tacit way, but as an aspect that should be considered because of its ability to affect and to modify the production of knowledge.

Another interesting dichotomy that is being increasingly challenged is the definition of natural versus artificial reality. Laboratory work is carried out in an environment that is artificially created, using isolated natural objects that enable researchers to generate certain phenomena that for this very reason are not found elsewhere. Therefore, the results are not external phenomena, but rather a set of descriptions and rules of procedure that has been constructed by scientists. Even though the existence of an external world is not refuted, this approach reveals the virtual nature of scientific reality. Under these criteria, the dichotomy between that which is natural and that which is a product of scientific culture disappears. Artificiality takes on a new dimension, serving as the focus of techno-scientific research, either in making of nature a series of manufactured objects, or in reintroducing them experimentally into alternative forms of life, such as those generated by nanotechnology.

The scientific community

Science considered out of context and separated from both social reality and the cultural implications of technology becomes a privileged territory –an island of intellectual protection that promotes error and/or self-serving recognition. To ignore this, either willingly or unwillingly, encourages problematic political and economic associations. These concerns have been transferred from the theoretical body of science both to research institutions and to the role of scientists. In response, social sciences, especially the sociology of science, have analyzed science as an institution. This interest in the scientific community is not recent, however. In 1973, Merton and other sociologists [7] examined science as a social institution made up of communities of researchers whose weapons are knowledge, talent, experience and scientific instruments. Such communities are strongly stratified and share values, alliances and arguments in order to achieve scientific authority and intellectual prestige. Symbolic assets that, in turn, are converted into forms of shared capital: grants, scholarships, prizes, improved facilities, and the best students; in other words, nuclei of power that can affect the priorities of scientific progress.

The incursion of the social sciences into the realm of scientific privacy has been extended to the study of research laboratories using an ethnographic approach, as if they were indeed small communities. Microsociology studies [6,9] have been carried out with the goal of identifying the research processes and relations among scientist that mediate the kinds of scientific knowledge produced in laboratories. The component parts of this process can be observed ethnographically and include data processing, note taking, criteria applied to choosing experiments, social relation-

ships between researchers, and also the analysis of controversies and theoretical transactions, the use of language to formulate the feasibility of independent facts, and the metaphorical formulations employed in scientific articles to communicate research results and make them credible to other colleagues and to peer-review committees of high-impact journals. These kinds of studies help us to understand that the context of scientific work consists of a wide range of trans-scientific fields as well as networks of social relationships that go beyond the disciplinary boundaries of each scientific community.

Cultural anthropology contributes to scientific knowledge by equipping it with additional, cultural tools. Not only does it provide the aforementioned ethnographic studies on research laboratories, but it also tracks the spread of knowledge through scientific and non-scientific communities. Furthermore, it searches for information on perception, acceptability and distribution of risk and safety in regulatory agencies and bioethics committees, media and especially on the subjects of experimentation and opinion, i.e. patients, families and segments of the general public.

Science's relationship with other disciplines

Anthropological and sociological studies have revealed that science is not a passive form of knowledge. It is, instead, the development of theoretical, cultural and techno-social constructions that can be used to change the nature of all that, until now, was considered to be reality and even the ultimate truth. This conclusion inverts the models of the observed versus the observing disciplines. Thus, in the humanities, the idealization of science as focusing solely on natural physical models, as if they were paradigms of social order and for understanding culture, has vanished, replaced by the recognition that the boundaries and compartments separating disciplines that no longer bear the ontological status of privilege must give way to multi-methodological forms of criticism and interdisciplinarity. Science, philosophy, sociology and anthropology interact with each other. Ideas and their expression must therefore adapt to this comparative and reflective approach that joins disciplines into systems of knowledge. By sharing resources and creating joint-venture approaches, these systems of knowledge reflect a process of complex actions and reactions the diversity of which is open to all kinds of interpretation: a network of apprenticeships where data are discussed and knowledge is produced or destroyed depending on the situation and the definition of problems.

This approach breaks with the perception of the hegemony of scientific knowledge. Locating science in a context of social reality prevents the colonialism of knowledge, which is also present in models of human intellectual development. In this framework, anthropology has placed science farthest along the path of human evolution with respect to the hierarchy Magic and Religion since Western rationality has been the main criterion used to determine the value of knowledge derived from other cultures, and even its utility. However, ethnographic research itself has pointed out that scientists have searched for, analyzed and subsequently transformed indigenous knowledge and its applications, especially herbal therapy, as if they were manufactured products, packaged and distributed to its own profit with little thought to the effects on local markets and medical practice. This lack of consideration, or kidnapping of experience, explains the substitution of traditional medicine and local techniques to sustain resources by the uncontrolled introduction of biotechnologies, especially agro-alimentary technologies, e.g. alien seeds and pesticides.

Many may think that the role of science is not to solve social challenges, but to clarify intellectual questions and theoretical problems. Indeed, this is one of its aims; however, it is one thing to convert knowledge into an asset of limited value, which only confirms a unique hegemony, and another to accept the pluralism of knowledge. In this sense, too few critical voices have been heard [8], and efforts to create an intercultural convergence of both universal and local knowledge and its practices are still in their infancy. Such efforts are not merely of intellectual interest or a refinement of a particular attitude; rather, they are needed to face critical, interrelated and global problems, such as pollution, social exclusion and disease, that cannot be solved quickly because of their economic impact, the current lack of viable alternatives, and the requirement for long-term sustainable solutions. An effective response must include internal and external evaluations of the problems. This means that the problem has to be defined by scientists, social agencies as well as the owner of the impact or unhealthy situation so that the design for prevention or implementation not only takes into account life styles and local knowledge but it becomes a co-laboratory for common responsibility.

These intercultural approaches will give a new dimension to science. Nowadays, uniformity, standardization and conformity are not the best means for navigating new directions in science, neither is maintaining the disciplinary boundaries that have defined the inclusion and exclusion of certain types of knowledge. This situation was recognized by universities that several years ago adopted interdisciplinary programs of study and thus a dialogue with alternative sources of knowledge. The ability to incorporate other methods and systems of knowledge as well as conjoint responsibility has proved to test both the genuine flexibility of conceptual systems and their utility in recognizing limitations and alternatives.

At this point, we cannot continue dividing human beings and their reality into two dimensions: scientific and cultural because it has side effects. To do so would mean doubting again about risks whether they lie in the biotechnological modification of nature or in the lack of cultural ability to recognize the mutual implications of this process and therefore the need for prevention and precaution.

Ethics in science

Science, considered as a human venture, does not have boundaries, but it does have limits regarding its credibility

and public authority. The ethical aspects of science have been highly discussed over the last several years. Bioethics commissions and committees have proliferated in all fields of research. While a wide range of positions have been adopted, fortunately, they are always in agreement with human rights and with the recognition of situational morals and the individual conscience.

Beyond any declaration of principles and precautionary rules, new approaches to scientific and social responsibility are being sought, as Bloor proposed [1], regarding the control of results-either right or wrong-as well as to extending ethical considerability from humans to animals and objects. While these approaches provide guidelines rather than solutions to specific problems, they nonetheless help to establish links between different systems of knowledge so as to allow the development of a mutual transfer of knowledge between experts and lay people.

Hopefully, public understanding of science will eventually reach a level that is high enough such that problems and priorities will be defined and solutions will be reached by consensus. Until this desideratum is achieved, it must be understood that science in cultural key represents the hope of re-theorizing and remodeling systems, organisms and communities. And since scientific culture has the potential to develop theories and models of and for action that reveal not exactly how the world is, but rather how it could be, let's beguin to face the design of new socio-cultural and techno-scientific realities, in a responsible and sustainable way.

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