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RESEARCH ARTICLE

Making Science is Global, Science Culture Remains Local

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ABSTRACT

The paper deals with the cultures related to science and discusses, on one hand, 'scientific culture' which is global in nature and refers to as the way science and research is carried out all over the world with the same procedures and similar equipment, with the same theoretical tools and mathematical formalisms, with global mobility of expertise, and communicating to a global peer review process performed by the leading academic journals in each field. The scientific culture remains almost constant and can be mapped by sets of scientometric indicators where input and output variables are reported in standard formats. But on the other, 'science culture' refers to the way everyday people think of, imagine and value and contest science and scientific knowledge in their everyday life and thus continues to vary with the world's cultural diversity. We expect that the public imagination and the conversations about science, varies widely along traditional boundaries of 'deep culture', with geography, across generations and levels of education and different historical mentalities across the world. There is urgent need for reconsideration of the relationship between this global 'scientific culture' and local 'science culture' as common sense.

KEYWORDS: Scientific Culture, Science Culture, Common Sense, Mapping Culture of Science, Science Culture Index (SCI)

Introduction

The argument:

1. The notion of scientific culture (scienti-fic from Latin 'scientia facere') should be kept distinct from that of science culture
   1.1. Global scientific culture retains diverse managerial and epistemic styles.

   1.2. Modern 'techno-science' unifies the dual origin of science — technological problems and metaphysical speculation.
2. 'Science culture' is the symbolic context of making science.
   2.1. While scientific culture is global, science culture remains local.
   2.2. The culture of science needs to be mapped in comparison and longitudinally.
3. Conclusion: Let us consider common sense and science more globally

I formulate my argument as work in progress with a series of linked statements. Rather than fully-elaborated theses, I see them as contributions to an ongoing discussion. The main idea is to suggest an important distinction between 'scientific culture' and 'science culture'. The term 'culture' is notoriously wide reaching, and includes the active production of culture as producers, the more passive participation in culture as consumers, and the often unconscious assumptions that are being cultivated and keep everything together. The latter is also referred to by terms such as 'spirit', the 'life world', 'mentalities' and 'common sense'. Because 'culture' in the latter sense of the term refers to the taken-for-granted and unquestioned foundations of both common sense and science, the analysis of the life world requires a special effort to raise awareness and reflections (Moran, 2012; Blumenberg, 2010).

The notion of Scientific Culture (Scienti-Fic from Latin 'Scientia Facere') Should be Kept Distinct from That of Science Culture

On the potential distinction between 'scientific culture' and 'science culture' we find an analogous discussion in organisational analysis. In a classic paper on that topic Smircich (1983) argued that the concept of 'culture' has a double use. On the one hand 'culture' refers to the manners of constituting a productive unit, its values and taken for granted operative norms, the organisation of its modus operandi. In this sense, culture is the outcome or the dependent variable of managerial interventions; we might also call this the perspective '*outside-*

in'. Managers are supposed to be 'cultural workers' comparable to artists, they design and maintain productive structures. On the other hand, any industry responds to the cultural context of the locality in order to succeed, wherever it operates. Thus, culture is the context of any managerial designs; we might call this the perspective '*inside-out*'. This context is beyond control as is the weather and the climate of a location; it requires recognition and adaptation. Here 'culture' is the independent variable that requires adaptation for actions to be sustainable; industrious activity is in fact external relations internalized. This all assumes a third perspective, for which both '*outside-in*' and '*inside-out*' are topics of observation.

What looks like a minor difference in suffix, might be a useful index of a key distinction. Scientific culture — the making of science or the conduct of science and research — is now pretty much a global affair. Research laboratories all over the world operate on the same materials, with the same procedures and similar equipment, with the same theoretical tools and mathematical formalisms, with global mobility of expertise, and communicating to a global peer review process performed by the leading academic journals in each field. The field of Scientometrics is assessing the performance of 'scientific culture' in all its diversity through indicators of publication and citations.

Global scientific culture retains diverse managerial and epistemic styles

While scientific culture is mainly a matter of performance, a notion of qualitative diversity in terms of 'research style' remains. An example of discerning operational style is a recent magazine reportage on CERN, the large-scale super-collider installations of subatomic physics near Geneva, as a 'democratic republic of science' (CH-*Tages Anzeiger*, 26 Oct 2013). We can see that this diversity of organizational operations remains within a global framework that is recognized and understood everywhere in the human universe. Such notions of difference in the operations of science continue to be of interest and are detailed in the following sources:

- On thinking styles and thinking communities (Fleck, 1979 [1935]) as revealed by laboratory studies (Latour and Woolgar, 1979);
- The six styles of European science (Crombie, 1994);
- Three life styles of science personified by Newton, Goethe & Napoleon (Fuller, 2010); and
- Romantic and rationalist science according to Luria (1993).

While a sense of style might continue for insiders, the global nature of scientific science is mapped mainly as quantitative performance by sets of scientometric indicators. Input and output variables are reported in standard formats as defined by manuals from FRASCATI to OSLO and beyond. Such reporting is undertaken by national and international agencies that anxiously monitor a global competition over rankings of these intangible assets. The investment in R&D (GERD, BERD, HERD) in % of GDP of the country or in % of sales at the corporate level, the manpower involved in research per million population, the number of patents generated, the number of research documents produced in % of global output, citations received, or the balance-sheet of hi-tech exports and imports are now regularly reported as indicators of innovation. Most of these indicators are inspired by an economic rationale to ascertain science exclusively as a productive factor (Godin, 2005).

While happy to acknowledge an operative ‘scientific culture’, most scientists and their policy protagonists would not like to see science in the remit of culture politics jointly with Sports, Museums, and Opera. Advocates of science are anxious to see decisions on science policy to be made at the high table of economic policy and not at the low table of culture subsidies and identity politics. Actors close to policy making are therefore rather reluctant to talk of ‘scientific culture’ as it would prejudice ministerial responsibility. The language of ‘culture’ with regard to science, either outside-in or inside-out is therefore very much an academic pursuit unless cultural intangibles are being considered worth the strategic investment.

Modern 'techno-science' unifies the dual origin of science — technological problems and metaphysical speculation.

A theory put forward by Dorn (1991) purports that science has a dual origin determined by geographical-climatic conditions. Where rainfall was frequent and thus there was no water shortage through the annual cycle, these regions saw historically the emergence of science as a metaphysical pursuit. There will be a cosmogony, i.e. speculative theory of the cosmos and its origin. The classical example here is ancient Greek science of observation and speculation, of which we know the authors. In world regions where water was sparse, collective efforts were required to develop and maintain supplies all through the year with elaborate irrigation systems. These collective efforts of construction and maintenance bring forward a science that is focused on technological-practical efforts and the science contributions remained mainly anonymous. The archetype of this type of science history is Mesopotamia and Ancient Egypt, where astronomers predicted the rising water levels of Euphrates, Tigris and Nile by making calendars. Who remembers any scientists involved in those efforts?

We might argue that modern 'big science' such as the Manhattan Project which brought about the nuclear bomb in the 1940s, or later efforts such as the Green Revolution or the Human Genome Project were projects that bridged the metaphysical and the technological quests. Undertakings of similar scope of resource mobilisation are nowadays known as 'techno-science' as in the recent Human Brain Project or the Hadron Collider at CERN. This is research at the frontiers of knowledge, where the engineering element cannot be separated neatly from that of scientific thinking; the question, what is the engineering, what is the science is difficult to answer if we consider the day-to-day collaborations in the conduct of science.

'Science Culture' is the Symbolic Context of Making Science

Apparently, philosophy of science is as useful to the conduct of science as ornithology is to the life of birds (a saying attributed to Richard Feynman). Nevertheless, many scientists cultivate their preferred self-presentation with the help of authoritative philosophical accounts of what it means 'to do science'. This includes the demarcation of science from pseudo-science and non-science, the formalisation of hypothetic-deductive reasoning and the logic of modelling. However, all these authoritative accounts do not exhaust the proliferation of symbolic *representations of science* in society. We might seek to map empirically this residual variety of representations of science under the term 'science culture': how is science perceived? Let us look *'inside-out'*! This leaves us with the old problem of how to frame the inside-out gaze, as a problem of alarm (i.e. the anti-science anxiety or other deficit concepts) or as a resource to work with and from (Bauer, 2015; Anderson, 1981).

While scientific culture is global, science culture remains local

The science culture, the way people think of, imagine, value, admire and contest scientists and scientific knowledge in their everyday life continues to vary across the world's persistent diversity. We must expect that the public imagination and the conversation of science, of what science is, does and we can expect from it, i.e. the *social representations of science*, vary along traditional boundaries of geography, across generations with very different experiences, levels of education and mentalities of longue durée. Historical persistence is likely to be a feature of different cultures of science across the globe for some time to come. Deep mentalities are not shifting quickly, but resurgent as identity presentation in a global concert. In Europe, Africa, India or China, we find ways of speaking of 'capitalism with European, Islamic, Chinese, African or Indian characteristics'. This might by analogy also apply to the social representations of science: Can we ascertain the image of science with European, American, Chinese, Arabic, African or Indian characteristics? This intuition is already reflected in some discussions of the public understanding of science, where we report the facts as well as on the concepts that secure these facts. What in Europe is discussed as public understanding of science, is in China predominantly referenced as 'literacy' (Wang *et al*, 2012), is in India the quest for the 'scientific temper' (Kumar, 2011), in Africa the local knowledge of 'African philosophy' (DuPlessis, 2012), and in the US climate change debates this is referred as 'motivated reasoning' (Kahan, 2013). On a theoretical plane, we might ask: what determines this variety of the culture of science, both in concepts and facts?

The thesis of 'multiple modernities' argues that the process of modernisation does not follow the One-Best-Way which the sociologist Max Weber charted as the 'rationalisation' of social affairs and the progressive 'disenchantment' of Nature at the beginning of the last century. Weber's idea was ethnocentrically assuming European and Protestant-religious notions of development (Carroll, 2011). Different paths to modernity, incorporating elements of rationality and retaining enchantment of Nature must give rise to different science cultures, in particular with respect to the tolerance of scientific and numinous entities in everyday life.

Dorn's (1991) conjecture of the dual origins of science, rainfall and irrigation, while no longer holding true for the production of knowledge, continues to hold its grip on the everyday imagination of science through the appreciation or dismissal of its metaphysical quests for ultimate knowledge. Thus we must recognize that the image and the imagination of science is fuelled by local resources (Doorman, 1989), as a matter of milieu specific worldviews (as in social representations) and in relation to particular political grievances and mobilisations (as in civic epistemologies).

The culture of science needs to be mapped in comparison and longitudinally

If scientometrics does the job of mapping the conduct of scientific culture on a global scale *outside-in*, then the contextual culture of science needs to be mapped equally with empirical observations *inside-out*. We might do this as an investigation of cultural stock and in the performance of science culture outside the laboratory. Social representations theory (Bauer and Gaskell, 1999; Bauer, 2014) and the idea of civic epistemologies (Jasanoff, 2005) are useful concepts to compare the culture of science; the two concepts offer a different framing of the issue, indicated for different contexts. Social representation focuses on the cultural stock of taken-for-granted resources and makes visible the diversity of worldviews of different milieus and communities and the system of communication that sustains it; this is manifest in competition to alternatives. Civic epistemology shows up diversity in the political mobilisations around particular grievances and in conflict with dominant powers. This is exemplified in the controversies over nuclear power and genetic engineering for agriculture and human health care.

This agenda of mapping the science culture must be addressed by considering several issues separately and jointly:

- Creating viable indicators of this local 'Science Culture';
- Moving this exercise beyond 'performance races' towards a typology of functional equivalences. An example of this might be the Science Culture Index (SCI);
- Mobilizing and encouraging the construction of a global database that enables comparative research (we have outlined such an agenda in Bauer, 2012 and in Bauer *et al.*, 2012).

The basic idea is to stimulate real comparative research with a view to reconstructing cultural trajectories. This includes the comparison of segmentations of the public of science in different contexts. This exercise needs to learn from previous attempts in the same direction which have failed to galvanise international collaborations by exclusively focussing on a limited number of survey-type indicators. The effort requires renewed reflections on what are the key dimensions of such metrics. However, there is no need to throw away the metrics which we are already familiar with such as knowledge, utilitarian attitudes, interest and engagement with science, but to rework them for the new purposes.

Conclusion: Let us Consider Common Sense and Science more Globally

The notion of science culture overlaps with the older notions of the life-world and practices of common sense (CS). In the ancient double sense of 'sensus communis', the term refers to the capacity of bridging different sensory perceptions and conflicting public concern into a synthetic judgement. CS highlights the everyday need to judge on the basis of a diversity of considerations. However, the relations between common sense and science are historically controversial. This relation can be seen in various ways.

First, common sense serves as the 'other' against which science is to be demarcated. Progress of science means getting away from, overcoming and substituting CS. Here CS is often synonymous to superstition, irrational belief, and popular delusions that will have to be debunked. The world is a better place, when common sense has been replaced by scientific notions. This is consistent with a notion of an elite group of virtuosi who know and the people that are ignorant ('oligo poloi' versus 'hoi poloi', the elected few versus the many). Here we are facing a long tradition of polemics against stocks of harmful beliefs. And this chimes with many other distinctions where a clear hierarchy is drawn such as episteme and doxa, knowledge and opinion/belief, science and superstition.

Second, science is considered the continuation of CS with other means; it is an elaboration of CS ('The whole of science is nothing more than a refinement of everyday thinking', A. Einstein in *Physics & Reality*, 1936). Sociologists of science have observed: there is very little difference between everyday living and life in a laboratory, and this becomes clear once you follow researchers in their footsteps.

Thirdly, CS is a source of knowledge which science has yet to fully explore, either through logical explications of its assertions or through mobilisation of its value and moral competences. Here, one might think of the recent dignification of traditional and local knowledge for purposes of developing synthetic drugs through genetic engineering with the help of indigenous ethno-botany or a general folk-biology (Balick and Cox, 1996). The flipside of this endeavour includes modern forms of phyto-piracy.

Fourthly, common sense notions of health and illness are increasingly recognized to be part of the solution to health issues. The way ill people perceive and construe their health predicaments is no longer ignored as part of the illness, but understood as part of the therapy effort. Representations of the body, health and illness motivate the healing process and guide the coping with illness (Petrie and Weinman, 2012). This logic of understanding the functions of common sense or lay beliefs might well apply to other walks of life in the search for better interventions.

Our discussions and research on science culture invite a reconsideration of the relationship between unified global science and a locally diverse science culture as common sense. This might be particularly fruitful when we consider that past discussions of CS remain very much within the European intellectual traditions (Gautier and Laugier, 2009; Van Holthoon and Olson, 1987). How and to what extent is the notion of common sense, or any pragmatic equivalent, present in other cultures? We ask: What makes the appeal to a 'common sense' possible; is CS a universal reference or an ethno-centric niche particular to the Graeco-Roman tradition of longue durée? The increasingly international nature of the discussions of public understanding of science and the scientific tempers are fitting occasions to at least raise these questions of concept and measurement in a new fashion.

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