Ontological Criteria of Science and Perspectives for Sociology of Science[1]

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Abstract

In this paper I do an analysis of Isabelle Stengers' conception of modern science to answer the question of what ontological criteria of science she offers. Now some trends in sociology of science address themselves to Stengers' works and find them to be very useful for providing ontological arguments for the possibility of knowledge. But then, how is it possible for sociology of science to be interested in an ontological proof of science if it, by definition, treats knowledge as related to a subject (society), and deals with the ways of construction of knowledge, and thus belongs to the critical tradition? Can sociology of science be interested in 'the world in itself', not related to subject? If not, then what kind of ontology can it use?

In the second part of this paper I will turn to some examples of sociology of science where the focus of interest is on ontological arguments for knowledge.

Introduction

The stimulus for this investigation was given by Bruno Latour's famous words about Isabelle Stengers' work: *Stengers*, *he says, has chosen to look for criteria of science not in epistemology but in ontology, not in the word but in the world.* [2]

It is known that up to the eighteenth century, philosophy offered ontological arguments for the possibility of knowledge.

Descartes, Spinoza and even Hume postulated definite ontological preconditions of knowledge. In Descartes' case it was a reference to infinite substance, God, which guaranteed true knowledge. In other words, the ontological criterion of knowledge can be expressed by the following statement: thinking is defined by what thinking thinks about (Gaidenko 2001, 319–321) (i.e. by its object or reality or the world that guarantee truth if thinking is carried out correctly).

On the contrary, the epistemological argument for knowledge (and science) as successively conducted by Kant does not refer to any cognizable

substance, but appeals only to the cognizing subject whose structure defines knowledge and constructs its object. So, if in the first case substance itself defines knowledge; in the second case the structure of subject defines knowledge. Here all content of knowledge is understood as related to the subject, that's why we can say that after Kant a 'theory of subject takes the place of metaphysics of substance' (Gaidenko 2001, 321).

Returning to Isabelle Stengers, I became interested in trying to answer the question of what ontological criteria of science she needs if we take into account the fact that her work is of vital importance for some trends of current sociology of science. So my question is how is it possible for sociology of science to be interested in an ontological proof of science if it, by definition, treats knowledge as related to a subject (society), and deals with the ways of construction of knowledge, and in this respect proceeds from a Kantian paradigm? Can sociology of science be interested in 'the world in itself', not related to subject? If not, then what kind of ontology can it use?

I will do an analysis of Stengers' book 'The Invention of Modern Science' (Stengers 2000b) to answer this question. After that I will turn to some examples of sociology of science where the focus of interest is on ontological arguments for knowledge.

Isabelle Stengers: science under the sign of event

Epistemologists failed when trying to prove the identity of science and its norms—Stengers writes—but it does not mean that, as relativists conclude, there is no difference between science and irrational opinion (2000a, 42–43). Then what does it mean? It means that the criteria of science can be found elsewhere. This 'elsewhere' as one may suppose is not epistemology but ontology, *not the word but the world*.

Since ontology is the development of one or another concept of being I start with Stengers' concept of being:

The core notion of being Stengers introduces is the notion of the event (Stengers 2000b, 66–69). Stengers follows Deleuze in her definition of the event.

According to Deleuze (Deleuze 1998, 20–44), the event is an effect which lies on the surface of the actual state of affairs. That is, the event results from the concrete mixture of things as the meaning of the realization of bodily causes and their combinations. Deleuze derives this concept of event from stoic philosophy. For stoics the universe consists of bodies in a physical sense. These bodies permanently form configurations, and the denotations of these configurations are events. So, if Plato's ideas or Aristotle's forms are eternal causes giving rise to bodily things, then stoic events, on the contrary, are meanings which come after the concrete mixture of bodily things.

The event itself is bodiless and acts as a quasi-cause, or as an ontological alternative, opening a new perspective in which everything that gains significance does so in the space of the consequences of the event. As I understand Deleuze (and Stengers), the event is a sort of interval between the concrete mixture of things and the significances we can place upon it. Stengers says: *the event is a creator of meaning, but still waiting for significance* (Stengers 2000b, 92).

As a result of the actual mixture of bodies the event is neither eternal nor pre-existing. Coming after things, events intervene in the course of history and constitute the difference between 'before' and 'after'. The very events are responsible for the lack of symmetry between past and future, i.e. for the state of indetermination in which present and future cannot be reduced to past, the unknown yet to the known already. That is why event points to the singular character of being: that which occurs is not necessary; it arises as a novelty and it is able to change the course of history unexpectedly.[3] These characteristics of being refer to the fact that being is understood in terms of becoming.

Then what is becoming? From the outset, mainstream ancient philosophy understood being as opposite to becoming. Being is the 'what' of becoming, different from the latter, it is eternal, invariable, stable, equal to itself. The problem of being was at the same time the problem of knowledge. Becoming, which is unstable and never equal to itself, cannot be an object of thought (it is impossible to know what is not). Only fixed being can be cognizable. As Aristotle says, one can know things insofar they contain eternal and identical being.

The idea that only that which is stable and equal to itself as substance can be cognizable, has become basic to the building of all theories and scientific theories down to the modern age, wherever matter had been identified with substance.[4]

According to this point of view, substance is that which can be discovered or comprehended but cannot be modified or constructed. That is why within the framework of an ontological argument for knowledge, the structure of the subject was being analysed primarily in connection with the problem of a fallacy and its causes. If substance is invariable, then the differences of its representations depend only on circumstantial (subjective) conditions (Gaidenko 2001, 319).

Deleuze considers that the overcoming of this substance tradition is possible as a replacement of the substance by the event.

But how is it possible to know becoming but not being, i.e. to obtain knowledge about unstable 'objects', which as Latour says, 'don't wait outside and don't remain equal to themselves' (Latour 1997)? What is science that 'cognizes' events? Stengers answers this question when she places science 'under the sign of event' (Stengers 2000b).

If modern science belongs to the event, then it appears as a contingent process. But the contingency of science is not its negative description. Every contingency contains the highest measure of being as singularity. Science has not the necessary origin but this does not mean that nothing really significant happened. 'The contingent process invites us to follow it'—Stengers writes (2000b, 71).

It means that from Stengers' point of view, modern science is justified not by criteria and norms (as epistemologists are trying to argue) but by the very event which arose as a meaning of the definite state of things and became an action as a quasi-cause. It created the space in which the response to the question 'Is it scientific?' became decidable in a positive way (Stengers 2000b, 73).

The event that created modern science, as Stengers shows, was the experimental situation invented by Galileo. This situation constituted a new type of truth that passed over the formerly impassable gap between intellectual construction and physical object. It is known that ancient thought postulated two kinds of reality and two opposite kinds of knowledge:

mathematics cognizes eternal and stable being, physics deals with fluctuating matter and produces only approximate knowledge.

Galileo unites these two kinds of knowledge into a single one—mathematical physics, because in the experiment speculative mathematics and manifest physics coincide with each other.

Galileo's artificial objects (the polished balls moving along the inclined plane) expressed 'nature written by mathematical language'. Here, in the laboratory we can see nature, not in itself, but in the light of our questions. That is why Kant interpreted this experimental knowledge as a construction: we can know about reality only what we put into it ourselves. For Kant an experiment is an argument for a constructivist mode of knowledge.

But Stengers sees the construction as referring to the event. What Galileo constructed (or invented), namely experimental apparatus and procedure, was the situation in which things were made to speak. It was through the experimental demonstration, where things show themselves, that this special kind of arguments was being attained: it was a testimony of things (the motion of falling bodies), which was able to affirm one fiction (namely the laws of the motion of artificial bodies) against all others.

Why was this experimental situation invented by Galileo the very event (as Stengers insists) but yet neither a representation nor 'pure' construction in the epistemological sense? Because it is impossible 'to discover pure causality neither on the human side nor on the non-human side'—she answered (Stengers 2000a, 44).

Deleuze says, that the event 'is not a being, but the way of being of things expressed by verb' (Deleuze 1998) (one of his examples is an incision of a body under a surgeon's scalpel). From this, Stengers also considers that Galileo's experimental situation constitutes a definite way of being of things which cannot be 'explained or deduced from some kind of pre-existing identity' (Stengers 2000a, 45): it is an innovative configuration of things created by experimental apparatus in Galileo's laboratory.

Galileo really invented this apparatus, he is its author but the specificity of this authorship consists in the fact that it opens space for things in themselves. Galileo's apparatus is able to bring things into existence, so that now the author can withdraw to let things (the motion of falling bodies in this case) testify in his place.

This motion is fabricated because it is related to technology (the apparatus) and it is artificial, but at the same time it is real because it arises as the concrete testimony of things which silences Galileo's opponents. One abstraction among others (since it was the very abstraction: Galileo premeditated this fictitious world) it turns out to be 'not only abstraction' when this fictitious world becomes the practical world of the experimental situation. This fiction becomes the truth for those who are gathered around the experimental apparatus, i.e. it comes as 'local and conditional triumph over skepticism' (Stengers 2000b, 84).

That is why the 'abstract scientific representation' Galileo attains expresses the event but not a general procedure. The event redistributes both things and humans—it produces the definite way of being of things as well as the definite way of being of humans who enter into the laboratory as a collective of colleagues respecting the constraints of this experimental procedure.

Neither Galileo himself nor the laws of motion define the way of being of 'the scientific', but the interactive stabilization of apparatus, humans, bodies and 'facts', constitutes the situation that became paradigmatic for modern science. Because 'the scientific' is the significance we put on the event while the event is the meaning of the world in a certain state (thus, 'objectivity' or 'theory' belong to the response to the event).

This situation cannot be reduced to 'the simple possession of knowledge' or to construction in an epistemological sense. The matter concerns, rather, construction in an ontological sense, i.e. the matter concerns the building of new collectives in the process of which humans participate. It is interesting that in the Russian language the word 'event' literally means 'co-being'—*'so-bytie',* i.e. something like co-authorship in bringing entities into existence.

Sociology of science and the conception of becoming

What is the place for sociology of science in this framework? Adopting the idea of being as becoming (or an event), sociology of science finds itself in an unusual position. On the one hand, it recognizes that there is no such thing as 'the world in itself', and thus considers scientific facts

as constructions and inventions, keeping the emphasis on the active role of human collectives in the building of scientific knowledge. But on the other hand, it sees that the collectives that are responsible for these constructions are not initial and autonomous, but themselves belong to the consequences of the certain state of the world, and they belong to the response to the event as well, i.e. they are also constructed.

This ambivalent position goes beyond the dichotomy that science is either 'objective' and describes 'the world in itself' or 'subjective' and can be reduced to 'mere opinion'. Instead, this 'new' sociology of science argues for a dialectic between reality and objectivity on the one hand, and opinions, beliefs and interests on the other hand, a dialectic that constitutes the practices we recognize as scientific ones.

Thus, Andrew Pickering, one representative of this new sociology of science, devoted one of his latest articles to the very conception of becoming and its consequences for social sciences in general and STS particularly (Pickering 2003). The image of becoming which Pickering outlines is also derived from Deleuzian ontology:

> The image is one of multiplicity. Imagine a set of entities. Imagine each of them sporting endlessly, changing their nature open-endedly, first this way then that, in indefinite spaces of possibility. Imagine that subsets of these sportings occasionally come into alignment and reciprocally sustain or interactively stabilize one another, forming a new entity that sports anew. Imagine that the original entities formed in the same way, so that all entities are assemblages. Iterate (Pickering 2003, 97).

What is important here is that this ontology denies any kind of fundamentalism: 'the present state of the set of entities does not determine its future'—Pickering writes (2003, 97). It means that there is no such initial state of affairs in which subsequent development of things would be necessarily contained. Any state of the set of entities comes into being as a new configuration of bodies.

The scientific laboratory, from Pickering's point of view, is one of the places where this novelty, as he puts it, 'temporally emerges'. That is why, in parallel with Stengers, Pickering claims an 'interactive stabilization' of natural objects, instruments and scientists, which results in new collectives of conceptual, social and material actors.

Paralleling Stengers, Pickering argues for the construction of new scientific fact, but this construction does not belong to epistemology alone nor can it be reduced to theory alone. The case in point is an ontological construction of the world in the real time of practice.

Thus, Pickering (2000b) refers to cybernetics as the site where one can see the replacement of the representational tradition by what he calls the *performative idiom*. Cybernetics, Pickering argues, initially arose as an ontological project because it was aimed at making and exploring communication systems open for interchanges between them and their environment. Having the processes of information transfer as its basic object, cybernetics dealt with the coordination of entities without distinction between human and non-human realms. As a result, cybernetics was interested not in a representation of the 'external world', but in grasping a real time world process. The capacity for self-organization of a cybernetic device such as a homeostat was modelled on the brain as 'an adaptive controller of behaviour' that responded to the material environment through an interaction with it. This model of the brain and its engineering exemplifies an understanding of the intellect 'in the performative idiom—as a seat of agency immediately engaged with the agency of its environment' (Pickering 2000b, 5). Hence an analogy between a scientist and the unit of a multiunit homeostat set-up arises (Pickering 2000b, 4): the scientist accommodates (see the dialectic of resistance and accommodation developed in Pickering 1995) to the material environment unfolding unpredictably (other units of homeostat) and all the units achieve a certain (open-ended) stabilization in relation to each other. This state of stabilization can be considered as a scientific result, which emerges as a joint product of the efforts of both the scientist and the environment and none of them appears separate as a generative part.

From this de-centred perspective, the sociologist's work lies in analysing the complex interplay of all (human and non-human) actors, the interplay that generates new entities.

That's why Pickering says: 'We would like to change the definition of sociology a bit. We would like to see it as the kind of impure sociology of people and things that we practice' (2000a, 312). Such a position allows sociology of science to keep its identity without falling into relativism.

Another example of this 'impure' sociology balancing between the 'real' and the 'constructed' can be found in the works of Donna Haraway, the biologist, philosopher, and technoscience studies participant. Haraway draws ontological intuitions not from Deleuze, as did Pickering, but from Whitehead (Haraway 2003). Whitehead is well known as a creator of process philosophy. It may be said that he replaced the substance with process: 'for him the very process is the substance of the world' (Kissel 1990, 31). Becoming, in Whitehead's philosophy, is consequently more fundamental than being: becoming is an actualization of being. Hence, any entity is regarded by Whitehead as an *actual occasion* (or an actual event) with its inherent self-development, which unfolds due to creativity (Whitehead 1979). According to Whitehead creativity is a principle of novelty according to which any entity is a novel 'togetherness of the many'. The latter is attainable through so called 'concrescence' as the process of interrelation of forming events.

Haraway follows the Whiteheadian idea of 'concrescence' as she portrays a picture of relational ontology. Concrescence means the process of participation of 'the many' in a unified, distinct thing that is a creative assimilation of all past entities as its initial elements. The concept of 'companion-species' Haraway uses (2003) serves as an illustration of such an ontology where the elementary unit is relationship: 'There cannot be just one companion species; there must be at least two to make one' (2003, 63). In Haraway's story, none of the partners (dogs and humans as companion-species) pre-existed the relationship, but both of them were co-constituents, products of their own relating. In a certain sense, each of them comes as an 'actual occasion', the new togetherness, actualized the potentiality of the other. In this ontology there is no substance which lies in the foundation of the process of becoming: 'there is no foundation', says Haraway, 'there are only elephants supporting elephants supporting elephants all the way down' (2003, 63). Dogs and humans mutually invent each other in 'a kind of Whiteheadian concrescence' (2003, 69).

Here constructionism comes as a synonym of concrescence that is the opposite, not to realism, but to fundamentalism: 'constructivism is about contingency and specificity but not epistemological relativism' (Haraway 1997, 99). Contingency and specificity are characteristics of the event and,

therefore, Haraway's analysis of science also places science 'under the sign of event'. Thus, in Haraway's interpretation, science is always technoscience, i.e. unlike an ahistorical representation of objects, it comes as a historical construction of 'the new togetherness', the process of concrescence of technological, social, inorganic, and organic agencies (Haraway 1997). Science, justified by the event, appears as a set of situations that are simultaneously natural and artificial, real and invented. For example, *oncomouse*, the invented and patented animal, is the product of technoscience, the new togetherness of many actors whose relations form the 'world-building space called laboratory' (Haraway 1997, 81–83). The reality of an invented, artificial *oncomouse* is the same kind of reality as the artificial situation in Galileo's laboratory: in both cases, the invention means opening a space for things themselves to testify in the place of their inventor's testimony. As a result of this, the scientific product *emerges*, i.e. it comes into existence as a genuinely new entity due to a creative mutual assimilation of all kinds of actors.

Conclusion

I have now tried to answer the question of how sociology of science could be interested in an ontological criterion of science. There are two main epistemological positions that reflect back upon the traditional dualism of Western philosophy: the first one can be called ontological epistemology or dogmatics; the second one is critical epistemology (with a skeptical branch). The first one emphasizes an invariant character of independent reality and places epistemology under ontology, while the second position displays a constructivist mode of knowledge and places ontology under epistemology. Hence it is obvious that sociology of science, which belongs to the critical tradition, and which at the same time appeals to an ontological argument, is contradictory. However, an ontologically oriented sociology of science endeavours to resolve this contradiction when it recognizes the ontological unit as an event.

The event is truly a dialectical category uniting being and becoming. At the level of epistemology, it presupposes 'not only the interaction between the cognizing and the cognizable but also that this interaction

creates the difference between past and future' (Prigogine & Stengers 2001, 215). In other words, it presupposes that science does not cognize the world in terms of representation but creates the world in terms of ontological construction.

My answer here is thus that sociology of science can be interested in an ontological argument without contradiction[5]—if it uses conceptions of the event referring to becoming—because 'ontological choreography' (Haraway 2003) cuts across dogmatics and criticism. But, of course, this calls for a revision of the notions of sociology and society. This revision can be observed in the 'new sociology of science'.

Notes

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2 See Latour, B., 'Stengers' Shibboleth' in Stengers (1997).

3 In the chapter 'How We See the World' (see Prigogine & Stengers 2001), the authors also designate the following three fundamental properties of being: irreversibility, an event, instability.

4 Descartes identified matter with substance; he postulated two substances—*res cogitans* and *res extensa*—and thus matter gained the characteristics of substance: it became cognizable.

5 To put it more precisely, the contradiction remains, but within the limits of two-valued logic depending on the 'substance tradition'.

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