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**TRANSFORMATION,
DEGRADATION,
DISAPPEARANCE
OF SCIENTIFIC
OBJECTS**

The phenomenon of transformation, degradation or plain disappearance of scientific objects has not been entirely neglected in the field of history and philosophy of sciences. However, one could hardly fail to notice that in the post-Kuhnian, historically-oriented philosophy of the sciences, history is chiefly unidirectional. In fact, it mostly focuses on the processes of *construction, invention, genealogy, coming into being*, etc., and, in so doing, shows a marked preference to inquiring at the “ascending” slope of the past, leaving the process of the abandonment of scientific objects relatively disregarded. In contrast, we believe that the study of the different ways this latter process takes place has something to teach us about the scientific mind in action, and therefore, about the science itself.

The general idea we put forward – insinuated also in the title of the Prague conference that has

inspired this special issue¹ – can be expressed as follows: scientific objects do not simply vanish when they are abandoned by new science. Even if proven inadequate, obsolete or null, outmoded scientific objects do not instantly disappear from scientific practices. Sometimes they persist side by side with new objects; sometimes they survive in the form of trace elements in the realm of the new knowledge. On other occasions, their disappearance takes the form of *gradual retreat*, when scientific objects undergo an epistemological *déclassement*. It is on this very phenomenon of progressive evanescence that we invited our authors to focus their attention. However, before addressing their contributions, we must first say some words about our current notions.

¹ “Transformation, Degradation, Disappearance of Scientific Objects”, conference held at the Institute of Philosophy of the Czech Academy of Sciences, Prague, Czech Republic, June 14–15, 2016. The meeting was supported by the funding scheme of the Czech Academy of Sciences “Strategy AV21”. Michael Friedman’s, Jacques Joseph’s and Hans-Jörg Rheinberger’s papers published in this issue were first presented on this occasion.

Objects and Scientific Objects

It is relatively well established that in our philosophical tradition, the Latin substantive *objectum* and the philosophical concept it bears, which have no direct counterpart in the Greek tradition, didn't appear before the 13th century. The idea of an *object* emerges then only tardily, after the adjective *objectus*, its source, is coined within Augustine's theory of vision where it used to characterize the body hindering the rays that emanate from the eye.² It is important to insist with Alain De Libera that the ancient notion of object, as it was used at the end of the Middle Ages and the beginning of modern times, referred to the contents of mental representations, and not to what is supposed

² Even recently Lorraine Daston underlines the persistence of the oppositional connotation of the term: "In the English verb 'to object' the oppositional, even accusatory sense of the word is still vivid. In an extended sense, objects throw themselves in front of us, smite the senses, thrust themselves into our consciousness." Lorraine DASTON (ed.), *Biographies of Scientific Objects*. Chicago: Chicago University Press 2000, p. 2. Solid and autonomous this time, *object* conceived as *obstacle* is said to resonate in the conception of the *object* that generally populates historians', sociologists', and philosophers' reflections on science. It is not impossible that a more extensive inquiry into the history of the word "object" would have been helpful for Daston's demonstration that "scientific objects can be simultaneously real and historical" (*ibid.*, p. 3).

to be located *outside of the thought*. It sounds indeed curious to us today that such an external entity was precisely designated as the *subject*, as it is deemed permanent and standing by itself. This is the reason why De Libera – who follows in this specific point Heidegger's observation – was conducted to speak of a "reversal" of the meaning of these terms when thinking of the transition from medieval to modern philosophy.³ In the last analysis, however, De Libera tended to think that our contemporary notion of the "object of knowledge", as it appeared plainly only with Kant, inherited all the meanings contained in both notions. In our day, when we use the expression "scientific object" without specification, we mobilize in fact the same basic meanings.

We wish to draw on this history of the term, which is mainly gone out of our minds, and to free, so to speak, the adjective "scientific" (in the expression "scientific object") so that it no longer marks the act of taking possession (mental, instrumental, etc.) of an external object, but instead restrains the class of objects we are interested in: the

³ See Alain DE LIBERA, "Où va la philosophie médiévale? Leçon inaugurale au Collège de France du 13 février 2014" [online]. 2014. Available at: <<http://www.college-de-france.fr/site/alain-de-libera/inaugural-lecture-2014-02-13-18h00.htm>> [cit. 6. 3. 2017], § 32.

objects of science. This is how we let the notion of “scientific object” embrace, and even merge, the two poles of scientific endeavour that are commonly kept apart. As a matter of fact, the term does not exclusively refer to the objects scientists strive to know; the notion also comprises various elements constitutive of the technical and conceptual apparatus of a given science, insofar as they are, or used to be, objects of reflection: experimental devices, methods, forms of expression, types of modelization, etc. – the known and stabilized objects, on which the scientists are acting and that they use as instruments both in experimental practice and formal sciences. The simple notion of a scientific object also comprises another double sense. The stabilized object of knowledge we act through, or we act with, appears certainly to us as a manifestation of the real, since in acting through or with it, we make possible the emergence of new and unexpected determinations, and at the same time we necessarily encounter a resistance to the transparency of our operations. The interesting point is that the materiality of the real would here be unjustly considered as fully accountable of this experience. Even in the formal sciences, behind the appearance, we encounter the solid character of the known object as a resistance to manipulations and, at the same time,

as a possible treasure of new determinations attained in virtue of our operations.

These preliminary observations eventually lead us to suggest that from the epistemological point of view, all essential demarcation between the inner and the outer world of the science is dispensable.

Speaking about “scientific objects” in these symmetrized meanings has little aspirations for originality since we can find them in all the contemporary literature on science under other denominations. Our aim is nevertheless to avoid, as early as possible, any inappropriate associations that other and similar expressions may inspire. Thus the notion of “epistemic objects”,⁴ in some cases, risks to entail ambiguity since for the majority of English speaking scholars, the term “epistemic” refers to knowledge in

⁴ Hasok Chang uses the term to indicate the Kantian ingredient of his conception: “The world as we know it is populated by *epistemic objects*, by which I mean entities that we identify as constituent parts of reality. I use the designation ‘epistemic’ as relating to the human process of seeking knowledge, as an indication that I wish to discuss objects as we conceive them in our interaction with them, without a presumption that our conceptions correspond in some intractable sense to the shape of an ‘external’ world that is entirely divorced from ourselves.” Hasok CHANG, “The Persistence of Epistemic Objects Through Scientific Change.” *Erkenntnis*, vol. 75, 2011, no. 3, p. 413 (413–429).

its most general meaning. Withdrawing the need to emphasize the outward “intentionality” of the scientific research allows us to plainly indicate, with the notion of “scientific object”, that only scientific knowledge is at stake.

A tentative typology of “scientific objects” was recently sketched by Theodore Arabatzis who evokes Ian Hacking’s historical ontology as able to “do justice to their [...] various modes of being and becoming.”⁵ The discrimination between different kinds of scientific objects thus plays an essential role for Arabatzis: “the question regarding the birth and historicity of scientific objects admits different answers depending on the particular kind of scientific objects we are dealing with.”⁶ This

⁵ Theodore Arabatzis, “On the Historicity of Scientific Objects.” *Erkenntnis*, vol. 75, 2011, no. 3, p. 382 (377–390).

⁶ *Ibid.*, p. 381. The pluralist metaphysics Arabatzis advocates takes its roots in the following tentative distinctions: “– Naturally occurring entities (e.g. planets) versus artificially produced entities (e.g. genetically modified organisms). – Naturally occurring regularities (e.g. the retrograde motion of the planets) versus phenomena created in the laboratory (e.g. the laser). The latter may or may not have a counterpart in nature. – Historical entities (e.g. species) versus entities that are not supposed to have a history (e.g. electrons). – Stable objects (e.g. rocks) versus fleeting objects (e.g. clouds or dreams). – Objects accessible to unaided observation versus indirectly observable, or even in principle unobservable, objects. – Objects of theoretical discourse without

line of thought sounds natural – at least when it is taken for granted that the most pressing question we can ask about the *biographies* of scientific objects is the mechanism of their *coming into being*. However, does it not lose a good part of its pertinence when the focus shifts from the birth to the death, and even less orthodoxly, to the process of dying, conceived as degradation, of scientific objects? Should it not be the *essence* or the nature of the empirical object here advantageously replaced by the *epistemic position* as the pertinent point in question?

The Ways Scientific Objects Vanish

It should be noted that it is precisely their epistemic position which makes *epistemic objects* and *technical objects* distinctive in Rheinberger’s view.⁷ In the context of the experimental research in biology, Rheinberger accentuates the “intentionality” of the scientific research, and conceives therefore *epistemic objects* explicitly as “targets of re-

experimental counterparts (e.g. the Higgs field) versus objects of experimental investigation that have not (yet) been embedded in a developed theoretical framework (e.g. electricity in the eighteenth century).” (pp. 379–380)

⁷ See the opening text of our special issue: Hans-Jörg RHEINBERGER, “On the Possible Transformation and Vanishment of Epistemic Objects,” pp. 269–278.

search” that eventually turn into *technical objects* accepted as part of a reliable and well-mastered hardware of science. In this context, the objects of Todd A. Hanson’s interest – steel towers and blockhouses used in American Cold War nuclear weapons testing – may be seen as ultimate instances of technical objects.⁸ It is so not only due to their fortified materiality but also for the brutality of the forces under which they collapse. In a way, Hanson’s paper completes Rheinberger who sketches different scenarios of disappearance he could identify via the study of the selected cases.

It is thus not only as an impressive metaphor that we put forward this extraordinary example of disappearance of scientific objects, degraded as they are or simply blown up by nuclear explosions. Quite surprisingly, an important epistemological question emerges from the rudeness of the nuclear testing program settings as soon as they are conceived, as Hanson invites us to do, as archeological sites: What exactly should be included in the *archeological record* to which the historian of “disappearance” appeals? The question is double-edged. First, it appears that even the very delimi-

tation of technical objects is a tricky affair. It is at least what Alistair Kwan shows in his paper devoted to the case of the use and disuse, in the pedagogical context, of the kymograph that proves to be “inherently incomplete” when reduced to its material condition.⁹ Second, the difficulty to set up an archeological corpus stems from the need to distinguish the vestiges of the “lost” object, i.e. its new “surviving” forms. It is in this light that we read Jacques Joseph’s study on the connection between More’s “Spirit of Nature” and Newton’s ether, which instead of being associated with any direct “influence” of More on Newton occurs via functional similarities between their theories.¹⁰ Yet, one may ask, how sizeable these functional similarities need to be if such a “spiritual succession” has to be firmly established? Can the Einsteinian field, for example, be said to be haunted by the same spirit, before being evacuated by Feynman’s ultimate formalization? There is no doubt that the question deserves generalization.

In quite a different context Michael Friedman hits a similar problem when speaking about “hybrids”

⁸ Todd A. HANSON, “Between the Ephemeral and the Enduring: A Dichotomy of Disappearance for the Scientific Objects of American Cold War Nuclear Weapons Testing,” pp. 279–299.

⁹ Alistair KWAN, “Do Not Kill Guinea Pig Before Setting up Apparatus: The Kymograph’s Lost Educational Context,” pp. 301–335.

¹⁰ Jacques JOSEPH, “Henry More’s “Spirit of Nature” and Newton’s Aether,” pp. 337–358.

apropos of models of molecules that find themselves halfway between two different, and a priori discrete ways of stereochemical modeling.¹¹ Friedman thus provides an excellent example of the progressive character of disappearance that eventually challenges, in its turn, the identity of “technical objects”. Indeed, instead of gaining the status of technical object by absorption, so to speak, when the knowledge is stabilized and well mastered, the new type of models proves to be *mere* technical tools as their epistemological function weakens. The technical status of scientific objects, thus suggests Friedman, may then represent a particular stage of their retirement or disappearance.

This special issue of *Theory of Science* is by no means intended to limit itself to echo the above-mentioned Prague conference. The considerable interest, generated by the topic that we proposed via an open call for papers, makes us confident that the set of papers our readers find in this volume will be accepted as a serviceable starting point for further discussions.

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¹¹ Michael FRIEDMAN, “A Failed Encounter in Mathematics and Chemistry: The Folded Models of van ’t Hoff and Sachse,” pp. 359–386.