

Pickering Andrew, Living in the material world: on realism and experimental practice, in Gooding, David, Trevor Pinch & Simon Schaffer, Ed., *The uses of experiments*, Cambridge: Cambridge University Press, 1989, 275-297.

Keywords

Scientific facts, realism/anti-realism, experimental strategies

Domain

Physics

Abstract

Traditional discussions about realism focus on the ontological status of the entities postulated by well-confirmed theories, i.e. theories whose theoretical predictions are judged to agree with statements of experimental fact. This kind of discourse leaves unexamined the crucial problem of how the statements of experimental fact are constituted in material practice. The aim of this essay is to show that, once this problem is taken into account, the issue of realism can be seen in a new light. On the basis of this analysis, traditional correspondence realism appears untenable, and an alternative position, called *pragmatic realism* emerges as a new viable option. Pragmatic realism is a noncorrespondence realist perspective avoiding the alternative between correspondence realism and an outright anti-realist position, and is based on the idea that experimental facts are the result of the interactive stabilisation of three elements: *material procedure*, *instrumental model* and *phenomenal model*. The coherence among these elements is not rigidly determined by how nature is in itself, as correspondence realists maintain, for it is the contingent upshot of a process of accommodation to resistances arising within the material world. Nevertheless, the material world, contrary to what some antirealists claim, play a role in the stabilization of scientific knowledge, and it does so precisely through those resistances. Anti-realism can thus be avoided and replaced by pragmatic realism. The essay argues for this perspective by analysing an episode of the hunting of the quark: the researches carried out at the University of Genoa by the physicist Giacomo Morpurgo during the 60ies and the early 70ies. This case study, based both on published material and on Morpurgo's own detailed commentary, shows how subsequent results are obtained through a series of both conceptual and practical accommodations to resistances encountered in the material world.

Development

Pickering proposes a three-fold classification of the ingredients necessary to the production of an experimental fact: 1) *material procedure* that is the set of actions the experimenter performs on the apparatus, including perceptual activity; 2) *instrumental model* that is "the experimenter's conceptual understanding of how the apparatus functions" (p. 277); 3) *phenomenal model* that is the conceptual understanding of the phenomenon under investigation. Elements 2) and 3) can be both characterized as conceptual models, whereas 1) refers to the specifically material dimension. Pickering describes the relation between 1), 2), 3) on the one hand, and scientific facts on the other in the following way: "Material procedures (...) when interpreted through an instrumental

model, produce facts within the framework of a phenomenal model” (pp. 277-278). A fact, therefore, arises when a three-way coherence among these elements is obtained thanks to an interactive stabilization. The non-uniqueness of the outcome of the stabilization process provides, by itself, a strong argument against correspondence realism. However, Pickering believes that “there is a direct and analysable relation between scientific knowledge and the material world, though it one of made coherence, not natural correspondence” (p. 279), for the material world *resists* to the experimenter’s attempts to achieve the three-way coherence. Yet, acknowledging the essential role of the interaction with the material world does not lead us back to correspondence realism, for it makes sense to talk about a resistance only with respect to the experimenter’s prior expectations. The way the material world resists, isn’t, therefore, an intrinsic feature of the world itself. This fact is exemplified by Morpurgo’s researches on quarks. After a series of accommodations of the material procedures and of the related instrumental models, Morpurgo obtained a series of charge measurements that could be deemed to indicate that electric charge can vary continuously. This result is incompatible with both the tradition belief that the values of the charge must be multiple of the constant e , and with the quark hypothesis, according to which quarks carry fractional charges equal to either $1/3 e$ or $2/3 e$. Thus, the measurement obtained can count as a resistance only against the background of Morpurgo’s reduced plasticity at the level of the phenomenal model. Pickering explains this reduced plasticity with Morpurgo’s commitments to the general views of his scientific community. The analysis of the local experimental achievement of stable results can thus be linked to the constraints imposed by the need of a social stabilization of practices and findings.

Methodology

Philosophical analysis, historical case study.

Specific contributions

The essay provides clear examples of how an experimental fact is constituted by achieving a stable coherence between material and conceptual practices. In particular, the reconstruction of Morpurgo’s experiments clarifies how an experimenter can react to resistances thanks to the plasticity of the available material and intellectual resources. This analysis of experimental practices is linked to the general problem of scientific realism.

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