Against semantic realism: the pragmatics of scientific theories

Scientific realism is often expressed in the form of three components: metaphysical realism (there exists an external reality), semantic realism, (scientific theories are true or false in virtue of this external reality), and epistemic realism (scientific methodology is a successful way to approach truth) (Psillos 1999). My focus in this presentation is on semantic realism: the assumption that scientific theories are true or false in virtue of their correspondence to reality. This can apply to theoretical vocabulary, which would refer to natural properties rather than be mere conventional or useful classifications, or to their structure, which would correspond to a real structure (either extensional, as space-time, or modal, as laws of nature) and not to mere observational regularities.

Semantic issues were at the forefront of discussions in philosophy of of science during the first half of 20th century, but after the failure of reductionist programs in philosophy of language, many authors, realist and anti-realist alike, eventually adopted semantic realism and turned their focus away from philosophy of language. This attitude can be considered the doxa nowadays, with such claims as "interpreting a theory is telling what the world would be like if the theory were true" being asserted uncritically (Ruestche 2013, Papineau 1993). I think it unduly narrows our perspective, for example in quantum mechanics, where several anti-realist interpretations are being developed.

In this presentation, I will argue that this move is unfounded and I will suggest a concrete way philosophy of language can throw light on the nature of scientific representation by applying considerations from pragmatics, a field that has developed considerably in the recent decades, to the philosophy of science.

A first reason for the dismissal of philosophy of language comes from authors with structuralist leanings who have claimed that characterizing theories as sets of statements was a mistake, and that most semantic problems could be bypassed by adopting a semantic view, i.e. considering theories as collections of models (Suppe 1972, van Fraassen 1980, Ladyman & Ross 2007). Admittedly, the notion of model is central in scientific activity, and it had been largely neglected by early philosophers of science. However, it is becoming increasingly recognized that the statement view and the semantic

view are more or less equivalent, in that the models of a theory are structured topologically by a common vocabulary: one needs a language and axioms to describe this topology (Halvorson 2012). This means that despite the importance of models, philosophy of language can still be relevant for understanding the nature of scientific theories and their relations to the world.

A second reason to dismiss the relevance of philosophy of language in philosophy of science could stem from the idea that the issue is more or less settled since the work of Kripke (1980) and Putnam (1975), who notoriously argued for direct reference on the basis of a relative autonomy of meaning with regards to our observations and beliefs. However this conclusion can be challenged.

First, there are arguments against semantic realism: casting meaning in terms of transcendental truth conditions makes it difficult to understand how one could acquire knowledge and manifest this knowledge (Dummett 1978). More generally, the correspondence theory of truth is problematic: how could we step out of our own representations to contemplate a correspondence between them and the world? Isn't postulating a correspondence relation just adding more theory to the theory? (Putnam 1980) These arguments challenge the idea that representation in general would be about something absolutely independent from us.

Secondly, the fact that meaning is autonomous from direct observations and beliefs does not make of semantic realism the only option at our disposal. Or in the context of philosophy of science, the fact that theoretical terms transcend theory change (whales are still whales even if not classified among fishes) and technical choices (distances can be measured in various ways, which evolve with technological developments), and that they can be attributed without actual observations (dispositional terms) does not strictly entail that they aim at referring to natural properties.

In particular, it seems to me that a whole field of philosophy of language has been neglected in this debate, namely pragmatics (see Kepa and Perry 2015). Pragmatics emphasizes the context-sensitivity of language and its performative role (so "the fridge is empty" is interpreted differently if the locutor wants to clean the fridge or to prepare dinner, and the statement could be an invitation to go to the grocery store). Pragmatics is compatible with the idea that conventional meaning is relatively autonomous from our observations and beliefs, because it relates it to intentional aspects, and this dependence on intentional aspects challenges the view that meaning is a

matter of correspondence to an independent reality. Therefore, there is an alternative that deserves consideration.

I think pragmatics can throw some light in philosophy of science. To explain why, let me start with an analogy: just as natural languages have a vocabulary, grammatical rules and meaning conventions that can be used to produce well-formed sentences, a physical theory has a vocabulary ("force", "spin"), a formalism (Hilbert space, Minkowski space) and laws and rules (Maxwell's equation) that can be used to produce well-formed models.

If models are analogous to sentences, the imports of pragmatics in natural languages can be directly applied to scientific theories. In particular, one might observe that objects, degrees of freedom and coordinate systems of physical models get their reference fixed when the model is applied to a concrete experimental situation: they are then associated with measuring apparatus, physical directions in the laboratory, and so on, in the same way indexicals, such as "I" or "Now", get their reference fixed in context. It has also been shown that experimentation is contextual: contextually applied practical knowledge (calibration of instruments, etc.) is involved to measure or control physical quantities (e.g. Bogen & Woodward, 1988). This mirrors the idea that context enriches meaning through implicatures: a theoretical statement such as "turn the temperature to 100°C" would be interpreted differently depending on the experimental context, thus accounting for the lack of a systematic correspondence between observations and theoretical terms. Finally, pragmatics has emphasized the performative role of language. Scientific models can be considered performative as well, in the sense that they require controlled interventions to be applied, and that they can be selected for their theoretical or technological purposes, rather than to explain hitherto observed phenomena. In this matter, old or new theories can be used indifferently. In sum, pragmatics applied to scientific theorizing seems to provide a coherent picture of scientific activity.

If taken seriously, the implication of this analogy are the following: scientific models can convey representations of the world and have truth-values, just as sentences usually do, but their truth-value should be deemed relative to intentional aspects and to an epistemic context. The content of a theory as a whole, by contrast, would not convey any representation of the world, but rather, as a language, structure the way that the theory can be applied to various domains of experience in relation to various possible intentions. Meaning is not analytic, because it can be discussed and revised, nor

synthetic, because these revisions are based on utility rather than truth. Similarly, the content of a scientific theory would be neither analytic because it can be revised, nor synthetic, because this revision does not follow directly from experimental failure (Kuhn 1962), but pragmatic.

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