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A pluralist view on theories

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Abstract — In philosophy of science, several views have been espoused on the meaning of the term ‘theory’; among these are the syntactic view and the semantic view. But even after decades of debate, no consensus has been reached on an all-encompassing positively defined view on theories. Here we take that to mean that the outcome of the debate is that such an all-encompassing view is nonexistent. Correspondingly, the purpose of this paper is to present a pluralist view on theories: it is negatively defined, yet it may break the deadlock in the ongoing debate on the meaning of ‘theory’.

In philosophy of science there are a number of distinct views on what ‘theory’ means: what is at stake is a criterion by which a body of statements can be called a ‘theory’, which is generally seen as a positive value. Of historical importance are the *syntactic view*, the core of which has been formulated by Rudolf Carnap (1923), and the *semantic view*, originally proposed by Patrick Suppes (1960).

Naively put, the syntactic view—also called the *received view* by Putnam (1962)—is that a theory is a collection of axioms expressed in a formal system, together with an empirical interpretation of the terms. The most obvious argument against the corresponding monistic position that the term ‘theory’ should *only* be used in this sense is that then squarely against existing scientific practice, several widely accepted bodies of knowledge cannot be called a ‘theory’, cf. (Halvorson, 2016). For that reason, many philosophers of science reject this monistic position.

The semantic view, which emerged from criticism of the syntactic view, is, naively put, that a theory is a collection of models. It is true that several versions of the semantic view have been developed that are more elaborate than this naive formulation, e.g. by Suppes (1967) and by Van Fraassen (1980), but these all “share a core commitment to viewing theories as an abstract specifications of a class of models” (Craver, 2002). But like the monistic position corresponding to the syntactic view, the monistic position corresponding to the semantic view has drawn severe criticism as well; for a fairly recent encyclopedic overview, see e.g. (Frigg, 2014). An additional criticism from the perspective of theory and model development is this: it may be true that a theory specifies a collection of models, but what the semantic view fails to take into account is that this collection of models is unknown at the moment a theory is formulated—usually, the development of even one model of a theory is an enterprise in itself. For example, it is certainly true that General Relativity (GR) corresponds to a collection of models, but to date—more than a century after the publication of GR—no model of GR with two or more interacting massive bodies has ever been developed. There is no general solution of any of the n -body problems in GR; in particular, there is no model of GR that describes our solar system. The few models available concern either systems with one massive body (such as a black hole) in an otherwise empty spacetime, or concern systems that in one way or another are restricted (such as systems with a test particle, which is assumed to leave the gravitational field undisturbed). That is to say: GR has already been formulated (as a set of mathematically expressed equations with a physical interpretation), but the collection of models it specifies has not (yet) been developed.

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So let us not kid ourselves by saying that the one is identical or equivalent to the other. A similar argument can be made with quantum mechanics: there are no models (solutions of the Schroedinger equation) that describe atoms with more than one electron.

The prolonged debate of the syntactic view versus the semantic view has led to highly differentiated analyses of the circumstances under which the use of the term ‘theory’ is justified. However, the state of affairs at the beginning of this decade was that the philosophical problem of what a theory is had not yet been solved (Muller, 2011); fact of the matter is that this debate has still far from settled. Shortly after Muller published his conclusion, Halvorson reported that “some philosophers have suggested that we should stop trying to answer the question what a theory is” (2016); in that line of thinking, here we take the fact that the debate on ‘theory’ hasn’t settled to mean that the outcome of the debate is that it has turned out to be impossible to give an all-encompassing *positive* definition of the term ‘theory’ based on either the syntactic or the semantic view such that everything that is widely agreed on to be a ‘theory’ fits that definition. That, however, does not necessarily mean that the discussion on ‘theory’ has ended in a deadlock: below a pluralist view on theories is put forward that encompasses both the syntactic and the semantic view. This view is not positively defined, but that doesn’t mean that the view is useless—it may even be the only view that is generally defensible.

First of all we note that in scientific practice the word ‘theory’ is used as a predicate: the question is not what a theory ‘is’, but rather when the predicate ‘theory’ applies to the output of a research c.q. research program. That said, the **pluralist view** on ‘theory’ is the following:

- (i) ‘theory’ is a predicate that applies to *explanantia* (i.e. bodies of statements that can be used to explain phenomena);
- (ii) the predicate ‘theory’ is *primitive* in the sense that it defies a precise definition in terms of other well-defined notions in philosophy of science;
- (iii) there is *no uniform set of criteria*, such that the predicate ‘theory’ applies to the output of a research program in science if and only if these criteria are satisfied;
- (iv) there can be *no gratuitous use* of the predicate ‘theory’: in each instance, a (scientific) justification has to be given for its application.

From this pluralist viewpoint the scope of the meaning of ‘theory’ can then be gauged by the collection of research outputs to which it applies.

This view incorporates the syntactic view in the sense that if we adopt this pluralist view, then we agree with proponents of the syntactic view that a set of formalized statements with an empirical interpretation can be called a ‘theory’; however, we do not agree with the corresponding monistic view that the predicate ‘theory’ *only* applies to a set of formalized statements with an empirical interpretation. Likewise, this view incorporates the semantic view in the sense that if we adopt this pluralist view, then we agree with proponents of the semantic view that a collection of models can be called a ‘theory’; however, we do not agree with the corresponding monistic view that *only* a collection of models can be called a ‘theory’.

Furthermore, the pluralist view is not merely the dualist view that the predicate ‘theory’ applies when it applies from either the syntactic or the semantic viewpoint: there are also subjects to which the predicate ‘theory’ applies from the pluralistic viewpoint, but not from the syntactic or the semantic viewpoint. An example is ‘string theory’ in physics. There is no such thing as a ‘string theory’ in the sense of a physically complete description of a unified field that is based on the notion of a string and that has been formulated as a set of mathematically expressed axioms: there is only a research program in theoretical physics aimed at such a unified field description. From the pluralistic viewpoint there is no objection against the application

of the predicate ‘theory’ to the combined output of that research program: even though the physics are speculative, the rigorous application of mathematics is enough of a justification. So, in this case the predicate ‘theory’ applies to a (dynamic) body of statements that is so far not axiomatized and that so far doesn’t specify a model. Obviously, there is no such thing as string theory from the syntactic viewpoint, because up till now no mathematically expressed description of a unified field has been axiomatically introduced—of course, a collection of axioms that exists only *hypothetically* cannot be called a theory. And from the semantic viewpoint there is no such a thing as string theory either, because no collection of models has so far been specified: here we also have that a collection of models that exists only *hypothetically* cannot be called a theory. That said, let us investigate the monistic views corresponding with the syntactic and the semantic views using Kant’s categorical imperative. So, let’s consider that everyone should adopt the monistic view that the term ‘theory’ can only be used in accordance with the syntactic c.q. the semantic view. A consequence is then all physicists would have to stop talking about “string theory”. Obviously, this goes squarely against everyday scientific practice. Ergo, these monistic views are untenable—the same goes for the dualist view mentioned above.

Last but not least, adopting this pluralist view does not imply that one suddenly has to consider any statement to be a ‘theory’. Consider, for example, the statement ‘the child of a werewolf and a vampire can only be killed by a silver bullet and a stake through the heart’: this is an *explanans*, because it can be used to explain why the child didn’t die even though it was shot with a silver bullet. However, this statement is not a theory from the pluralist viewpoint, because there is no scientific justification for calling this a theory. Although this example is rather trivial, it nevertheless shows that it is not the case that all of a sudden everything becomes a ‘theory’ when one adopts the pluralist view.

Concluding, we have presented a pluralist view on ‘theory’. On the one hand, this means that we take the view that the predicate ‘theory’ applies under those circumstances under which it applies from the syntactic or the semantic viewpoint. On the other hand, however, this means that we take the view that there are not only circumstances under which the predicate ‘theory’ does apply in spite of the fact that it doesn’t apply from the syntactic or the semantic viewpoint, but also circumstances under which the predicate ‘theory’ doesn’t apply at all—there is no ‘anything goes’ from the pluralistic viewpoint.

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