

Review of Andreas Hüttemann's *A Minimal Metaphysics for Scientific Practice*

Andreas Hüttemann, *A Minimal Metaphysics for Scientific Practice*. Cambridge University Press (2021), viii+232 pp. \$99.99 (hardcover)

The aim of Andreas Hüttemann's recent book, published in 2021, is, as the title suggests, to offer a minimal metaphysics for scientific practice. Hüttemann understands this as "the project of making explicit assumptions concerning the structure of reality that best explain the success of scientific practice." The metaphysics offered is "minimal" in the sense that it "refrains from postulating any structure that is explanatorily irrelevant for understanding scientific practice" (1).

Hüttemann reaches his metaphysical conclusions using an inference to the best explanation. The explananda are certain items of scientific practice that have remained stable over a long period and are therefore seen as central. Crucially, they concern all kinds of sciences—not only fundamental physics, thus allowing Hüttemann to extract metaphysical claims without making the assumption (that Hüttemann rejects) that physics is ontologically fundamental.

Though minimal, this project is "ambitious" in that "it is directed at what scientific practice reveals about the *structure of the world* itself." In this sense, it is "*realistically* conceived metaphysics" (4). Two questions arise at the outset. First, why call what Hüttemann does *metaphysics*? Well, it's *descriptive* metaphysics because its aim is to derive the metaphysical assumptions that best explain the success of scientific practice. Second, why of scientific practice and not of scientific theories? Hüttemann's main reason why we need to shift attention from theories to practice, is that theories have a best-before date, as shown by the argument from the pessimistic induction. For Hüttemann, the content of the scientific image of the world has not been stable enough over time to allow us to extract safe conclusions about the world's ontology; on the contrary, scientific practice (or, certainly some parts of it, viz. "the practice of predicting, explaining, confirming and manipulating based on scientific findings" [34]) has remained invariant.

However, the stability of these practices is a matter of degree, as Hüttemann readily admits. Conversely, if stability is a reliable guide to infer metaphysical claims, by the same token, because there have been substantial parts of past scientific theories that have remained relatively stable over time, they too can be taken to be a comparatively reliable basis from which to infer metaphysical conclusions. Hence, theories and practices are (should be) both the basis on which general assumptions concerning the structure of reality can be drawn.

Chapters 1 and 2 contain Hüttemann's account of laws of nature and form the core of his analysis, which Hüttemann develops by looking at the role of law statements in the practices of explanation, confirmation, manipulation, and prediction. Now, that's a *prima facie* problem, the reason being that there can be lawlike statements playing a role in practice without there being any laws of nature *qua* truth-makers of the lawlike statements! Be that as it may, Hüttemann takes the general form of a law-statement to be:

(A) All systems of a certain kind K behave according to Σ ,

where Σ is a “law-predicate,” typically standing for an equation (14). He draws a distinction between two kinds of generalization that are packed into law statements and which the previously mentioned practices help us unpack, which he calls internal and external generalizations. Internal generalizations are typically expressed by mathematical equations and “quantify over a domain of values for variables” (24). External generalizations delineate the kind of systems to which the equations apply; they have the form: Equation $[X]$ pertains to all systems of a certain kind $[K]$. Consider Galileo’s law of free fall: Starting from rest, the distance traversed by a freely falling body is proportional to the square of the time of fall, or, in mathematical terms $s = 1/2 gt^2$. The internal generalization in this case is that the equation holds for all values of t , whereas the external generalization is that the equation describes the behavior of a specific class of systems, namely, free-falling objects (12).

Hüttemann takes it that this distinction is issued by scientific practice in that the external generalizations are presupposed by, but do not feature in, scientific explanations, whereas internal generalizations do all the explaining (18–19). A difficulty here is to specify how the content of the law statement applies to—and hence, explains—worldly cases. That’s a difficulty because the kinds of systems that the law statements describe are not really worldly.

The chief novelty of Hüttemann’s account is in his claim that all the characteristics of law statements can be explicated in terms of invariance, that is “in terms of the fact that they are invariant with respect to a number of different kinds of circumstances” (23). Invariance for Hüttemann “best explains a certain feature of scientific practice, namely, why we can rely on laws” (26). It is a modal notion and accounts for all other natural modalities and dependence relations we find in scientific practice; in particular, it underpins causal reasoning and reductive practices. What makes invariance modal? The fact that it “concerns not only actual but also counterfactual changes” (30). For Hüttemann, invariance is prior to laws, in the sense that ontologically, invariance can be explicated without reference to laws; epistemologically, he thinks, it may well be that we have to rely on laws to establish claims of invariance.

However, the very idea that invariance is modal might well undermine Hüttemann’s priority claim. Thinking of counterfactual changes invites the question: What changes can be deemed possible? Here a clear answer can be: Those that are consistent with fundamental laws of nature. If so, invariance cannot have modal force independently of what laws there are. Alternatively, it might be claimed that laws and invariance are on a par. In either case, Hüttemann’s priority claim is challenged. More generally, what seems to be missing from Hüttemann’s minimal metaphysics is an account of counterfactual conditionals.

Hüttemann accepts the existence of so-called *ceteris paribus*-laws (cp-laws), but he does not take this as incompatible with the claim that “external” (or “internal”) generalizations fail to be invariant. His way to escape the criticism that the existence of *ceteris paribus*-laws weakens the nomological necessity of laws is to argue in favor of a dispositional account of cp-laws. Thus, in the lengthy and rich Chapter 2, Hüttemann discusses what he takes as the two central problems posed by the existence of cp-laws, the “semantic problem” (what are the truth conditions for

cp-laws?) and the “confirmation problem” (how can cp-laws be confirmed/disconfirmed?). His solution is to take laws to attribute multitrack dispositions to systems; thus, given cp-laws, law statements have to take the following form:

(B) All physical systems of a certain kind are disposed to behave according to Σ . (64)

This account, Hüttemann thinks, best explains the practice of “extrapolation,” where “generalisations that have been found to hold under specific circumstances also hold under different circumstances” (51). The reason that there is no problem with the failure of invariance in the case of cp-laws, then, is that even in cases of interferences, the disposition attributed to the system by the law is indeed possessed by the system (and maybe it is only partially manifested). Hüttemann thinks that this dispositional account can solve both the semantic and the confirmation problems.

In the chapters that follow, Hüttemann analyses causal reasoning and reductive practices by relying on the account of laws and modality developed in Chapters 1 and 2. He thinks that all “natural modalities” can be explicated in terms of invariance relations. Chapters 3 and 4 are about causation; Hüttemann’s main claim is that our everyday notion of causation can be understood in terms of what he calls a “quasi-inertial process” that is interfered with, where a quasi-inertial process is characterized in terms of what the system is disposed to do in the absence of interferences. A cause in the ordinary sense, then, is a factor that interferes with this quasi-inertial process. In Chapter 4, Hüttemann applies this analysis to the problems of preemption and transitivity.

Chapters 5 to 7 concern reductive explanatory strategies. A main claim is that the reason we take reductive reasoning to be appealing is not because we take reductive explanations to give us what is fundamental or ontologically primary, but simply because such reasoning is “part of what we consider good science” (148). Chapters 6 and 7 extend this discussion by rejecting the view that there is some further “metaphysical structure” that we should postulate to make sense of reductive reasoning. He opts for Ontologically Neutral Monism, which combines “ontological monism” with “descriptive pluralism,” allowing “for a plurality of descriptions of a system (or of reality), none of which is ontologically privileged as the exclusively true account of reality, provided they are empirically adequate” (202).

In the concluding Chapter 8, Hüttemann returns to the characterization of the general form of the metaphysical arguments pursued in the book, that is as inferences to the best explanation, and contrasts his approach with other approaches in metaphysics of science. Hüttemann is certainly right in criticizing the excesses of “radical naturalised metaphysics that the only purpose of metaphysics is to be serviceable to the sciences” (216). We fully agree that “[q]uestions about dispositions and categorical properties or about universals and tropes are perfectly fine questions irrespective of whether or not physics or any other science has any use for the accounts developed in answering these questions”; these questions should be taken seriously “whether or not they promote natural science” (216). And yet we are skeptical about the prospects of Hüttemann’s minimalist approach. To see why, let us take another quick look at the central notion of invariance.

In using invariance to account for the natural necessity of laws, Hüttemann explicates what he calls the “modal surface structure” of law statements; that is, he leaves it an open question whether the modal structure attributed to laws can be reduced to nonmodal facts, that is whether Humeanism is true. As he puts it, this further question “may be an interesting question on its own, but answers to this question typically do not do any work in explaining the success of the scientific practice we have” (12). So, although the notion of invariance is required to account for how laws function within practice, Hüttemann does not want to ask the further question, that is what ontology underlies invariance relations? His metaphysical minimalism amounts then to a kind of metaphysical agnosticism about what would seem to be the most interesting metaphysical questions—whether, for example, our world is a Humean or neo-Aristotelian one. However, such a metaphysical agnosticism may be seen to undermine the claim that minimalism amounts to a really metaphysical view, as it remains unclear in what sense invariance is a (minimal) *metaphysical* commitment as opposed to a concept-already-in-use in science, for which there is no need for any metaphysical explication.

If criticism in philosophy is a sign of admiration, it should be clear that Andreas Hüttemann has written an admirable book. Full of insightful thoughts, important arguments, and challenging views. Anyone remotely interested in the metaphysics of science should read it.

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