METAPHYSICS AND THE PHILOSOPHY OF SCIENCE

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Should metaphysics be informed by the results of contemporary science? Should it be naturalized? The debate surrounding these and similar questions is one of the most vigorous in contemporary theoretical philosophy. However, until now many positions have only been roughly sketched out, and there has been very limited dialogue between the proponents of naturalization and the defenders of traditional metaphysics. This is unfortunate, considering the fact that the status and legitimacy of an entire philosophical sub-discipline is at stake.

As a contribution to the debate over the proper relationship between metaphysics and science, *Metaphysics and the Philosophy of Science* is both highly relevant and valuable. The book contains original contributions by ten renowned and knowledgeable authors, with an introduction by one of the editors. The collection is not aimed at defending naturalized metaphysics, nor do the individual authors pursue a shared agenda. Rather, *Metaphysics and the Philosophy of Science* seeks to provide 'a more general picture of the relationship between science and metaphysics' (p. 5). It touches on potential contributions by the special sciences (especially physics and the life

sciences) to metaphysics, raises various questions regarding methodology in metaphysics, and evaluates the prospects of a more scientifically orientated metaphysics.

In the first chapter, Katherine Brading reconstructs Newton's *Principia* as a seminal contribution not just to the history of physics, but also the philosophy of time. Brading shows how Newton distinguishes absolute from relative, true from apparent, and mathematical from common time. She argues (against fellow scholars) that each of the three distinctions is meaningful, relevant, and necessary to Newton's project (to account for the world, including astronomical phenomena, in terms of matter in motion). Most importantly, Brading attempts to show that Newton introduces a new methodology: questions concerning whether time is absolute or relative, true or apparent, and mathematical or common are to be assessed not *a priori* but empirically. Lastly, Brading suggests that a 'more historically driven methodology' (p. 39) inspired by Newton's 'empiricist metaphysics' (p. 13) might help establish a common ground for metaphysicians and philosophers of physics to jointly tackle important issues in the philosophy of time.

Chapters 2–4 focus on the metaphysical impact of findings and practices in the life sciences. Michael Strevens (Chapter 2) compares two compositional theories of complex systems and applies them to an easily accessible sample case (the predator–prey population cycle of the Canadian lynx and the snowshoe hare). He argues that the more traditional 'wedding cake' ontology view of composition, according to which complex systems are spatiotemporally composed from lower level entities, makes it practically impossible to calculate the behaviour of complex systems: it allows even small changes to influence the system as a whole and the number of interactions between parts quickly becomes unmanageable. Strevens then argues that this 'explosion of complexity' is avoided by his own enion probability analysis (EPA). EPA assigns probabilities to the relevant behaviours of the individuals that constitute the system—the 'enions', as Strevens calls them. We can then predict the future development of the system by aggregating the probabilities, without having to take into account small changes in enions or large numbers of interactions. (For example, once we have established that any given hare has a 0.05 probability of falling prey to a lynx in a given month, we do not need to worry about the unforseen actions of individual hares.) For Strevens, EPA's avoidance of complexity explosions is an example for the usefulness of distributed ontologies.

Matthew Slater (Chapter 3) takes a more methodological, meta-level approach. After giving a brief, but helpful, overview of current stances on naturalized metaphysics in its various forms, he examines the fates of naturalistic arguments employed to either support or refute certain views in the ontology of species. Interestingly, Slater notes that naturalistic arguments succeed against essentialism, but do not suffice to establish a view of species as individuals or to refute Boyd's homeostatic property cluster account. (The reasons for this are that essentialism, the view that species share micro-structural essences, is empirically incorrect; biologists' practice of treating species as individuals is outweighed by metaphysical reflections on the incoherence of indeterminately existing objects; and the homeostatic property cluster account may be incompatible with certain schools in biological systematics, though this does not automatically make it false.) Slater concludes that naturalized metaphysics is not 'an all-purpose club against a prioristic metaphysics' (pp. 56–7), as naturalistic arguments are not all equally epistemically valuable. Accordingly, we should not presume that all empirical claims trump all metaphysical claims, and we should be aware of the possibility of hidden metaphysical presuppositions and unconceived metaphysical alternatives when evaluating theories.

With Kenneth Waters's contribution (Chapter 4), we return to the question of what the special sciences can teach us about ontology. Waters argues that biology, and genetics in particular, is sufficiently advanced and general enough to allow us to draw metaphysical conclusions (if generality is understood 'in terms of what one finds at many different scales' (p. 86)). Reflections on geneticists' practice of partitioning DNA molecules in various ways leads Waters to assert that in present-day biology, there are no such things as genes at the molecular level. From this, he draws two conclusions. First, given that the deliberate partitioning of DNA is highly successful and hence

well adapted to reality, he advances and defends the substantial metaphysical thesis that there is no overall structure to reality. Second, whereas scientific metaphysics typically consists in either adopting scientific results or claiming a continuity of methods between science and metaphysics, Waters warns us that this may lead to incorrect conclusions (as in the case with supposedly obvious but incorrect metaphysical interpretations of the classical gene concept). Instead, we should also take into account the investigative and manipulative practices of science.

Chapters 5–10 each turn their attention away from what the special sciences can teach us about metaphysics and towards more general issues concerning the relationship between metaphysics, science, and the philosophy of science. First, Jenann Ismael (Chapter 5) takes on a central problem of twentieth-century metaphysics of science: how can we account for the frequent appeals to modal notions in science (such as 'cause', 'natural law', and 'probability') without metaphysically committing to the non-actual or merely possible? The (neo-Humean) reduction of modal to non-modal notions is an unpalatable option here because of a seemingly unbridgeable gap between statements about categorical facts and statements about modal structures in terms of truth conditions and informative content. This difference, Ismael argues, makes sense only in the light of the function of the modal content of scientific models. Models are tools that guide processes of decision and prediction. This requires knowledge of non-actual, alternative courses of events, actions, and their effects. Ismael promotes an 'empiricist realism about modality' (p. 122), which avoids both reduction and reification of modality: modal structures fulfil a function, for which they need to represent the world, but they do not involve ontological commitments that contradict basic empiricist beliefs.

Taking a different angle, Kyle Stanford (Chapter 6) critically discusses three science-friendly responses to the so-called comeback of metaphysics in twentieth-century analytic philosophy. First, scientific (or scientistic) metaphysicians (like James Ladyman and Don Ross) aim to utilize scientific results for answering philosophical questions. Second, proponents of complementary metaphysics (like Laurie Paul) believe that there is no methodological difference between metaphysics and science, but that metaphysics is concerned with features of the world that are somehow metaphysically prior. Finally, philosophers engaged in the metaphysics of science apply metaphysical tools to science to better understand the commitments and presuppositions of our best scientific theories. (Note that Stanford's understanding of the term 'metaphysics of science' differs from other, more familiar contemporary uses.) Stanford argues that scientistic and complementary metaphysics are misguided, and that metaphysics of science, although legitimate as a descriptive endeavour, is unlikely to significantly advance our knowledge, as it adds little to our scientific theories.

In his 'Apology for Naturalized Metaphysics' (Chapter 7), James Ladyman presents and defends the central ideas from his widely quoted *Every Thing Must Go* ([2007]; co-authored with Don Ross and others). Ladyman goes over a number of objections to his criticism of metaphysics and reiterates his points: appeal to common sense and intuition are central to metaphysical methodology; this methodology is therefore decoupled from science; and non-naturalized metaphysics hence contributes nothing to knowledge. He then partly explains, partly sketches the central positive theses of his book, including the principle of naturalistic closure, rainforest realism, ontic structural realism, and the role of real patterns. Finally, in an attempt to illustrate the superiority of naturalized over traditional analytic metaphysics, Ladyman argues that the latter's view of composition contradicts what our best science has to say about the issue—for example, that composition is based on the interactions of parts and on causal processes through time (that is, that composition is dynamical and diachronic).

Making a less ambitious point, Juha Saatsi (Chapter 8) aims to discredit two popular (naturalist) strategies for justifying explanationism in metaphysics by claiming continuity with science. First, explanationists believe that both in metaphysics and in science we arrive at our theories by means of inferences to the best explanation (for

example, to the existence of unobservable entities or abstracta, respectively). They reason that if we are justified in proceeding thus in science, the same is true of metaphysics. Second, explanationists may claim that all assumptions, including the metaphysical, that indispensably contribute to the success of a scientific theory partake of whatever confirmation that success conveys to the theory. Saatsi argues that both strategies are flawed: The history of science illustrates that successful theories (and their ontological assumptions) need not be literally true. It also shows that explanatory virtues play a subordinate role to experimental evidence in science. Whereas explanatory inferences may lead to progress in science, scientific and metaphysical explanations are too dissimilar to justify the application of explanatory inferences in metaphysics.

James Woodward's dialogue (Chapter 9) simulates a conversation between himself and Prof. Metafisico, a caricature of an obstinate metaphysician who criticizes Woodward's interventionist account of causation for not properly metaphysically grounding causation. The conversation quickly turns to questions regarding the supposedly foundational role of metaphysics, the nature and relevance of grounding relations and truth-makers, and the usefulness of the best systems account of the laws of nature. Woodward's character argues that there are legitimate methodological and epistemological concerns (such as identifying causal relationships) that can be addressed without engaging in fundamental metaphysics, that Metafisico's notion of grounding remains unclear, and that reductive accounts like the best systems approach misrepresent scientific practice (as being centred on trade-offs of transempirical virtues). Woodward thus makes object-level philosophical points, but the chapter is also intended to be read as a comment on the bad habits of (some) metaphysicians, such as ascribing relevance to questions on grounds of personal preferences, referring to science only when it serves their own goals, and flatly preferring abstract over methodological concerns.

Martin Thomson-Jones (Chapter 10) argues that philosophers of science discussing aspects of scientific practice such as modelling, confirmation, and explanation and who employ such notions as 'model', 'mathematical structure', and 'fictional object' cannot forgo certain metaphysical questions. Nonetheless, some philosophers of science attempt to do just that. Legitimizing their 'bracketing strategy' (p. 229), they claim that it is possible to talk as if there were *X*s without having to commit to whether *X*s exist, or to any particular account of what *X*s are like. Thomson-Jones objects that as philosophers (of science), we strive for truth and understanding. Not knowing whether fictional objects exist, we cannot understand statements like 'Scientists model real pendula by considering fictional objects like the simple pendulum', and we cannot know how they are true. Furthermore, different accounts of the nature of fictional objects yield different understandings of modelling. (For example, if we conceive of models as objects at non-actual worlds, we can simply compare their properties to the properties of real-world objects.) Thomson-Jones concludes that questions about the existence and nature of *X*s cannot be bracketed. His paper concludes the volume.

Quite obviously, the individual contributions differ substantially in topic, complexity, and length. For example, Woodward's piece, although long, is a fun read, whereas parts of Ladyman's article will not offer much insight to anybody not already familiar with his work. Woodward's and Thomson-Jones's arguments run in opposite directions (to the effect that certain metaphysical questions can or cannot be bracketed). Stanford's diagnosis of trends in naturalized metaphysics is somewhat cursory, whereas Saatsi's arguments against explanationism are well argued but of limited impact (as he cautiously notes). And Slater nicely illustrates a meta-philosophical point, whereas Waters and Ismael both propose complex metaphysical theses that require further argument.

Despite succeeding in presenting 'a variety of perspectives' (p. 3), I find the collection oddly composed. *Metaphysics and the Philosophy of Science* sets out with a historical piece of Newton exegesis (only loosely connected to the current debate) and then oscillates strongly between more object-level metaphysical accounts and meta-level methodological approaches (for example, Strevens's and Saatsi's contributions, respectively).

As is to be expected from 'philosophers of science who have reflected on the relation between metaphysics and science by coming from the "science end"' (p. 3), the majority of authors are more or less strongly naturalistically minded. This is characteristic of the entire debate and former publications on the subject matter. In this respect, the book is a reiteration of the *status quo* rather than a leap forward.

Although I found some contributions more interesting than others, I believe that each will find its own attentive audience, and that *Metaphysics and the Philosophy of Science* is another milestone in the debate surrounding naturalized metaphysics. However, because the chapters differ to the extent they do, it is unlikely to be a book read from start to finish.

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References

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