Metaphysics as modelling: a reply to L. A. Paul
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In her paper "Metaphysics as modelling: the handmaiden's tale", L. A. Paul (2012) seeks to defend contemporary metaphysics against the charge that "exploring and understanding the world through metaphysical reflection is obsolete". I argue that her defense fails, but that the reasons why enable us to make progress in providing an epistemological justification for metaphysical enquiry.

Paul's defense of contemporary metaphysics comes in two steps. First, she seeks to establish a domain of metaphysical enquiry distinct from that of scientific enquiry. Second, with that in place, she seeks to show that the methods of metaphysics are similar to those of science in just those ways that would make it appropriate for a scientific realist to also be a metaphysical realist. This second step involves three distinct claims, such that her overall defense involves the following four theses:

1. The domain of metaphysical enquiry does not coincide with that of science.
2. The semantic view of theories offers a characterization of metaphysical and scientific theories appropriate for the scientific realist and metaphysical realist alike.
3. The evaluation of metaphysical and scientific theories is similar in epistemically relevant ways (through the role of epistemic virtues).
4. Ordinary experience provides a defeasible yet broadly reliable guide to the metaphysics of the actual world.

I argue against each of these in turn. Nevertheless, I take myself to have a shared agenda with Paul, in maintaining that there are legitimate and distinctively metaphysical questions and areas of inquiry. Where we differ is in our understanding of the relationship between metaphysical and scientific theorizing, and in the methodologies that we advocate. In this paper I attempt to identify and explicate those differences, as a contribution towards deepening our understanding of how we might best pursue our metaphysical enquiries.

1. The domain of metaphysical enquiry does not coincide with that of science.

Paul's first thesis is that "the questions and problems addressed by metaphysicians are often distinct from those addressed by scientists" (p. 4). There is a weak reading of this claim on which it seems to me unobjectionable. I agree with Paul that there is no reason to suppose that all the legitimate questions that one may ask about the natural world are exhausted by those that scientists ask, and especially no reason to suppose that they are exhausted by the questions scientists *currently* ask (let alone those that they are also able to address by their current methods).

However, Paul intends a much stronger reading of her first thesis than this. She is making the claim that scientific theories and the scientists who develop and use them presuppose metaphysical concepts in a manner that is naïve and uncritical, these concepts lying *outside* the domain of science and *within* the domain of metaphysics. According to Paul, these metaphysical concepts relate to the distinctive subject-matter of metaphysics, and she claims both ontological and conceptual priority for this subject-matter. It is this stronger thesis with which I wish to take issue.

The first question we might ask is what distinguishes this metaphysical subject-matter from the subject-matter of science. As Paul herself makes clear, there is no clear boundary between the domains of metaphysics and science, and the boundary itself moves as our sciences develop. I would add, moreover, that "scientist" is not a timeless natural kind, and that the methods of the sciences evolve over time. So, she and I agree that a crisp demarcation criterion between metaphysics and science that picks out a timeless domain for metaphysics is not what we are looking for. What, then, constitutes or demarcates the domain of metaphysics?

Paul suggests (p. 4) that paradigmatically metaphysical projects include "systematic, general truths concerning fundamental facts" about natures (the most basic ontological categories), types of composition, and primitive distinctions. For example, a metaphysical project concerning composition would try to "determine whether and how less fundamental constituents of the world are built from their metaphysically prior constituents". She then describes how she understands the relationship of this project to

the sciences, claiming that "the different approaches are not in tension, for the ontological account involves features of the world that are metaphysically prior to those of the scientific account". When it comes to composition, for example, she claims that while physics and chemistry may provide a causal story about how the parts cohere to form a composite physical object, it is metaphysics that provides the account of unity by which the composition of the parts results (or fails to result) in a genuine whole. It is in this sense that the subject-matter of metaphysics is, according to Paul, ontologically prior to the subject-matter of science (p. 6): "[m]etaphysics tries to tell us what laws, naturalness, properties, objects, persistence, and causal relations fundamentally *are*, in terms of natures, and science tries to discover *which* entities there are or how these natures are exemplified." Elaborating on this claim of ontological priority, Paul says (p. 6): "The fact that the subject matter of metaphysics can be ontologically prior to the subject matter of science is reflected in the fact that many concepts of metaphysics are conceptually prior to the concepts of science" and goes on to claim that "scientific theorizing usually uncritically assumes the very organizing principles and deep general truths that metaphysics is concerned to prescriptively develop and understand." Thus, we have both the ontological and conceptual priority of metaphysics over science, and it is in this sense that, according to Paul, the domain of metaphysical enquiry does not coincide with that of science.

I think this account of the relationship between metaphysical theorizing and scientific theorizing is misleading. Take, for example, causation. I agree with Paul that we have pre-scientific notions of causation that we may make use of in developing a given scientific theory. However, her conceptual priority claim requires that the pre-scientific notions of causation that we use in this way have an epistemic status that is importantly independent of the development of that scientific theory. I agree with Ismael (2013, pp. 231-233) that this is a mistake: if a pre-scientific notion of causation is central to the theorizing in question, then the very development of that scientific theory itself involves a critique and development of that concept, so that there is no *independent* concept of causation to be studied by metaphysicians in isolation from the *details* of scientific theories. On this view, while scientists themselves may not explicitly engage in metaphysical discussions

concerning causation, any philosopher who wishes to do so must pay attention to the details of the relevant scientific theorizing.

In order to further develop this discussion, we need to make two distinctions, one between synchronic theories versus diachronic theorizing, and a second between the questions scientists ask versus the questions philosophers may address using science. A scientific theory, taken off the shelf and studied as a timeless object, may indeed presuppose concepts that the theory itself fails to properly explicate. This may seem to support Paul's position. However, when theories are viewed diachronically, such that the process of theorizing is the subject of our philosophical scrutiny, we are then able to see which of those concepts are themselves being subjected to investigation through the process of scientific theorizing. A classic example here is in our theorizing about space and time. In his book *Understanding Space-Time*, DiSalle (2006) provides an extended treatment of the development of our concepts of space and time under the pressures and demands of physical theorizing about the motions of bodies, arguing that "[d]espite the delusions of philosophers and scientists of having purely epistemological or metaphysical insights into the nature of space-time, philosophy is not an independent source of knowledge of space-time" (p. 157). Rather, he argues, the developments in physical theorizing are part of an ongoing critique of concepts that, though having their origins in everyday experience, have been refined, revised and elaborated as physics has developed. In sum, the process of physical theorizing is an engagement with *those very concepts* with which the metaphysician is concerned, and moreover there is no alternative source of spatiotemporal concepts to which she can appeal. In order to respond to this line of argument, the metaphysician would need to show otherwise. To do so would require engagement with the details of scientific theorizing, in order to show that what the metaphysicians claim has been left out, has indeed been left out. Merely pointing to a scientific theory (rather than to the process of theorizing by which that theory came about) and saying that it does not include some aspect of our pre-theoretic concept does not suffice, since that aspect may have been subject to revision in the process of theorizing that led to that theory.

The second distinction mentioned above is between the questions scientists ask versus the questions philosophers may address using science, and my point is simply this: just because scientists themselves may not ask questions about the metaphysics of properties, objects, persistence, and causation, it does not follow that their theorizing does not probe these concepts. Indeed, where these concepts are relied upon in scientific theorizing, there is every chance that they will be subject to development and revision in the process of that theorizing, and it behooves philosophers engaged in metaphysical questions to pay attention to the details of that theorizing.

Paul argues for a type of metaphysical work that need not pay attention to the details of scientific theorizing in this way. Recall the quotation given above, in which Paul says that "scientific theorizing usually uncritically assumes the very organizing principles and deep general truths that metaphysics is concerned to prescriptively develop and understand." The word "prescriptive" here is important for understanding her view: metaphysicians will tell us how to think about the concepts that are "uncritically assumed" (p. 6) in scientific theorizing. Scientific theories, she says (pp. 6-7), are not to "preemptively define the role or concepts of metaphysics". Rather, the relationship between the work of the metaphysician and scientific theories is simply that the metaphysicians' accounts of "their" concepts should be in some weak sense "consistent with accepted scientific theories of the world" (p. 6). In my opinion, this fails to do justice to the conceptual work that is done in the process of scientific theorizing, and fails to hold the metaphysician appropriately accountable to the details of that theorizing. Where the a priori metaphysician described by Paul assumes that there *is* a concept (or family of concepts) of causation to be explicated, the empiricist metaphysician accepts that there may be no such concept applicable to the actual world, and that our empirical theorizing within the actual world is an ineliminable resource in determining what, if any, concept or concepts of causation are available and appropriate for those wishing to say something about the actual world in which we find ourselves. Similarly, where Paul's a priori metaphysician assumes that we can develop a general account of parts and wholes applicable to our actual world independent of any particular physical theory, the empiricist metaphysician makes no such assumption, and seeks to

mobilize our best empirical theories as tools for investigating metaphysical questions of mereology.[1]

As should be clear by now, I find Paul's account of the relationship between metaphysics and science problematic *not* because I think that scientists ask and answer all the legitimate questions there are about the natural world, but because Paul's account fails to avail the metaphysician of epistemic resources crucial to her own projects and questions. This is a difference of opinion about the appropriate way to understand the relationship between metaphysical and scientific theorizing, and it is one which has implications for the appropriate methodologies for pursuing our metaphysical questions. By framing the debate not as one of metaphysics versus science, but of the appropriate relationship between metaphysical and scientific theorizing, we can make progress on methodology with respect to questions of metaphysics. Thus, I share Paul's rejection of the view that "exploring and understanding the world through metaphysical reflection is obsolete", but I disagree with her about how best to proceed with our metaphysical reflections.

2. The semantic view of theories offers a characterization of metaphysical and scientific theories appropriate for the scientific realist and metaphysical realist alike.

Paul suggests that we think about metaphysical theorizing as a process of modelling analogous in important ways to modelling in science. Here, we are restricting our attention to a type of metaphysics that seeks to make true claims about the actual world in which we find ourselves, and I think Paul's proposal is interesting for metaphysicians and philosophers of science alike. For example, her proposal includes discussions of thought experiments and of the importance of modelling for the investigation of counterfactual

[1] Quantum mechahnical non-separability is the most famous example of science challenging our "intuitions" about parts and wholes, but we need not turn to quantum theory to see mereological work being done within scientific theorizing. For problems of part and whole in Newtonian physics, see Brading (2011, 2013).

dependencies, about both of which there is a large literature in philosophy of science. The extent to which metaphysical modelling can be thought of as similar to scientific modelling will depend on the details of issues in that literature. I agree with Paul that attempting to make concrete a methodology or methodologies for metaphysics is an extremely healthy move, not least because it enables us to get more precise about the strengths and weaknesses of metaphysics as an approach to obtaining knowledge about the actual world. In what follows, I outline some problems for a methodology for metaphysics that appeals to modelling and to the semantic view of theories.

For Paul, "the most important differences between the scientific method and the metaphysical method derive merely from the difference in subject matter and the resultant difference in the role they give to ordinary experience." I will argue that this "merely" makes all the difference in the world. The central claim Paul makes is this (p. 10): "The theory is true just in case it has a model that is isomorphic to the relevant features of the world, including (but not limited to) the structures that can be described in experimental and measurement reports."[2] For the metaphysician to be justified in her claim that she has anything to say about the metaphysics of the actual world, she must be able to justify her claims of isomorphism between her models and the world. Whether she can do so in a manner analogous to the scientific realist will be the subject of this and the following sections.

For the scientific realist, the empirical success of science plays an important role in justifying the claim of isomorphism between theory and world, via some form of "no miracles" argument: if our models were not (at least approximately) isomorphic to the structures in the world then the success of science would be a miracle.[3] And by success of science here we mean *detailed empirical success* including successful novel predictions and so forth. The semantic view of theories offers no royal road to realism because it leaves open the question of the relationship between the models of the theory and the world.

[2] Within philosophy of science, there is abundant literature on the semantic view of theories, both in its original formulation and subsequent developments, and on its problems (see Winther, 2016, and references therein). However, for our purposes I set these to one side and pursue the spirit of Paul's appeal to the semantic view.
[3] Brading and Landry, 2006, section 4.

Some version of "no miracles", involving feedback between theory and empirical evidence, is central to the move from instrumentalism to a scientific realist position, and if the metaphysical realist is to adopt the methods of the scientific realist then she will need an analogous argument in order to justify her claim of isomorphism between her models and the world. Contrary to Paul, it is not merely the different subject-matter and the resulting role of ordinary experience that differentiates the methods of the scientific realist from those of the metaphysical realist, but the role of detailed empirical evidence in justifying the theory-world connection. So the metaphysician who claims a methodology analogous to that of a scientific realist must offer an alternative justification where success does not mean detailed empirical success. In her paper, Paul offers no such alternative justification, and this presents a direct challenge to her attempt to minimize the differences between the methods of the metaphysician and those of the scientific realist.

3. The evaluation of metaphysical and scientific theories is similar in epistemically relevant ways (through the role of epistemic virtues).

Paul claims (p. 19) that both metaphysical and scientific theorizing rely "on a priori reasoning based on the evaluation of theoretical virtues such as simplicity, strength, elegance and the like", and "in both sorts of theorizing, one thing that can justify the use of a priori reasoning is that they employ inference to the best explanation based on the idea that theories that maximize simplicity, strength, elegance, and other theoretical virtues are more likely to be true." She concludes: "The a priori elements of the method used by metaphysicians are often just part of the standard arsenal of tools employed by any theorist of the unobservable, the indirectly confirmable, and the abstract." Later on, she says (p. 21): "We use theoretical desiderata as guides to truth in metaphysics just as we use such desiderata as guides to truth in science, since the method is fundamentally the same even when the subject matter is different." I believe that this is false.

At any given time, our empirical evidence is typically insufficient to uniquely constrain scientific theorizing and theory choice. We therefore make use of additional virtues, and Paul's suggestion is that, in metaphysical theorizing, since empirical evidence will have

little if any relevance, it is these virtues on which we must rely to make theory selection: inference to the best explanation, she suggests, is here used to infer the best theory on the basis of virtues other than empirical adequacy, in just the same way as in science. It is worth pausing to understand the steps in this argument. First, we note that in scientific theorizing we make use of theoretical virtues. Second, we claim that these theoretical virtues are truth-conducive in scientific theorizing. Third, we claim that since they are truth-conducive for scientific theorizing, similarly they are truth-conducive for metaphysical theorizing. The problems for the argument arise in the second claim. The second claim is ambiguous between two distinct claims: first, that at least in some particular circumstances, certain theoretical virtues may be taken to be truth-conducive in scientific theorizing, albeit fallibly; second, that certain theoretical virtues are truth-conducive and this truth-conduciveness is context-independent. The latter, stronger, claim is not something that the scientific realist needs, but it is necessary for establishing Paul's third claim, that since theoretical virtues are truth-conducive for scientific theorizing, similarly they are truth-conducive for metaphysical theorizing. Paul puts this stronger claim herself in the following way (p. 21):

> "The theoretical desiderata we use to choose a theory include simplicity, explanatory power, fertility, elegance, etc., and are guides to overall explanatory power and support inference to the truth of theory. A scientific realist should take such desiderata to be truth-conducive, since it is hard to see how such desiderata can lead us to truth if they are merely or even mainly pragmatic virtues. If such theoretical desiderata are truth conducive in science, they are also truth conducive in metaphysics (and in mathematics, and in other areas). The main point I want to make here is that if the method can lead us to closer to the truth in science, it can lead us closer to the truth in metaphysics."

And she is even more explicit later on (p. 22):

> "if such features are truth conducive in the case of science, they should be truth conducive more generally. That is, if simplicity and other theoretical desiderata are truth conducive in scientific theorizing, they are truth conducive in metaphysical theorizing. This is a central part of my thesis: if we accept inference to the best

explanation in ordinary reasoning and in scientific theorizing, we should accept it in metaphysical theorizing."

I think Paul is right that her conclusion goes through if and only if the scientific realist in fact justifies her use of theoretical virtues by claiming that they are inherently (i.e. independently of context) truth-conducive such that a given theory is the best theory – the most likely to be true, the closest fit to the truth – *because* it best satisfies truth-conducive virtues. However, I also believe that this is not how the scientific realist argues, or is justified in arguing.

I agree that scientific theorizing requires appeal to theoretical virtues, and that the scientific realist may appeal to such virtues in justifying her claims about the likely truth (or approximate truth, or whatever) of a given theory in order to address underdetermination challenges to scientific realism. However, I do not believe that there are theoretical virtues that have been shown to be context-independently truth-conducive. Once again, this becomes visible if we turn our attention away from scientific theories considered sychronically to consider instead the diachronic process of scientific theorizing. Here, we see a history of learning when, and how, and in which contexts, different theoretical virtues are helpful in developing empirically successful (including empirically predictively novel) theories. Consider, for example, that classic case of empirical underdetermination, geocentric astronomy versus heliocentric astronomy in the sixteenth and seventeenth centuries. In the process of resolving this problem of underdetermination, multiple theoretical virtues were invoked by Kepler (for example) in his attempts to argue for heliocentrism as the real structure of our planetary system. These included harmony, simplicity, explanatory power, and so forth. However, it was only through the process of two hundred years of theorizing, including the interplay between theory and empirical evidence, that we learned which of these virtues were more helpful than others for the particular problem of solving the system of the world. Harmony and simplicity turned out to be misleading and equivocal (respectively), and explanatory power turned out to be highly effective if and only if it was tied to particular causal commitments (every acceleration of a body must have a material source) and freed from others (vortex theory). We learned about which virtues are effective in gravitational theory, and these proved

themselves within that context in the ensuing centuries. However, during that time we also learned that they are not context-independent; where the phenomena seem to demand non-linear theories, for example, a different set of virtues is needed.

The onus is on Paul, I believe, to show that the scientific realist not only requires, but also successfully deploys, a context-independent set of truth-conducive theoretical virtues, such that the metaphysician can help herself to these same virtues with a reasonable presumption that they will remain truth-conducive for her, too. No such case has yet been made.[4] In sum, Paul may be right that metaphysical theorizing involves maximizing theoretical virtues, but she has not provided any grounds for believing that such a method is truth-conducive.

4. Ordinary experience provides a defeasible yet broadly reliable guide to the metaphysics of the actual world.

Paul argues that it is appropriate for the metaphysician to "privilege ordinary experience in the sense of relying on it as an initial, but *defeasible*, guide to the nature of the world. Such a metaphysician starts with the defeasible assumption that the relevant feature of the world is as it seems to us, given ordinary experience." (p. 16) Thusfar, few scientists would disagree, so the metaphysician and the scientist share a common starting point. The difference, Paul claims, is that the metaphysician seeks to explore general truths or features of the world that "hold across all levels of experience, from the macroscopic level to the microscopic level", and therefore hold for macroscopic objects and events. But these

[4] The claims are made, but the argument is not given that this is how, in fact, the scientific realist can and must argue. Here is another example of the claim being made (p. 25): "To the extent that one can endorse the realist view that scientific theories are true (and that we can infer truth from successful explanation), one endorses the thesis that maximizing theoretical desiderata brings one closer to the truth. To the extent that the naturalist endorses the thesis that maximizing theoretical desiderata brings one closer to the truth, the naturalist can endorse the view that doing metaphysics, and philosophy more generally, is a rational and reasonable way to try to discover fundamental and general truths about the world."

general features, which seem to hold at the macroscopic level, are also present in the scientists' starting point, and scientists have found empirically powerful methods for discovering just where and when that defeasible guide is misleading. There is no independent domain of "general features" of our empirical experience that is somehow invisible to scientists and not found within the empirical evidence on which they draw. Contrary to Paul, the metaphysician is *not* perfectly justified in focusing on ordinary objects and properties of experience: she must first enquire whether those features of our experience have already proven themselves to be misleading, and for this she must acquaint herself with the relevant details of the relevant scientific theories. I argued above that the process of scientific theorizing has itself often been a process of enquiring into the very concepts that the metaphysician takes herself to be concerned with (such as properties, causation, composition, and so forth), and if this is right then the claim that ordinary experience is just as informative for the metaphysician in such cases is mistaken. To repeat a point made earlier: scientific theories, taken synchronically, do not wear their metaphysical investigations on their sleeves, but taken diachronically, the conceptual investigation that such theorizing involves can be uncovered and made visible by the philosopher, and the metaphysical import of such work developed and made plain.

Paul claims that "many interesting and important metaphysical theories are concerned with the actual world and its near relatives", but it is unclear what justifies the claim that these theories are indeed about the actual world. If they fail to engage with scientific theorizing in the way I have described above then, on the contrary, we have good reason to suspect that they may not concern the actual world, or even any of its near relatives, at all. This is because, as noted above (section 3), the scientific realists' "no miracles" argument is unavailable to the metaphysician when she attempts to justify a relationship (such as isomorphism) between her models and the actual world; ordinary experience can be profoundly misleading about the actual world, and is not to be relied upon as a guide; and superficial consistency with some scientific theory is unreliable as a means of engaging with the metaphysical critique that is involved in the scientific theorizing of which that theory is a part, and therefore unreliable as a route to the actual world. For example, when Paul says (p. 24) that "we perceive certain basic properties such as cohesiveness and

continuity, and we may use that information to construct a theory of how objects persist", we must recognize that (a) this theory applies to the actual world *if and only if* cohesiveness and continuity are basic properties of the actual world, and (b) ordinary experience has *already proven* itself to be an unreliable guide with respect to both.[5] Thus, a theory of how objects persist that is built on these "basic properties" is unlikely to turn out to apply to the actual world, or to any world close to our own.

Turning her attention to the example of space, Paul writes (p. 27) that "metaphysicians to this day respect the fact that facts about spacetime and motion, among other things, have been shown to be empirically determinable." This may be true, but it is insufficient. The philosophical significance for space and time of Newton's physics does not lie in the *fact* that absolute accelerations are (allegedly) empirically determinable in Newtonian theory whereas absolute velocities are not; nor of Einstein's special theory of relativity in the *fact* that we have no empirical way to determine whether spatially separated events are simultaneous; nor of Einstein's general theory of relativity in the *fact* that what is empirically determinable turns out to be the inertiogravitational structure of spacetime and not the inertial structure by itself. These "facts" could be incorporated into metaphysical theorizing about space and time in such a way that maintains consistency with these "facts", but which utterly fails to take on board the associated critique of the very concepts of space and time with which the metaphysician is concerned. To take the philosophical significance for time of Newton's physics as an example, Newton inherited a range of philosophical options, positions and distinctions concerning the nature and structure of time which, through the process of developing his project to solve the system of the world (in the *Principia*) he was forced to refine and revise (see Brading, 2016). Developments of this project, in turn, led to further conceptual clarifications and revisions, including those in Einstein's special and general theories of relativity (see DiSalle, 2006). If we are to understand how the upshot of this process connects to our shared starting point

[5] Continuity, for example, was a powerful and successful principle of physical theorizing from the 18th century into the early 20th century, before empirical evidence forced a reconsideration.

– to our pre-theoretical concepts of time – then we must understand the conceptual transformations hard-won through the scientific theorizing itself.

5. Conclusions

Paul argues for a degree of autonomy of metaphysics from science that seems to me epistemically unjustifiable. I have argued against her assertion of the ontological and conceptual priority of metaphysics, and against her view that there is a methodology for studing the metaphysics of this, the actual world, that need not pay attention to the details of scientific theorizing. It is important to stress that I am *not* claiming that all our legitimate metaphysical questions are already in deep ways engaged with by the details of scientific theorizing, or that there is nothing for the metaphysician to do that does not involve detailed knowledge of various areas of science. I agree with Paul that developing toy models, and playing around with "possibilities" that currently lie outside our empirical reach, can be a worthwhile activity for theoretical scientists and philosophers alike. However, the areas of overlap between the interests of the metaphysicians and the activities of the scientists are far greater than her position allows. This is easier to see once we set aside the dichotomy between the a priori metaphysician and the a posteriori scientist, as Paul urges us to do. Lying in between is the empiricist metaphysician, who takes empirical details and the detailed, local, processes of scientific theorizing to be epistemically relevant to our shared metaphysical questions. We do not need to suppose that the scientists are those who ask all the legitimate questions about the natural world in order to believe that the details of science are important for philosophy. Once we pay attention to the the processes of scientific theorizing, we see that the theorizing carried out by scientists engages in detail with a wider range of questions than the ones that they themselves happen to ask. These questions include many that belong to us, the metaphysicians.

The danger associated with the methodology for metaphysics advocated by Paul is that it will fail in its central aim: it will fail to say anything about the actual world. The appeal to the semantic view of theories and to theoretical virtues cannot bridge the gap between

theory and world. The empiricist metaphysics methodology that I advocate, and of which I have given some brief indications in this paper, seeks to significantly reduce that danger and thereby to offer far greater epistemological justification for our metaphysical theorizing than that which is to be had by mere metaphysics as modelling.

As I said at the outset, I take myself to have a shared agenda with Paul, in maintaining that there are legitimate and distinctively metaphysical questions and areas of inquiry. My goal here has been to try to identify precisely where and why we diverge, in the hope that this will further our conversation about methodologies for pursuing the metaphysical questions that we share.

Brading, K. 2011. 'On composite systems: Descartes, Newton, and the law-constitutive approach', in *Vanishing Matter and the Laws of Nature: Descartes and Beyond*, ed. Dana Jalobeanu and Peter Anstey, *Studies in Seventeenth-Century Philosophy*, Routledge, pp. 130-152.

-- 2013. 'Three principles of unity in Newton', *Studies in History and Philosophy of Science* 44, pp. 408-415.

-- 2016. 'Time for empiricist metaphysics'. Forthcoming in *Metaphysics and the Philosophy of Science*, ed. M. Slater and Z. Yudell. Oxford University Press.

Brading, K. and Landry, E. 2006. 'Scientific Structuralism: Presentation and Representation', with E. Landry, *Philosophy of Science* 73, pp. 571-81.

DiSalle, R. 2006. *Understanding Space-Time*, Cambridge University Press.

Ismael, J., 2013. 'Causation, Free Will, and Naturalism', in *Scientific Metaphysics*, ed. D. Ross, J. Ladyman, H. Kincaid. Oxford University Press.

Paul, L. A. 2012. 'Metaphysics as modelling: the handmaiden's tale'. *Philosophical Studies* 160: 1-29.

Winther, Rasmus Grønfeldt, 2016. "The Structure of Scientific Theories", *The Stanford Encyclopedia of Philosophy* (Spring 2016 Edition), Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/spr2016/entries/structure-scientific-theories/>.