Scientific Metaphysics

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2

On the Prospects of Naturalized Metaphysics

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> Ontology and metaphysics, at least in some of their forms, constitute boundary areas into which more strictly scientific analysis gradually shades off, so that there is no sharp line of demarcation between the myths of ontology and the hypothetical entities of empirical science or of mathematics.
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> Letter from C. G. Hempel to F. Sontag, 14 November 1956, Princeton (Hempel goes on to say that he prefers scientific analysis nonetheless.)

1. A slippery slope

There is a sense, now historically dated, in which believing in many of the unobservable entities and processes described by our best contemporary scientific theories, or the literal (even if only approximate) truth of scientific descriptions of such unobservables, is considered a metaphysical commitment. This is the sense of 'metaphysics' prevalent, for example, in some logical empiricist analyses of scientific knowledge, where claiming literal knowledge of any sort of unobservable is tantamount to metaphysics.

It is fair to say that today, however, epistemic commitments to many canonical scientific unobservables are not generally considered metaphysical per se. There may be good reason, as many scientific antirealists contend, to think that our epistemic powers are not so great as to warrant these commitments, but that is a reflection on epistemology, not the metaphysical nature of the commitments involved. The sorts of beliefs that scientific realists often present as warranted—in unobservable entities

such as positrons and genes, and unobservable processes such as β^+ decay and transcription—are no longer generally viewed as metaphysical in the way that beliefs in properties as tropes or *de re* causal necessity are viewed as metaphysical.

This said, many contemporary philosophers of science and, prominently among them, many scientific realists *do* advocate beliefs concerning things that philosophers today would *still* regard as metaphysical, including beliefs about properties, causation, laws of nature, *de re* modality, and so on. Indeed, philosophical defences of the reasonableness of believing in the sorts of scientific entities and processes that are *not* generally considered metaphysical today, such as genes and gene transcription, often make recourse to views about things that *are* regarded as falling under the purview of metaphysics, such as causation, modality, and so on. Here we have the beginnings of an apparently slippery slope. For if one's account of the reasonableness of believing in gene transcription depends on the reasonableness of one's understanding of the causal relations in virtue of which one is justified in knowing about genes and processes involving them in the first place, it is difficult to see how one could be entitled to the former without the latter. The realist edifice has supports, it seems, in certain metaphysical underpinnings, and the very attempt to establish the integrity of the supports casts one down a slippery slope into deeper and deeper metaphysical theorizing.

I have used scientific realism as an illustration of how slipperiness may come to bear, but it is important to note that in this regard, realism is hardly unique. Arguably, any epistemological position that takes us to have knowledge of the external world—whether of strictly speaking unobservable entities and processes, or of (only) medium-size observable goods, as some antirealist epistemologies would prefer—will face the same challenge. The causal and/or other relations in virtue of which observable things are known by humans themselves act as supports for the reasonableness of our knowledge of the observable, and to furnish a defensible account of these supports is to do what everyone would agree is metaphysics. Here too, the slippery slope seems unavoidable.

Where does it end? It is not my present intention to consider how regresses of philosophical explanation and justification can or must stop. My point here is simply to note that in justifying many beliefs commonly taken for granted, not least in the context of the sciences, the slippery slope presents itself almost immediately. One might well hold, for example, that in order to feel secure in the idea that realism is a coherent epistemic attitude to take towards the sciences, one should have a defensible account of the processes in virtue of which information is 'transmitted' from the relevant objects of inquiry and scientific instruments, via the array of intermediaries (models, simulations, etc.) we typically employ, to human consciousness. And then, having produced a serviceable account of these processes, one might reasonably wonder whether there is any sense to be made of the notions of property, entity, and so on, that are putatively engaged in them, given the highly variegated natures of things apparently revealed by scientific inquiry. If scientific entities are (*ex hypothesi*) simply collections of properties cohering at locations in space-time, for instance, might it not be reasonable to wonder whether there is a cogent picture of such coherence to be had?

The slippery slope is real, but one may hope nevertheless to keep from falling down. Many philosophers of sciences prefer not to engage in forms of metaphysical theorizing that are very far removed from the ontological theorizing most closely related to scientific inquiry, and this preference comes by way of at least two different motivations. One motivation is pragmatic and reflective of mere differences of philosophical interest: there is, after all, a division of labour in philosophy, and individual philosophers typically focus on the issues that most interest them while others toil elsewhere. The second motivation, however, is at once more principled and less ecumenical, and it is this motivation that interests me here. One might reject any philosophical engagement with the metaphysical underpinnings of various scientific beliefs, because one feels that theorizing this far down the slope is simply too far removed from the details of scientific investigation to be of interest to any interpretation of what scientific theories may say about the world. Or one could go further and suggest that deep metaphysics is too far removed from the details of scientific investigation to yield anything worth having at all. This would be to suggest that engaging in metaphysical pursuits too far down the slope is epistemically impotent, and thus a misguided philosophical pursuit.

Recent philosophy of science has presented both a willingness to grapple with the metaphysical underpinnings of our best current science, as well as a tendency to reject analytic metaphysics as it is commonly pursued in other domains of philosophy. Indeed, some philosophers of science do both,[1] and this suggests at least one strategy for halting the slide

[1] For two recent examples, see Ladyman and Ross (2007), and Maudlin (2007).

down the slippery slope—at least, halting the slide before one proceeds to questions one might think it unprofitable to consider. The idea here is that grappling with the metaphysical underpinnings of our best current science need not amount to metaphysics in the style of analytic metaphysics as it is problematically practiced in other domains. Rather, if done in the right sort of way, metaphysical theorizing might be acceptable in the context of the sciences even if it proves problematic elsewhere. This, in a nutshell, is the proposal and promise of *naturalized metaphysics*.

In the remainder of this chapter, I will examine the thought that if one simply does metaphysics in a naturalized sort of way, one may achieve the twin desiderata of (1) arresting one's slide down the slippery slope in time to avoid philosophizing about matters too far removed from scientific investigation to contribute towards an understanding of the natural world, and thereby (2) avoiding the sorts of metaphysics disparaged by some philosophers of science. I will begin with the assumption that these twin desiderata are, in some form or other, sensible ones to adopt, and argue that the project of naturalized metaphysics has not yet been conceived in such a way as to make these desiderata achievable. As currently described, the very idea of naturalized metaphysics is subject to a debilitating vagueness which renders its advocates unable to articulate convincingly what it is that makes metaphysical theorizing acceptable in some domains and problematic in others.

In section 2, I will explore the idea of naturalized metaphysics in its current form, and consider what it is about some analytic metaphysics that raises the hackles of some philosophers of science. This leads to a worry about the very coherence of naturalized metaphysics, which I consider in section 3. An obvious reply to this worry is presented and revealed to be intuitively compelling but largely empty. In section 4, I begin the process of giving content to this intuitive reply; the content is intended to augment our currently nascent conception of naturalized metaphysics in such a way as to clarify how one might assess different forms of metaphysical inquiry regarding their epistemic potential. To foreshadow my conclusion: it does not appear that this content can provide anything like an 'objective' determination of where one might reasonably stop on the slippery slope, and consequently, there is no 'neutral' advice to be had concerning what sorts of metaphysical theorizing are worth pursuing. The analysis does, however, help us to understand the epistemic risks involved when philosophers engage in different sorts of metaphysical projects. Armed with this knowledge, an appropriately voluntaristic choice awaits any philosopher who ventures into metaphysics, about where to draw the line.

2. Metaphysics naturalized and *simpliciter*, the a priori, and science

To begin, then, what is naturalized metaphysics? One might think that a clue regarding the nature of naturalized metaphysics should be derivable from the work that many philosophers of science do in investigating the metaphysical implications of our best scientific theories—the job of the metaphysician of science. What ontology of objects and processes is described by the mathematical formalism of theories in fundamental physics? Is natural selection a force that acts on some or other biological entity, or is it simply a statistical outcome of causal interactions acting at other levels of description? There are many questions that arise in thinking about how best to interpret scientific theories that call for some sort of metaphysical analysis, regarding ontology, causation, and so forth. Presumably, then, if there is such a thing as naturalized metaphysics, these sorts of investigations should comprise paradigm instances. However, acknowledging the fact that these investigations all stand in some relation to scientific knowledge, it is far from clear that anything helpful can be learned from simply lumping together such a wide diversity of philosophical projects, and the mere fact that some metaphysics concerns scientific knowledge is hardly an elaboration of the idea that some metaphysics is naturalized.

Let us retreat further, then, to something like first principles, and begin with a working definition of 'metaphysics' *simpliciter*. There is in current philosophical discourse something of a cottage industry whose aim is to determine what metaphysics is, precisely—work in so-called 'metametaphysics'—but it will suffice to proceed in simpler terms here. The Aristotelian conception of metaphysics identifies it principally with two things. The first is the study of being qua being, or ontology: considerations of the most general nature of existence and the natures of things that exist. The presumed generality of this kind of investigation contributes what many have traditionally taken to be a common connotation of metaphysics, that it is an inquiry into universal, timeless truths, but while many metaphysicians aspire to fundamentality of these sorts, it now seems an overly strict constraint in view of much contemporary metaphysics. The second focus of Aristotelian

metaphysics is the study of first causes and theology. Though certain aspects of the ancient study of ontology and first causes are somewhat outmoded today, it is fair to say that a focus on ontology and causation more generally has been retained. For present purposes, then, stripping away some perhaps old-fashioned connotations, let us proceed to think of metaphysics in terms of investigations into ontology and causation.

Having understood metaphysics in these general and innocuous terms, it should be clear immediately that there is nothing here to distinguish metaphysics *simpliciter* from metaphysics pursued in the context of the sciences, since clearly the latter is typified by attempts to theorize about the ontology and causal workings of the various systems and phenomena it investigates, no less than metaphysics *simpliciter*. This of course is what one should expect if naturalized metaphysics is to be a *form* of metaphysics (*simpliciter*), offering an important clue, I believe, in aid of the formulation of a plausible conception of naturalized metaphysics. The distinction between putatively acceptable naturalistic metaphysics and putatively excessive metaphysical inquiry does *not* concern *what* these forms of inquiry aim to do, where the relevant aims are conceived in the general and innocuous terms of shedding light on ontological and causal features of the world. Rather, it concerns *how* these forms of philosophical inquiry go about achieving these aims. It is not in terms of general goals but rather in terms of precise methods that the distinction between naturalized metaphysics and some other brands of ostensibly worrying analytic metaphysics must be drawn.

How, then, is the methodological distinction to be drawn? Metaphysics generally, and to some significant extent, proceeds by way of *a priori* stipulation and theorizing, and produces claims that are empirically untestable. It typically begins with the data of accepted facts and observable phenomena, and then attempts to provide an explanatory account of these things in terms of underlying realities. The degree to which such an account is removed from empirical considerations, however, is highly variable, or so one might reasonably contend. It is the idea of a priori stipulation and theorizing with no significant empirical tethering that generates worries about some approaches to metaphysics relative to others. The a priori character of metaphysics is manifested, in part, in the ways in which its arguments typically proceed, by appeal to intuitions and conceptual analysis. But the untethering of metaphysics from empirical considerations is most profound, so the argument in favour of naturalized

metaphysics would go, in domains of metaphysical theorizing external to the metaphysics of science, where the empirical content of scientific theories and models does not function to restrain otherwise profligate theorizing.

Thus, presumably, the methodological distinction between naturalized and non-naturalized metaphysics is to be understood in terms of proximity to the scientific context. Naturalized metaphysics is metaphysics that is inspired by and constrained by the output of our best science. Non-naturalized metaphysics is metaphysics that is not so inspired or constrained. As a consequence, non-naturalized, untethered metaphysics produces results—theories of universals, substances, bundles, necessities, possible worlds, and so on—that are not conceived as being answerable in any way to empirical investigation. In contrast, naturalized metaphysics, in virtue of its scientific starting point and context, is conceived as being susceptible and sensitive to empirical concerns.

There is a conflation in this first-pass characterization of naturalized metaphysics that should be immediately obvious, and which requires careful unpacking. The suggested distinction between naturalized and non-naturalized metaphysics just rehearsed turns on the idea that the former and not the latter is sufficiently connected, in some way, to empirical findings. This is the force of the idea of constraining otherwise a priori theorizing with empirical data. But in the characterization of naturalized metaphysics just given, it is science that plays the role of constrainer, not empirical data as such. The notion of an empirical constraint is thus conflated here with a scientific constraint. Admittedly, there is a certain caricature of the sciences on which this conflation is benign. The sciences are commonly described as a posteriori investigations whose outputs are empirically testable—observations are made to confirm novel predictions; hypotheses are subjected to experimental testing; instruments and techniques are constructed in order to detect, measure, and manipulate putative entities and processes; and so on. Hence, on this picture of science, the conflation of empirical investigation with scientific investigation in a discussion of naturalized metaphysics may seem entirely reasonable.

This picture of the sciences as comprehensively empirical is nevertheless a caricature, however. That this is so is readily apparent in the fact that not all sciences actually make novel predictions (evolutionary biology), or employ experiments (string theory), or are successful in manipulating things (cosmology). The degree to which and the ways in which the

many domains of investigation that come under the heading of 'the sciences' are empirical is highly variable. As a consequence, the distinction here between a priori and a posteriori methodology cannot simply be superimposed unproblematically on metaphysics and the sciences, respectively. This should raise at least some preliminary concern about the very idea of distinguishing naturalized and non-naturalized metaphysics on the basis of their contact (or lack thereof) with the empirical, simply in virtue of their contact (or lack thereof) with the sciences.

The foregoing note about variability in the empirical natures of different sciences is a telling fact in support of (though ultimately inessential to establishing) an interim contention I wish to put forward now. The contention is that it is a mistake to suggest, as does the preceding caricature, that science is a purely empirical enterprise. The fact that some scientific domains are more highly empirical than others, in more or less impressive ways than others, is some evidence for the proposition that empirical considerations are not exhaustive of what we call science, but even if one were to grant for the sake of argument that all of science is highly empirical in some specified manner, it is still doubtful that it would make any sense to think of the sciences as employing *solely* empirical methodologies. Certainly, throughout most of the history of natural philosophy, what we would now anachronistically identify as scientific investigation clearly incorporated both a priori and a posteriori methods of theorizing, as the line between metaphysics and the new sciences could hardly be drawn with any sharpness.[2] Closer to home, many have argued that there is also good reason to believe that even in the case of the modern sciences, the a priori is inextricably bound up with scientific knowledge.

I will not consider in any detail here the numerous ways in which philosophers of science have documented the central role played by a priori principles and reasoning in modern scientific work, and the corresponding inseparability of the a priori from scientific knowledge produced thereby. In opposition to this contention, one might argue that a priori considerations play no role at all in contemporary scientific practice, which would be to suggest a clean break between the present and clearly established examples of a priori supposition infusing scientific knowledge

[2] See Burtt (1952, on Copernicus, Kepler, Galileo, Descartes, Hobbes, Boyle, and Newton), Buchdahl (1969, on Descartes, Locke, Berkeley, Hume, Leibniz, and Kant), and Woolhouse (1988).

in the past: concepts of substance, essence, and form in the work of Copernicus and Kepler; concepts of the soul and matter for Descartes; concepts of absolute space and time for Newton (recall that his rotating bucket thought experiment is indeed an experiment *in thought*); and so on. If there is one thing that all serious epistemologies of science have in common, however, it is the view that the role played by a priori principles and reasoning in the construction of scientific knowledge is hardly a thing of the past.

One reason for suspicion regarding any suggestion that the a priori has been effectively stripped from the context of the modern sciences is the Kuhnian idea that all periods of normal science incorporate metaphysical assumptions into the disciplinary matrices that make up scientific disciplines and stabilize periods of research. As it happens, this is just one famous example from among the many different accounts to have been elaborated in recent philosophy of science of the cognitive preconditions of scientific work, which aim to describe the prior 'frameworks of investigation', 'networks of concepts', and so forth, that function to establish the very categories of objects, evidence, and inference that allow scientific questions to be posed and then investigated. These frameworks include a priori commitments. On this basis, then, one might plausibly maintain that the very possibility of framing and subsequently probing a hypothesis, empirically, requires that scientists presuppose an ontological scheme of possibilities within which the hypothesis can be formulated, before proceeding according to whatever principles of inference, extrapolation from evidence, and so on, are sanctioned within the relevant scientific community.

There is a rich history of thinking about scientific knowledge in precisely this way. From Kant's emphasis on the conceptual basis of knowledge (not merely grand concepts such as causality, but also finer-grained principles such as those concerning the nature of the universal aether), to neo-Kantian views of what some refer to as the constitutive a priori (Friedman, 2001) or the functional a priori (Stump, 2003). Just as in the case of the metaphysical aspects of Kuhn's disciplinary matrices, these constitutive or functional principles make certain kinds of scientific investigation possible, by providing, inter alia, a conceptual vocabulary and associated definitions in terms of which to cognize reality and fashion scientific ontology. Consider, furthermore, conventionalist understandings of the geometry of space-time, other variants of neo-Kantianism such as internal realism (Putnam, 1981), the 'scenes of inquiry' (Jardine, 1991),

'styles of reasoning' (Hacking, 1992), and even more broadly, Foucauldian epistemes. The contention that the sciences incorporate a priori commitments as part of their modus operandi—as a prerequisite to doing scientific work and thus generating scientific knowledge—is hardly controversial.[3] Indeed, it has been a widespread contention for some time now:

> A scientific theory arises in response to a problem . . . for instance one of producing a consistent explanation capable of accounting for both the wave-like and particle-like aspects in the behaviour of light. But a problem . . . presupposes a relatively stable matrix—a reality scheme, an intelligibility scheme, a *Lebenswelt*, basically, a conceptual matrix sufficiently consistent so that problems can arise within it. . . . Scientific theories deal with problems which arise within an intelligible context. Proposals establishing such a context, defining a reality-matrix, are not scientific theories but *metaphysical proposals*. (Kohak, 1974: 24, in an early paper on the demarcation of physics from metaphysics.)

In fairness, it is important to note that at least some neo-Kantian conventionalists claim, or are presented as claiming, that by adopting such views, they are not really engaging in metaphysics as such. In the present context, however, this apparently conflicting diagnosis is revealed as mere terminological confusion following from a particular use of the term 'metaphysics'. Some neo-Kantian positions (internal realism is an exemplar here) do reject a particular conception of metaphysical knowledge in terms of what is sometimes called 'metaphysical realism', but even this leaves the door open to neo-Kantian metaphysics. And since the very point of Kant's Copernican revolution was to *fuse* metaphysics and epistemology in such a way as to transcend the scepticism he saw as an inevitable consequence of the empiricism and rationalism that preceded him, it would be a mistake to think that the opposition of some neo-Kantians to metaphysics targets metaphysics *simpliciter*, as I have elaborated it here. Rather, it targets a particular metaphysical assumption.

However it is conceived very precisely, we are now in a position to ask an important question regarding the a priori: what is the import of the role it plays in scientific work, and of the resultant sculpting of scientific knowledge in accordance with various a priori moulds sanctioned within different domains of scientific investigation? In the next section, I will argue that the prevalence of a priori content described by the epistemologies of science just mentioned leads to a difficulty for the project of naturalized metaphysics as it is currently conceived. The solution to this difficulty will require an elaboration of the project in more compelling terms than have been articulated by its proponents thus far.

[3] In Chakravartty (2010), I argue that all systematic epistemologies of science appeal in some way, shape, or form to the notion of a priori content, sometimes explicitly and otherwise implicitly.

3. The incoherence of naïvely naturalized metaphysics, and a reply

Let us proceed with the understanding that scientific knowledge harbours some a priori content. I believe that this generates a charge of incoherence against the idea of naturalized metaphysics. And while an intuitive response to this charge is easily furnished, the response reveals just how impoverished our current conception of naturalized metaphysics is, or so I will suggest. I will consider these assertions in some detail momentarily, after first clarifying two implicit and critical assumptions: the first concerning the nature of scientific progress; and the second concerning the version of naturalism at stake in this discussion.

There is, I believe, in the very conception of naturalized metaphysics as it is currently best conceived, an implicit, non-trivial assumption about the nature of scientific progress. Any attempt to do metaphysics on the back of the sciences might be viewed in at least two different ways. On the one hand, there is a well-established tradition in the history of philosophy that regards metaphysical theorizing as a fruitful heuristic for scientific work. This is to suggest that to the extent that a priori theorizing is part of scientific work, it does not take the form of constitutive or functional principles per se, but rather speculative possibilities that are ultimately converted into empirical propositions as scientists devise means of testing them empirically. Popper, for example, maintained that metaphysical theorizing is heuristically useful to science in allowing the development of concepts that ultimately suggest directions for empirical research programmes. Atoms, elements, corpuscles of light, and fluidic or flow-type views of electricity are all examples of concepts that were born metaphysically, he would say, but grew up empirically. The same is true of now disconfirmed ideas such as the existence of a luminiferous aether, or traceable particle identity over time, or universally deterministic laws. These notions

may also have begun as a priori commitments, but over time, scientific work has revealed them to be untenable, empirically.[4]

Consider a more recent example from medical research in the fields of cell and tissue biology.[5] A significant literature here suggests that two conflicting metaphysical presuppositions—'reductionism' and 'organicism'—have shaped studies of cancer over the past few decades. Reductionism in this domain takes the form of genetic determinism, the idea that certain biological states and processes can be explained wholly or primarily in terms of genes, and organicism is the view that emergent phenomena at higher levels of biological organization are crucial to these explanations. Some organicists, for example, believe that the production of cancer cells can be explained in terms of abnormal tissue organization. But here, just as in the case of Popper's examples, one might argue that to the extent that the a priori infuses the relevant scientific knowledge, it is merely in the form of hypotheses that are offered in anticipation of a posteriori investigation. That is to say, the a priori is merely a heuristic device.

If naturalized metaphysics is to constitute a different and better form of metaphysics than some alternative, however, the merely heuristic conception of a priori theorizing cannot exhaust what is intended. The notion that the a priori may serve as a potential expedient in the service of empirical research seems uncontroversial, but there is nothing in the *merely* heuristic conception to explain how one might distinguish between naturalized metaphysics and any other sort, except in retrospect. That is to say, one might look back over the history of the sciences and describe metaphysical theorizing that was ultimately fruitful of empirical research as naturalized metaphysics post hoc. But surely this is not (exhaustive of) what anyone hoping to do naturalized metaphysics can intend, since the relevant intention is fuelled by the aspiration to distinguish naturalized from non-naturalized metaphysical theorizing *in the present*—not least as a normative guide to what sorts of metaphysical projects should be considered most worth engaging now. This is not to say, of course, that a heuristic role for the a priori is incompatible with the idea of naturalized metaphysics, but rather that this cannot be the whole story.

[4] Not everyone holds the influence of a priori theorizing in the context of scientific work to be so benign. Duhem, for instance, believed that metaphysics is often counterproductive to science, because it sometimes opposes or attempts to subordinate promising empirical investigations.

[5] For a detailed discussion of this case, see Marcum (2005).

In order to add to this story in the manner required, an assumption about scientific progress is necessary: one must assume that some parts of scientific theories are likely to be retained over time across theory change, and furthermore, that we are in a position to identify at least some of these parts. Without some such identification as a basis for metaphysics, the scientific ground of naturalized metaphysics would inevitably shift significantly in time, raising serious doubts about the motivation for distinguishing between metaphysics bearing a privileged relation to empirical science and metaphysics that lacks this quality. For if the scientific basis were radically unstable, one would have no good reason to suspect that metaphysics done in conjunction with it at any given time is preferable to metaphysics that is alien to it. The assumption of stability in the progress of science is by no means trivial, but certainly, many epistemologies of science are compatible with it. Some forms of instrumentalism and empiricism, for example, are compatible with the notion that the empirical content of scientific theorizing survives changes in theoretical superstructures, and several forms of scientific realism suggest that there are criteria according to which one may identify aspects of scientific theories that are likely to survive theory change in mature domains of science.[6]

A second assumption necessary to the articulation of the concept of naturalized metaphysics concerns the form of naturalism at issue. The idea of naturalism is generally associated with two rather different theses. The first we have encountered already: the notion that some philosophical (in this case, metaphysical) questions and answers evolve into and rightfully become scientific-empirical questions and answers over time, as thinking about them matures. This is what Quine suggested, for example, regarding epistemology and empirical psychology, or regarding natural kind philosophy and scientific taxonomy. This cannot be what naturalized metaphysicians have in mind, however, for as we have just noted, their enterprise is much diminished if we have no reason to think that this way of doing metaphysics is capable of telling us something about the world now, as opposed to merely spinning its wheels on the off chance and wishful thinking that what is produced may evolve into empirical investigations that tell us something about the world later. The force of this point is augmented by the observation that much of the metaphysics of science

[6] For some recent accounts of 'selective' realism, see Chakravartty (2007a), French (2006), Ladyman (1998), Psillos (1999), and Worrall (1989).

concerns issues—the nature of causation, laws, and modality; the objective or subjective basis of natural taxonomy; the individuality or non-individuality of entities in fundamental physics—that we have no reason at all to suspect will *ever* be settled by empirical investigation alone; on the contrary, since the concepts involved are not wholly empirical, or for that matter, wholly scientific.

A second and rather distinct idea commonly associated with naturalism is that philosophy (in this case, again, metaphysics) is continuous with science, and it is this conception of naturalism that is relevant to the present discussion. Presumably, the naturalized metaphysician holds that metaphysical theorizing in a naturalistic vein is continuous with and thereby close to the ground of empirical results (recall the quotation from Hempel with which this chapter began), unlike other work in metaphysics that is clearly further away. Here we see the impetus for the naturalized metaphysician's rejection of what I earlier described as metaphysical theorizing that is too far down the slippery slope from scientific investigation to be of serious interest to an interpretation of scientific knowledge, and the even more severe rejection of such theorizing as a misguided endeavour: epistemically impotent with regard to its prospects for yielding any genuine understanding of the natural world. Continuity with science, then, is the suggested means by which to ensure that metaphysics does not lapse into the unprofitable excesses of non-naturalized metaphysics. Naturalized metaphysics, *ex hypothesi*, in virtue of its continuity with science, enjoys some degree of epistemic privilege.

Having elaborated what I identified at the start of this section as two critical assumptions, concerning the nature of scientific progress and the form of naturalism at issue here, let us now proceed to the charge of incoherence against naturalized metaphysics. The metaphor of continuity is highly suggestive, but how should it be cashed out more precisely? Interestingly, our current conception of naturalized metaphysics, as characterized by those who are sympathetic to it, does not generally advance beyond the provision of further, equally vague sentiments, though even this modicum of help is instructive. It is not uncommon to hear that continuity in this context is evidenced by the fact that naturalized metaphysics is 'derived from', 'based on', or otherwise 'inspired' or 'motivated' or 'constrained by' our best science, which thereby serves as the proper

'ground' for metaphysical theorizing.[7] The fact that these expressions in quotation marks are vague, and the implication that we may wish to say something more precise about the notion and epistemic value of continuity, will be the subjects of section 4. For the moment, however, let us work with what we have, and consider more carefully the family of relations constituted here by derivation, basing, inspiration, motivation, constraint, and grounding.

What is it about continuity with the sciences, and the putatively resultant grounding of naturalized metaphysics, that is meant to afford it a privileged status in comparison to non-naturalized metaphysics? Recall that it is the a posteriori, empirical content of the sciences that is supposed to enhance the credentials of the metaphysics of science, and thus, by extension, one might argue that metaphysics that is done in such a way as to be empirically grounded may claim some epistemic privilege. Here we have the proposal of a criterion of adequacy for bona fide metaphysics: it must stand in a certain kind of *sanctioning* relation to empirical inquiry. And herein lies the difficulty. In order to make sense of the idea that one body of belief—scientific knowledge—stands in a sanctioning relation to another body of belief—the results of some metaphysical theorizing—it must be possible to distinguish clearly the relata of the sanctioning relation one from the other. That is, one must be capable of clearly distinguishing the associated forms of inquiry, so that one can then ground the outputs of one on the outputs of the other. But note here, once again, that there is a conflation in this reasoning! It is one thing to entertain the idea of grounding a priori theorizing in a posteriori knowledge, but it is quite another to imagine grounding a priori theorizing in scientific knowledge. For as we have seen, scientific knowledge itself has a priori dimensions.

Thus we arrive, finally, at the worry that there is something apparently incoherent about naturalized metaphysics as it is currently conceived. On this conception, metaphysical theorizing is legitimate only insofar as its constraint or ground is something empirical. However, in practice, this legitimization is attempted by taking *science* to be the constraint on or ground of proper metaphysical theorizing, and the sciences by their nature cannot provide the purely a posteriori content that the suggested criterion of legitimacy requires, because scientific knowledge comprises a blend of a

[7] Ladyman and Ross (2007, pp. 37–8) offer a more specific take on continuity when they recommend the use of metaphysical theorizing in the service of scientific unification.

priori and a posteriori content. While metaphysics *simpliciter* may be described purely in terms of its a priori or non-empirical character, the sciences cannot, on pain of caricature, be described purely in terms of their supposed a posteriori or empirical character. Given that scientific knowledge does have a priori dimensions, the sanctioning relation proposed by naturalized metaphysics, between a priori and a posteriori content, simply cannot be realized in the manner suggested. As a consequence, the idea of naturalized metaphysics as it is currently conceived lapses into incoherence.

There is an obvious reply to this charge of incoherence. Granting that scientific knowledge has a priori dimensions, and even granting that different branches of the sciences are a posteriori in highly variegated ways and to highly variable degrees, it remains the case that the forms of inquiry we collect under the banner of the sciences are permeated with a posteriori content in virtue of the empirical concepts with which they are concerned. So why not take 'naturalized metaphysics' to label those metaphysical projects that are derived from, based on, inspired by, motivated by, constrained by, and grounded in this specifically empirical content, as opposed to scientific knowledge more generally? Given that most scientific inquiry is inescapably infused with empirical content in virtue of a posteriori investigation, one might seek to ground naturalized metaphysics in this same, specifically empirical content. What could be simpler? I take this obvious reply to the worry of incoherence to be intuitively compelling—there seems something right about the idea that what distinguishes some forms of metaphysical theorizing from others is the question of how closely connected (or not) these projects are from the specifically empirical content of scientific knowledge.

Unfortunately, however, and despite its intuitive appeal, this natural way of thinking about naturalized metaphysics is largely empty, and cannot do the work our intuitions might suggest it should. The problem is that the criterion of legitimacy suggested is far too easy to fulfil. Indeed, there is good reason to think that it is generally trivially satisfied, which would entail that *every* metaphysical project is an instance of naturalized metaphysics: clearly a poor result from the perspective of an aspiring naturalized metaphysician. To illustrate the point, consider the following tendentious example. There was a philosopher who maintained that the theory of the Forms and realism about universals is derived from experience. For in the course of making empirical observations, he noticed that various objects of his experience had a number of similarities and differences, and these observations were borne out in countless numbers of a posteriori investigations. He then theorized about what ontological features these objects of empirical study might have in order to account for all of the observed similarities and differences, and *voilà*, Platonism is derived from experience.

It is hard to imagine anyone being especially impressed by the *empirical* nature of this derivation, though it is fair to say that it followed entirely in the course of theorizing based on empirical observations. This is an extreme demonstration of the emptiness of attempting to explicate the idea of naturalized metaphysics in terms of vaguely specified linkages to empirical content and a posteriori investigation. Any metaphysical project that is not immediately self-undermining *ab initio* will be consistent with empirical observations, and thus too easily linked to empirical content if the terms of the linkage are specified too broadly. In the next section, I will begin the process of articulating a more robust conception of naturalized metaphysics, by taking seriously the notion that the terms of this articulation must be significantly more precise than those we have canvassed thus far.

4. The grounding metaphor

We have learned that the idea of naturalized metaphysics must go beyond the mere idea of metaphysics as a useful heuristic for scientific work, and that its distinctive character, in contrast to non-naturalized metaphysics, has something to do with its continuity with a posteriori, empirical investigation. The ways in which this continuity is conceived as facilitating a distinctive character for naturalized metaphysics, however, have not yet been spelled out in a way that secures the distinction. There is a strong will here to distinguish cases in which, though it may never be possible to carry out an empirical test—for example, to establish the one-way speed of light, or to detect the presence of hidden variables in quantum mechanics—it is nevertheless possible to understand what may be regarded as a priori commitments as appropriately linked to a posteriori content. This linking takes the form of some appropriate grounding in a system of empirical concepts, observations, and so on. What is required, then, is some means by which to distinguish such work from work in non-naturalized metaphysics, which is perceived as being too preoccupied with epicycles on issues whose consideration takes place a very long distance from empirical investigation.

Recall that the explicit goal of naturalized metaphysics is to tame the putative excesses of some metaphysics *simpliciter* (which lends itself, or so the assertion goes, to inappropriately constrained speculation about things one could not possibly hope to know about, or about things concerning which one may have no reason to suppose there are even facts of the matter) by linking metaphysics to the naturalistically respectable project of trying to interpret the empirical content of our best science. This linkage must be to empirical content and not merely to science, for as argued in section 2, it is a mistake to think that scientific knowledge is wholly empirical, and as argued in section 3, the project of naturalized metaphysics must focus on empirical content if it is to escape the charge of incoherence. Escaping this charge, one might then hope to avoid falling down the slippery slope into the darkest depths of metaphysical speculation. In order to achieve these goals, we must scrutinize more seriously the metaphor of grounding, and as a first step, I suggest that we pay closer attention to the idea of *continuity* with the empirical. What does continuity mean, in this context? This, I believe, is the crux of the issue, and the only hope for giving a defensible formulation of the idea of naturalized metaphysics. In pursuit of greater clarity here, we require some sort of metric or metrics by which to make more precise the relevant notion or notions of continuity. Armed with such metrics, the more precise meanings of expressions like 'closeness to' and 'distance from' empirical work may finally come into focus.

The project I suggest here is a large one, and I cannot claim to know all or how many such metrics may be relevant to explicating a fully compelling account of naturalized metaphysics. One must begin somewhere, however, and in the remainder of this chapter, I will describe two parameters that appear to play a central role in our thinking about metaphors of proximity and distance with respect to a posteriori investigation. Even in so incomplete a form, I believe that these reflections yield important morals for our assessment of the epistemic potency of much of what is typically identified in contemporary philosophy as the metaphysics of science. And as we shall see, even our best efforts to demarcate naturalized metaphysics may leave open the question of where precisely to dig in one's heels on the slippery slope.

Perhaps the most obvious way to think about proximity to empirical content is in terms of what I will call the 'experiential distance' of an object of inquiry. This concerns the manner in which it is detected, if in fact it is detectable at all. Tyson, the barking dog across the street in our otherwise

quiet neighbourhood, is directly detectable by me using my unaided senses. Proteins are less directly detectable; I would need to take a sample from Tyson and perform an assay in the lab to detect them. The possible worlds in which I now demonstrate this procedure to my friends and neighbours are not detectable at all. There is a spectrum of cases here, and the further one moves along the spectrum, the further the distance of the object of inquiry from perception by the unaided senses. Since the demise of thoroughgoing rationalism in the philosophy of science, it is widely held that the further one goes in terms of experiential distance, *ceteris paribus*, the weaker the epistemic power of our inferences concerning putative targets of investigation. Of course, this is not to say that experiential distance is strictly inversely correlated with inferential strength, since the relevant epistemic conditions are not always equal. Neither is it to say that weaker inferences are insufficient to produce knowledge; scientific realists of various stripes argue precisely this point—when it comes to certain unobservable things under certain conditions, one may have good reasons to infer their existence. The idea is rather simply that the epistemic challenge to make warranted inferences mounts with experiential distance, *ceteris paribus*.

Another way of understanding the notion of proximity to empirical investigation is in terms of what I will call 'risk', which concerns how susceptible a hypotheses or a theory is to disconfirmation in light of the results of empirical work. The idea of 'susceptibility' here is a measure of how strongly empirical evidence weighs on our assessments of truth and falsity. For example, if empirical considerations are judged to be relatively unimportant to the assessment of the truth value of a proposition, the risk it engenders is low. Hypotheses that make very precise novel predictions about observable phenomena, on the other hand, take a greater risk than those that do not, which may include, for example, hypotheses that merely accommodate data that is already known. Hypotheses that include epicycles and idle wheels in accommodating the same empirical data as those that do not take no extra risk, and may thus be judged negatively as a result. Hypotheses that are riskier in these and perhaps other senses are generally viewed as being closer to empirical investigation, *ceteris paribus*, and the closer to empirical investigation they are, the greater the confirmation boost they receive if their predictions and accommodations are borne out in empirical investigation. As in the example of experiential distance, the idea of risk also generates a spectrum of cases, and one's assessments of

these factors help to determine the degrees of belief one should associate with the relevant hypotheses and theories.[8]

Experiential distance and risk are two parameters that seem central to cashing out the metaphor of grounding in a way that clarifies how continuity with a posteriori investigation can be ordered by means of epistemic metrics.[9] With tools such as these, expressions like 'closeness to' and 'distance from' empirical work begin to take on more precise meanings, which then give substance to our conception of naturalized metaphysics. These are merely two among what may well be a collection of parameters that are relevant to this conception, however. The onus is on those of us who see promise in the idea of naturalized metaphysics to work out precisely what further factors one might justifiably consider in determining when a given piece of a priori theorizing can be grounded in a posteriori investigation in such a way as to meet a reasonable epistemic threshold or standard, to whatever extent is deemed appropriate in the context. The ultimate promise and defence of naturalized metaphysics awaits this yet further articulation.

I am optimistic about the prospects of naturalized metaphysics, both as a philosophical endeavour that can be distinguished from metaphysics *simpliciter*, and as a form of inquiry that may contribute to our knowledge of the world. Lest optimism lead inadvertently to dogmatism, however, let me conclude with a brief, cautionary observation for aspiring naturalized metaphysicians (such as myself). If there is a tendency among some analytic metaphysicians to ignore the outputs of empirical science at their peril, there is equally a tendency among some aspiring naturalized metaphysicians to court excessive confidence in their wealth of scientific knowledge, but this latter vice is no less philosophically counterproductive than the former.

Quite reasonably, one may ask: where do the speculations of metaphysicians of science typically fall on the spectra of experiential distance and risk described above? Undeniably, on reflection, it seems the answer to this question must be: not very close to empirical investigation! Typically, no

[8] An interesting topic that I will not pursue here is the relationship between experiential distance and risk. One might expect these parameters to be sometimes but not always inversely correlated: sometimes, because hypotheses and theories about entities and processes at greater experiential distances are sometimes less susceptible to empirical findings; but not always, as for example when they generate novel predictions.

[9] For further consideration of these parameters, see Chakravartty (2007b).

matter how well informed by empirical details emanating from scientific work, our accounts of fundamental ontology in the sciences, or laws of nature, or the nature of time, and so on, do not fare especially well with respect to the metrics of experiential distance and risk. What this reflection serves to highlight is the perhaps obvious fact that expressions like 'derived from', 'based on', 'motivated by', 'inspired by', 'constrained by', and 'grounded in' do not mean *entailed by*. Indeed, from an epistemic perspective, the best one can hope for in employing these expressions is that metaphysics that stands in such relations is *compatible with* our best empirical science, and this should prove an antidote to any danger of hubris on the part of aspiring naturalized metaphysicians (such as myself). Despite too much casual rhetoric to the contrary, the metaphysical theses argued for by metaphysicians of science are not extracted from the empirical content of science, as if they were there already simply waiting to be mined. They are developed by means of a priori theorizing in the course of interpreting scientific claims. A necessary condition for successful interpretation here is compatibility with the science at issue, but this condition can only take one so far.

How impressed should one be with *mere* compatibility? Recall the tendentious example of realism about universals. Mere compatibility does not buy one much epistemic warrant in the absence of an impressive assessment of values of parameters such as experiential distance and risk. Test cases from the metaphysics of sciences abound, and what is striking about these cases is that the relevant a priori theorizing is highly underdetermined by our best science. Our best physics, for example, does not determine the fact that reality ultimately consists in an ontology of fundamental relations lacking ontologically significant relata (cf. Ladyman and Ross, 2007), or that laws of nature should be taken as primitive, that there are no such things as universals, and that time passes (cf. Maudlin, 2007). These are not the sorts of things on which current physics can be expected to pronounce univocally one way or the other. Indeed, aspiring naturalized metaphysicians often go out of their way to promote metaphysical theses that play no role in scientific practice (for example, pertaining to the unity of the sciences, or the metaphysical status of laws of nature), or that are at odds with at least some scientific claims taken at face value (such as the routine reference to ontologically significant relata, or the apparent inconsistency of Special Relativity with the passage of time).

Of course, it is an epistemically rational strategy to make inferences that are informed by the best information one has available, and on the reasonable assumption that mature scientific claims produced in part by empirical investigation likely furnish better information than their negations, metaphysics that is compatible with the outputs of our best science is obviously preferable.[10] The point here, however, is a deeper one: without invoking criteria such as experiential distance and risk, there is no obvious reason to think that metaphysics that is 'derived from' our best science is any more likely to produce knowledge of the world than metaphysics that is not so 'derived', but nonetheless compatible with our best science. And since our best empirical evidence, scientific or otherwise, generally underdetermines our best metaphysical theorizing, there is something deeply confused about any proposal for naturalized metaphysics that would seek to save metaphysics simply by scientizing it. It is for this reason that I contend that the attempt to sanction some metaphysics by making the grounding relation the *sine qua non* of legitimate metaphysics does not get us anywhere worth being all by itself. If we are to be naturalized metaphysicians, let us dedicate ourselves to the philosophical analysis of epistemically probative metrics for assessments of grounding.

That we already employ such metrics in the philosophy of science today, if only implicitly, explains why it is that much of what was once considered metaphysical by some empiricists is no longer considered metaphysical by most. Theorizing about the nature of things like phlogiston and white blood cells seems rather close to the ground of empirical investigation. Typical theorizing in the metaphysics of science, including some of the examples I have mentioned here, are not close at all. Let us be entirely transparent, then, about what naturalized metaphysics can achieve. It brings a priori considerations to bear on developing accounts of the underlying features of entities and processes of scientific discourse. It applies familiar criteria: consistency; coherence; simplicity; scope; unification; minimizing ad hoc hypotheses and primitive concepts; and so on. It marshals intuitions about these desiderata, in just the same manner as non-naturalized metaphysics, and appeals to these intuitions in determining the relative strengths and weaknesses of metaphysical hypotheses and

[10] For probing scepticism regarding this assumption, however, see Monton (2011), which argues that compatibility with current physics is not a plausibly truth-conducive desideratum for metaphysics.

theories. It also adduces intuitions regarding which phenomena most require explanations, and what would count as a good one. Generally, these arguments have the form, either explicitly or implicitly, of inferences to the best explanation. The better the explanatory work a hypothesis does, by some proffered lights, the greater its warrant. If the experiential distance is great and risk small, however, this should be reflected in our degrees of belief.

Metaphysical inferences will never be as strong as we might like, even if they are naturalized, and given the nature of inference to the best explanation, there will always be ultimately irresolvable subjective differences in our assignments of degrees of belief based on largely irresolvable differences in some of the intuitions we bring to bear on their assessment. As a consequence, it is simply a mistake to think that there is any one place on the slippery slope that is an objectively rational place to stop, for determinations of where best to stop are inevitably subject to variable intuitions regarding how much experiential distance and risk is tolerable in an inquiry we engage in hopes of learning something about the world. These determinations are choices that all metaphysicians must make, even those who pay close attention to the sciences. Some philosophers, perhaps many, will see this as bad news for metaphysicians of science. It is difficult to see how it could be, however. This is merely the human epistemic condition.

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