Science as a Guide to Metaphysics?

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1. Introduction

Analytic metaphysics is in resurgence; there is renewed and vigorous interest in topics such as time, causation, persistence, parthood and possible worlds. We who share this interest often pay lip-service to the idea that metaphysics should be informed by modern science; some take this duty very seriously.[2] But there is also a widespread suspicion that science cannot really contribute to metaphysics, and that scientific findings grossly underdetermine metaphysical claims. For some, this prompts the thought 'so much the worse for metaphysics'; others mutter 'so much the worse for science'.

One widely-discussed example is the apparent conflict between the special theory of relativity (STR) and presentism, the view that only what is present exists.[3] According to STR, when we ask whether or not two distant events occur simultaneously, different frames of reference will dictate different answers; moreover, STR does not privilege any particular reference frame as giving the real or the most fundamental answer. For many pairs of events, there is no absolute fact of the matter as to whether or not they occur simultaneously. Presentists claim that only what is present exists, which is to say only those events simultaneous with *now* exist. But according to STR, it seems, there is no absolute fact of the matter as to which events are simultaneous with now. Unless we can believe that there is no absolute fact of the matter as to what exists, it looks as if we shouldn't identify what exists with what is simultaneous with now. Thus presentism is false.

Presentists have responded to this 'refutation' in a number of ways, by pointing out that the absence of a privileged reference frame in STR does not entail that there is no such frame, or by claiming that there could be an equally good scientific theory which involved a privileged reference frame, and was thus hospitable to presentism. Opponents argue that this is just so much squirming, and that presentists should simply face up to the fact that their theory, though it might initially have seemed appealing, has been rendered untenable by scientific progress.[4]

What bearing does STR have on presentism? How, if at all, is science relevant to metaphysics? We could settle the second question by proclamation, simply defining metaphysics to be the subject that begins where science ends. But imposing such a boundary between science and metaphysics will not settle interesting questions like the first. If we leave open the question whether metaphysics and science are mutually exclusive, we may disagree about whether modern physics sheds light upon metaphysical questions about the reality of the past and future. But if we impose a boundary between the disciplines, we may

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[2] For good examples of the latter, see Callender (ed.) (2002).

[3] Presentists include Prior (1970) and Merricks (1994). The conflict also arises for those who believe that past and present exist, but the future does not. See Tooley (1997), McCall (1994).

[4] Another dispute of this type concerns the relevance of quantum statistics to the metaphysics of identity and individuality; French (1998).

still disagree about whether questions about the reality of the past and future lie on the science side of the line or the metaphysics side.

Although I will make some assumptions about the nature of metaphysical enquiry (see section 2, in particular), I will not attempt to define metaphysics. Instead, when I refer to 'metaphysics' or 'metaphysical issues', I mean issues of the sort typically discussed by self-described metaphysicians, who work in philosophy departments and publish in philosophy journals; issues which are typically taught to philosophy students in courses titled 'metaphysics'. So questions about the nature of time, causation, properties, numbers, persistence, possible worlds and so on will all count as metaphysical questions.[5] This characterisation is intended to leave open the question whether scientists also work on these metaphysical questions.

2. The Possibility of Metaphysics

In order to investigate the relevance of science to metaphysics, I will assume that metaphysics is possible. This assumption has two elements. First, I assume that it is sometimes possible to provide reasons for and against claims about the nature of time, of properties and so on. Without this assumption, the question whether and how science may provide such reasons does not even arise. Second, I assume that science is not the only possible source of reasons for and against metaphysical beliefs. This second element is more controversial than the first: it might be argued that science is our only source of knowledge about such matters, and thus that anything which cannot be investigated scientifically cannot be investigated at all. Whatever the merits of such an argument - and whatever account of scientific method it presupposes - I will not consider this position here. In part, this is because I want to limit the scope of my enquiry, and thus cannot undertake a full-scale defence of conceptual analysis, abduction, reasoning from intuitions and all the other habits of contemporary metaphysicians. But it is also because I am primarily interested in disputes about whether some new development in science sheds light upon a traditionally metaphysical question; the debate about presentism and special relativity fits this pattern. In such disputes, typically all parties concede that traditional debate was legitimate, if perhaps inconclusive, but they disagree about how, if at all, scientific input should now alter the course of debate. In order to make sense of these disagreements, it is necessary to assume that science is not the only source of reasonable belief about metaphysical matters, and that other methods have at least something to offer.

What goes along with the assumption that there can be extra-scientific reasons for and against metaphysical claims? I will take it that metaphysical claims may be meaningful even when they are not subject to empirical confirmation or disconfirmation. After all, it would be peculiar if metaphysical claims could be subject to non-empirical reasons, but only when they also had empirical confirmation or disconfirmation. For example, if a metaphysical theory's being simple counts defeasibly in its favour, then presumably it does so whether or not the theory is also subject to scientific investigation. This assumption does not load the dice against the relevance of science to metaphysics: to claim that meaningfulness and reasons may outrun empirical evidence is not to claim that metaphysics is entirely nonempirical. And

[5] I take it that physics is relevant to these topics, if any science is. But similar issues arise concerning the relevance of the cognitive sciences to the metaphysics of mind, and perhaps the relevance of biology to certain metaphysical questions.

to maintain that there can be non-scientific reasons for belief does not entail that these must outweigh the reasons provided by science.

So I will disregard those sceptics who argue that non-empirical claims are meaningless. A different attack on metaphysics is sometimes expressed as a kind of conceptual-scheme relativism. This is the thought that seemingly-rival metaphysical views are different but ultimately compatible ways of describing the same underlying reality. While I reject this relativism, it is not a threat to the project of this paper.[6] Even if we accept that metaphysical questions can be answered only relative to one conceptual scheme or another, enquiry within a given scheme is supposed to be subject to reason, and we can ask about the relevance of scientific findings to that process of reasoning with the conceptual scheme.

Some contemporary sceptics about metaphysics accept that metaphysical claims are meaningful and accept metaphysical debates at face-value. But they argue that the truth or falsity of metaphysical claims cannot be known, or that we cannot justify even tentative belief in one metaphysical theory rather than another, or that refusal to believe any metaphysical claim is perfectly well-justified.[7] Such scepticism is typically based upon rejection of the inferential methods of metaphysicians, and rejection of inference to the best explanation in particular. As such, it is incompatible with standard versions of scientific realism. I will further explore this connection below, but it should come as no surprise that anyone who is sceptical about the ability of science to give us knowledge of quarks and quasars will be sceptical about whether science can give us knowledge of universals and possible worlds.

3. Optimism and Pessimism

With these preliminaries out of the way, and with the assumption that metaphysical enquiry can be reasonable even where it outruns the scope of science, how, if at all, should we use scientific findings in our metaphysical enquiry? There are two widespread but conflicting views of this matter, each of which can seem very natural. The first view, roughly, is that if a scientific finding seems to bear upon a metaphysical matter, then you ignore it at your peril. Call this the 'optimist' view, since it is optimistic about the possibility of achieving metaphysical progress on the back of scientific progress. The alternative 'pessimistic' view is, roughly, that you can only get as much metaphysics out of a scientific theory as was put in by hand in the first place.

Here is a recent articulation of the optimist position. Theodore Sider argues that the special theory of relativity shows us that the present moment has no distinctive ontological status, and thus that presentism is false. He writes "in cases of science versus metaphysics, historically the smart money has been on science...consistency with something fairly close to current physics is a constraint that must be met by any adequate theory of time."[8] (The 'fairly close' is, I take it, intended to allow that physics may yet evolve.) It's a sobering point: who wants to sit in an armchair in an ivory tower, insisting that those guys with the big grants, big computers and big accelerators have got it wrong?

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[6] For a useful discussion, see the Introduction to Sider (2001).
[7] See, for example, van Fraassen (2002).
[8] Sider (2001), p.42.

But the pessimist view can seem very attractive too. Here is Lawrence Sklar, also discussing the apparent conflict between the special theory of relativity and presentism. "While our total world-view must, of course, be consistent with our best available scientific theories, it is a great mistake to read off a metaphysics superficially from the theory's overt appearance, and an even greater mistake to neglect the fact that metaphysical presuppositions have gone into the formulation of the theory, as it is usually framed, in the first place."[9] Sklar articulates the view that STR has metaphysical consequences only if we understand it to include Einstein's philosophical verificationism, and that we need not think of the verificationism as part of the scientific theory.

Steven French makes a related point, while discussing whether we can learn anything about the metaphysics of identity and individuality from the strangeness of quantum statistics. "[There is] a problem for this program of 'reading metaphysics off current physics', to put it crudely, which arises from what might be called the 'underdetermination' of metaphysics by physics."[10] There is the suggestion in both Sklar and French that the properly scientific or empirical portions of the theories in question are each compatible with a range of different metaphysical views, and thus do not point in one direction rather than another. It's a compelling thought: isn't it naive to assume that scientists investigate the world without metaphysical prejudice, so that their findings can act as unbiased arbiters between rival metaphysical views?

I think that both optimism and pessimism have core elements of truth. In line with optimism, it should be uncontroversial that our metaphysical beliefs ought to be empirically adequate, so long as 'empirically adequate' is understood to mean something like 'consistent with our beliefs about what we observe' or even 'consistent with the truth about what we observe'. This claim should be uncontroversial, for several reasons. First, it does not presuppose that metaphysical claims have empirical consequences in isolation; given the right auxiliary hypotheses, empirical adequacy may be very easily achieved. Second, it seems to be a consequence of taking truth, or at least consistency, as a desideratum in metaphysics. Third, it does not preclude our revising our beliefs about what we observe in the light of our metaphysical beliefs; consistency can be achieved in various ways. Why should this uncontroversial claim make optimism seem plausible? Because, given the remarkable empirical successes of science, it is inviting to see consistency with science as the best way to achieve empirical adequacy.

But in line with pessimism, it should also be uncontroversial that no interesting metaphysical view is simply entailed by what we observe, that the content of a metaphysical claim outruns its empirical consequences, and *a fortiori* outruns its consequences for what has in fact already been observed. The fact that a metaphysical view seems to be part of a coherent and empirically successful scientific theory gives us good reason to think that it is empirically adequate, but, as the pessimist reminds us, this is very far from being a guarantee of its truth. Moreover, there may be other, incompatible yet empirically adequate metaphysical views. Empirical adequacy is a desideratum for metaphysical beliefs, but empirical adequacy is not

[9] Sklar (1981), p.131.
[10] French (1998) p.93.

truth. Given these uncontroversial claims, what is at stake between the optimist and the pessimist?

4. The Positions Characterised

We need to formulate optimism and pessimism in such a way that each position is compatible with the uncontroversial truths. I propose the following as a characterisation of optimism:

(**Optimism**) There are actual cases in which the involvement of a metaphysical claim in an empirically successful scientific theory provides some reason to think that the claim is true.

This characterisation allows us to identify two forms of pessimism, corresponding to two different reasons for rejecting Optimism.

(**Radical Pessimism**) The involvement of a metaphysical claim in an empirically successful scientific theory can never provide any reason to think that the claim is true.

(**Moderate Pessimism**) There is a kind of involvement in theory which, were a metaphysical claim to achieve this involvement, would provide some reason to think the claim is true; but there are no cases of metaphysical claims being involved in theory in this way.

These characterisations are hardly precise, of course, without a precise notion of 'involvement'. I will say more about this below; in brief, the involvement in question is the kind of involvement which, according to scientific realists at least, gives us reason to believe a claim about unobservable entities. When a claim is involved in a scientific theory, in this sense, it shares responsibility for generating the empirical success of the theory. Radical Pessimists believe that such involvement does not give us reason to believe metaphysical claims. Moderate Pessimists believe that, were a metaphysical claim to be involved in the relevant way, it would earn the kind of confirmation which scientific realists ascribe to obviously scientific claims which are thus involved, but they also believe that metaphysical claims are never really involved. Optimists believe that real involvement of metaphysical claims actually occurs and that it gives us reason to believe the claims in question. I will discuss possible bases for these three positions below, but before doing so I want to explain how each is compatible with the uncontroversial truths I identified above.

The first uncontroversial claim is that our metaphysical beliefs ought to be empirically adequate. This is, of course, compatible with Optimism. But it is also compatible with both forms of Pessimism: to deny that metaphysical claims are confirmed by their roles in scientific theories is not to deny that metaphysical claims must be empirically adequate. A metaphysical claim incompatible with empirically adequate scientific theory need not be empirically inadequate; rather, it may be incompatible with those elements of the scientific theory which go beyond the empirical data. To be agnostic about the metaphysics of a successful scientific theory or even to prefer a rival metaphysics is not to reject the goal of empirical adequacy.

The second uncontroversial claim that no interesting metaphysical claim is simply entailed by the empirical data. This is, of course, compatible with both forms of Pessimism. But it is also compatible with Optimism: one can admit that involvement in an empirically successful

scientific theory does not entail the truth of a metaphysical claim whilst maintaining that it nevertheless provides some defeasible reason to think that the claim is true. We are familiar with this dialectic from the debate about underdetermination of theory by data in the philosophy of science.[11] Empirically equivalent theories are ubiquitous: for any scientific theory T, we can consider the 'theory' T_e which says simply that T is empirically adequate. T and T_e are empirically equivalent. But the fact that empirical data are compatible with more than one theory does not mean that the data support each theory equally. Our choice between empirically equivalent theories need not be underdetermined in the sense that any choice is as reasonable as any other. For example, one theory may better explain the data than another, or it may be better integrated with other well-confirmed theories. Optimists can adopt the same approach to metaphysical claims. Although the empirical data and perhaps some of the lower-level scientific theorising are compatible with more than one metaphysical theory, they may nevertheless give us reason to prefer one metaphysics over another.

Thus Optimists accept that the empirical data do not simply dictate which metaphysics is correct, whilst supposing that, on occasion, a metaphysical claim seems so integral to the success of a scientific theory that we have reason to think that the claim is true. Moderate Pessimists accept that such integration would indeed provide reason to believe, but argue that metaphysical claims never in fact play an integral role in generating success. Radical Pessimists argue that whether or not a metaphysical claim is somehow integrated or involved in a scientific theory is irrelevant to whether we have reason to believe it true. Optimists and Moderate Pessimists have a common view about justification which differs sharply from that of Radical Pessimists; Optimists and Moderate Pessimists differ over whether science can ever satisfy the condition for justifying a metaphysical claim.

5. Scientific Realism and Radical Pessimism

How should we choose between these three views about the relevance of science to metaphysics? Unsurprisingly, commitments here are partly determined by philosophical commitments elsewhere (not forgetting the various assumptions which were required to limit our choice to these three positions). In this section I will argue that scientific realists should reject Radical Pessimism, and that those who reject scientific realism should reject Optimism; thus Moderate Pessimism is compatible with both scientific realism and with anti-realism. Scientific realism, as I shall understand it here, is the view that there are cases where the involvement of a claim about an unobservable entity in an empirically successful scientific theory provides reason to think that the claim is true.

This characterisation has obvious parallels with my characterisation of Optimism, and it is at once rather weak and rather specific, compared with a more standard characterisation of scientific realism. Realism might more standardly be characterised as the view that the entities posited by mature and successful scientific theories, or entities very like them, exist.[12] My characterisation is weaker than this in that it says merely that there are cases in which we should believe something a theory tells us about the unobservable, not that every successful theory constitutes such a case.[13] And it is more specific in its claim not just that we have

[11] See, for example, Laudan and Leplin (1991).
[12] This is the 'epistemic' element of scientific realism as characterised by Psillos (1999) xix.
[13] It is also weak in that it is compatible with structural realism, according to which the success of science sometimes gives us reason to believe in facts about the structure of the unobservable, though not about the

reason to believe the claims of successful theories, but that it is their role in that success which gives us this reason. However, this more specific claim is typically endorsed by scientific realists, even if it is not typically used to characterise their doctrine.

Scientific realists, I claim, should reject Radical Pessimism. If they do not, they are committed to finding some in-principle difference between claims about unobservable 'scientific' entities and 'metaphysical' claims, a difference which could explain why, although the former gain confirmation from their integration into successful scientific theories, the latter do not, even if they are just as integrated. What difference could this be? One possibility is that metaphysical claims do not have the right semantic status, that they lack truth-values or are not assertoric. This paper presupposes that this is the wrong view of metaphysics; moreover this odd combination of instrumentalism about metaphysics and realism about scientific claims is entirely unmotivated. Historically, claims have shifted from the realm of metaphysics to that of science, as science extends its reach. Whilst claims may thereby become more tractable, they certainly do not seem to gain assertoric status or truth-values in the process.

Could there be other differences between metaphysical and scientific claims which make the former but not the latter immune to confirmation through involvement in successful prediction and explanation? One might think that metaphysical claims ought to be certain: since there is rarely any advantage to having a metaphysical opinion as opposed to remaining agnostic, perhaps we can afford extreme caution in this domain. But Radical Pessimism is not the view that, though we can obtain defeasible evidence for or against metaphysical claims, we should hold ourselves to higher standards in this area than we do in other areas. Rather, it is the view that such defeasible, empirically-derived evidence is just not available in this area, although the methods of inference to the best explanation are perfectly reasonable in theoretical science. We have yet to see a reason for accepting this pessimism. Metaphysics, recall, is not that subject which of its very nature lies beyond scientific investigation. Rather, it is concerned with topics such as time, causation, persistence and possible worlds, topics which seem to overlap with the topics which, according to the scientific realist, may be investigated by scientists using inference to the best explanation. If we assume scientific realism, there is neither a content-based nor a semantic difference between scientific topics and metaphysical topics which could justify Radical Pessimism.

So scientific realists should not be Radical Pessimists. What about those who reject scientific realism? Given the way I have characterised realism, it might be rejected for two different reasons. First, one might think that the involvement of a claim about the unobservable in generating predictive success is irrelevant to whether we should believe it: someone who rejects scientific realism for this reason is committed to Radical Pessimism. Second, one might simply think that claims about the unobservable never do any work in generating novel success: this thought leads naturally to Moderate Pessimism. Either way, it is difficult to reconcile Optimism with the rejection of scientific realism. One might reject scientific realism whilst continuing to believe in the possibility of metaphysics, on the grounds that we have distinctive methods of enquiry for metaphysics. But this is to espouse Radical Pessimism. Those who reject scientific realism should accept either Moderate or Radical

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intrinsic nature of unobservable entities. See Worrall (1989) and Ladyman (1998).

Pessimism, while those who accept scientific realism should accept either Optimism or Moderate Pessimism.

6. Scientific Realism, Moderate Pessimism and Optimism

Suppose then that we adopt scientific realism. How are we to choose between Moderate Pessimism and Optimism? There is little hope of finding an *a priori* method of deciding between these two positions. The two views agree about the nature of justification in this realm, agreeing that we have reason to believe metaphysical claims to the extent that they are genuinely involved in generating empirical success (this need not be the only source of reasons for or against metaphysical claims, of course), but they disagree as to how often such involvement occurs in the history of science. We will need to look case-by-case in order to see whether a pattern arises.

But what are we to look for? What kind of 'involvement' is it that would bring confirmation to a metaphysical claim, were it ever achieved? For guidance, we can turn to the work of scientific realists, who face a similar question as they address the pessimistic meta-induction. This anti-realist argument asserts that there are plenty of theories in the history of science which were empirically successful, but which posited the existence of entities in which we no longer believe. The aim is to undermine the realist claim that empirical success is a reliable symptom of theoretical truth.

Realists offer a range of responses, sometimes in combination. First, it is argued, there are not *so* many theories in the history of science which actually achieved widespread empirical success but are now rejected. This is especially plausible if we take empirical success to involve the successful prediction of phenomena which the theory is not specifically crafted to predict, as well as the intentional accommodation of known empirical data. Second, realists may argue that, even where a scientific theory achieves empirical success of the right, impressive kind, credit for this success need not be distributed throughout the entire theory. It may be that some parts of the theory are idle, failing to contribute to empirical success. Then the empirical success does not give us reason to believe in those idle elements.

These strategies may be adopted in concert, in order to cut down the number of problem cases, and save the realist position. Realists believe that, when a theoretical claim is genuinely involved in generating suitably impressive empirical success, this gives us good reason to believe the claim, and that various theoretical elements of modern science are thus involved. (A structural realist would add that the only theoretical elements which are suitably involved and thus confirmed are in fact theoretical claims about structures.) Against the pessimistic meta-induction, realists retort that there are very few cases in which a claim about the unobservable is supported by its involvement in generating empirical success, but later rejected as false.

The involvement in generating impressive empirical success which scientific realists cite is the kind of involvement which brings empirical confirmation, according to both Moderate Pessimists and Optimists, though they disagree as to whether metaphysical claims are ever really involved in generating empirical success. How can we spot involvement, and thus arbitrate between the two positions? In defending scientific realism, Stathis Psillos proposes

the following strategy for characterising genuine involvement of a theoretical posit in generating novel success:

"Suppose that H together with another set of hypotheses H' (and some auxiliaries A) entail a prediction P. H indispensably contributes to the generation of P if H' and A alone cannot yield P and no other available hypothesis H* which is consistent with H' and A can replace H without loss in the relevant derivation of P."

As Psillos points out, if we place no constraints on what counts as a good theory, then every theoretical claim will turn out to be dispensable: we can write down the Craig-transform of a theory (roughly, that element of the theory which refers to what is observable), or just "'cook up' a hypothesis H* by writing P into it.". Rather, to show that H is dispensable, we must construct an alternative which is "independently motivated, non ad hoc, potentially explanatory, etc...".[14] So, if a claim H is to be involved in generating a prediction in a way which entitles it to share in the confirmation which successful prediction brings (according to the scientific realist at least), H must satisfy two conditions with respect to the generation of the prediction. First, it must be the case that the theory-minus-H cannot generate the prediction alone. Second, it must also be the case that there is no available, sensible alternative to H which could have done the work just as well. In fact, the first condition may be subsumed under the second: we can think of the theory-minus-H as an alternative theory which must satisfy the conditions of non ad hocness, independent motivation and so on.[15]

Moderate Pessimists and Optimists agree that some such criterion of involvement should apply to the metaphysical elements of a scientific theory if they are to be confirmed by the empirical success of the theory, but they disagree about whether the criterion is ever satisfied. This has some consequences for certain kinds of dispute in metaphysics.

7. Metaphysicians' Duties

So far, I have been discussing what, if anything, we can learn from science about traditionally metaphysical questions. But this issue can be expressed in a more negative way. What should a metaphysician do if told that her favourite metaphysical theory is undermined by scientific findings? Is this the ultimate refutation of a metaphysical claim, or merely an obstacle which can be circumvented easily? This question is at the heart of the dispute about presentism and the special theory of relativity. I shall discuss that case below, but in this section I will consider the question more abstractly. In order to do so, I will use the labels 'scientific metaphysics' to refer to the metaphysical claim supposedly supported by scientific theory, and 'traditional metaphysics' to refer to the rival claim which is to be defended against this. The labels are just a convenient shorthand, and should not be taken as labels for different schools of thought.

The first step for a metaphysician who wishes to oppose the metaphysics apparently embodied in science is to ask whether the scientific theory in question really is empirically successful (recall how scientific realists argued that few theories have enjoyed widespread novel empirical success). In practice, most full-time philosophers do not have the expertise to quarrel credibly with scientific orthodoxy about empirical facts. But a more promising line

[14] All quotations from Psillos (1999) p.110.

[15] See Kitcher (1993) chapter 5 for an alternative realist approach.

may be to argue either that there is disagreement amongst scientists regarding the status of a theory, or else that there is reason to think that the theory will ultimately be rejected. For example, one might try to use the difficulty of combining quantum theory with relativity theory in order to justify scepticism about the metaphysical consequences of both theories.

But let's suppose we accept that the science in question is state-of-the-art, and generates suitably impressive unforeseen predictions and accommodations: it is our best guide to empirical adequacy at least. Then the defender of traditional metaphysics must construct a system of belief which includes the traditional metaphysics but which is empirically equivalent to the scientific system. This may be easily, if artificially, achieved by conjoining the empirical elements of the scientific worldview with the traditional metaphysics, or by adding auxiliaries which guarantee that, where the traditional metaphysics diverges from the scientific metaphysics, there are no empirical consequences of this divergence.

This necessary step does not, however, establish that the scientific metaphysics is an easily-eliminated element of the scientific theory, and thus on a par with traditional metaphysics. In order to defend the traditional metaphysics against the scientific rival, further steps must be taken. These must involve either Undermining, or Counterargument, as I shall label the two strategies.

Undermining: this is the attempt to show that the scientific metaphysics is not involved in generating novel prediction, and thus that its appearance in a scientific theory does not give us reason to think it true. Recall Psillos's criterion: a claim is confirmed by empirical success if (i) the remainder of the scientific theory could not generate the success without it, and (ii) there is no independently-motivated, non-ad hoc, potentially explanatory rival theory which could generate equal success. Merely cooking up an ad hoc theory which involves the traditional metaphysics is not enough to meet this criterion. A more promising route is to consult the historical record in the hope of discovering a rival scientific theory which is less supportive of the scientific metaphysics (some of those who object to the metaphysics of Einstein's special theory of relativity have turned to Lorentz's rival ether theory).[16] Another option is to argue that the scientific metaphysics is merely an artefact of the standard way of formulating the scientific theory, and that there is another, equally promising formulation which doesn't involve the scientific metaphysics.

There is a second necessary element to the Undermining strategy, if this first part can be successfully carried out. Undermining the presumed support of the scientific metaphysics merely puts it on a par with the traditional metaphysics; it is also necessary to provide reasons to believe the traditional metaphysics as opposed to the 'scientific' metaphysics, given that science cannot arbitrate. And, of course, these reasons to believe must be compatible with the auxiliaries and assumptions required in order to establish that the traditional metaphysics can be incorporated into a well-motivated, empirically adequate theory.

Counterargument: this alternative to Undermining accepts that the scientific metaphysics is genuinely confirmed by the role it plays in generating empirical success, but claims that independent reasons to believe the traditional metaphysics outweigh this scientific support. Even on this approach, it is necessary to show how the traditional metaphysics is empirically

[16] For a very helpful discussion, see Zahar (1989).

adequate, given that we have accepted the empirical adequacy of the science in question. But it will be enough to cook up an ad hoc account, since the goal is not to show that the scientific metaphysics is idle in the scientific theory.

In practice the distinction between Undermining and Counterargument will not be sharply drawn. There are intermediate positions, where the alternative theory involving traditional metaphysics looks only somewhat ad hoc, and there are somewhat compelling non-scientific reasons to prefer the traditional metaphysics. Moreover, the way in which I have outlined the strategies here should not be taken to imply that the burden of proof always lies with the defender of traditional metaphysics. Rather, the strategies indicate what the debate turns on; depending on the context the burden of proof may be upon the traditional metaphysician to pursue one of these strategies successfully, or upon the scientific metaphysician to show that this cannot be done.

How do these various strategies relate to the initial, intuitive characterisations of optimism and pessimism? Recall the uncontroversial core of optimism: metaphysical beliefs, like other beliefs, should be empirically adequate, and contemporary science is our best guide to empirical adequacy. This thought is now reflected in the requirement that traditional metaphysicians must provide a system of beliefs which involves traditional metaphysics and which is empirically equivalent to scientific theory (or, depending where the burden of proof lies, scientific metaphysicians must show that this cannot be done). Recall the uncontroversial core of pessimism: empirical data do not simply entail any interesting metaphysical view. This thought is now reflected in the requirement that scientific metaphysicians must show that the scientific metaphysics is genuinely involved in generating the empirical success of the theory if they are to claim that it is supported by science (or, depending where the burden of proof lies, traditional metaphysicians must show that there is no such involvement).

8. Presentism and Special Relativity

Recall that, according to the special theory of relativity (STR), whether or not two events are simultaneous is not an absolute matter. The question about simultaneity may be answered differently according different frames of reference.[17] Moreover, STR does not distinguish any reference frame as more fundamental than any other. In particular, the question whether some distant event is simultaneous with my typing *now* is answered differently according to different reference frames, no one of which is the most basic frame. If to be present is to be simultaneous with my typing *now*, then STR provides no single best verdict as to whether some distant event is present. For all that STR tells us, what is present is not an absolute but a frame-dependent matter. The relativity of simultaneity and the consequent 'relativity of presentness' seems, *prima facie*, to spell trouble for metaphysical accounts of time which ascribe some special ontological status to the present. One such account is *presentism*, the view that only present objects and events exist.

Faced with STR, we seem to have three options. First, we might accept that presentness is frame-dependent, accept that existence cannot be frame-dependent, and thus reject presentism. Second, we might accept that presentness is frame-dependent, insist that only

[17] More precisely: there are pairs of events which are non-simultaneous according to every reference frame, but there is no pair of events simultaneous according to every reference frame.

what is present exists, and thus conclude that existence is frame-dependent. This second option is too relativistic (in a bad way) for almost everyone, and may undermine the intuitions that lead initially to presentism.[18] Third, we might accept that existence cannot be frame-dependent, insist on the truth of presentism, and thus conclude that there is a privileged frame of reference, one which escapes notice in STR. Simultaneity in that privileged frame is absolute simultaneity, and events absolutely simultaneous with my typing *now* are absolutely present. Positing a privileged frame of reference does not compel us to adopt presentism, for we might argue that what is absolutely past and future is also real. But the third option *permits* us to be presentists without conceding that existence is frame-dependent.

This third option maintains that there is a privileged frame, although STR does not privilege any frame. Does this brand of presentism conflict with STR? According to Simon Saunders, it does: "[Presentism] contradicts [STR] in the sense that it implies that special relativity is badly deficient as a fundamental theory of the world."[19] The implication here is that it is foolhardy for philosophers to contradict established scientific theory in this way. Defenders of presentism (or, at least, defenders of the compatibility of presentism and STR) argue that to suppose the existence of some privileged frame is merely to go beyond STR. Presentism supplements STR without attempting to supplant it; balking at this is supposedly the mark of outmoded verificationism.

Here we have the type of conflict I described in more abstract terms above. STR achieves a great deal of empirical success without positing an absolute frame of reference. This doesn't entail that there is no absolute frame of reference, but does it make it unreasonable to think that there is such a frame? How does this debate fit into the strategies I outlined above? Assuming that the presentist shoulders the burden of proof, as they seem expected to do in this debate, their first job is to explain how an absolute frame of reference could be part of an empirically adequate theory.

The easiest way to do this is to posit that the absolute frame is undetectable, and thus that, while STR is empirically adequate, there is a further fact about the universe which it fails to capture. According to Saunders, this is to claim that STR is "badly deficient"; presentists may retort that they accept that STR is empirically adequate. The next job is to pursue either Undermining or Counterexample. To use Undermining is to try to show that the scientific metaphysics (in this case the claim that there is no absolute frame of reference and thus no absolute simultaneity and no unique present) is not really involved in the generating the empirical success of STR. Following Psillos's criterion, this involves arguing that a presentist alternative to STR is independently motivated, non ad hoc and explanatory. This attempt is sometimes made by reviving Lorentz's ether theory, according to which there is a privileged frame of reference (stationary in the ether) but compensatory phenomena prevent us detecting that frame. This step is important because, if viable, the Lorentz theory has a theoretical, explanatory coherence absent from the ad hoc conjunction of STR with the claim 'there is an empirically undetectable privileged reference frame'.

The case of STR illustrates the fact that Psillos's first criterion for a claim's being involved in a theory is a special case of his second criterion (section 6). Could STR without the claim

[18] For further discussion see Putnam (1967) and Sklar (1981).
[19] Saunders (2001) p. 279.

that there is no privileged reference frame generate the same empirical success as standard STR? Is there an alternative to STR which could generate the same empirical success as standard STR? Because the scientific metaphysics here is a negative claim - there is no privileged frame of reference - to remove this metaphysical claim from STR is in a sense to consider a more expansive alternative theory.

If the viability of the Lorentz ether theory or some other presentism-friendly alternative to STR is established, this doesn't complete Undermining. Presentists must also show, from this scientifically-level playing field, how their ontology is preferable to one which takes both past and future to exist. Importantly, this argument must now be done within the assumptions already made in order to defend the Lorentz theory (or other alternative). That's to say, presentists must explain the advantages of presentism in a world in which we are unable to detect which spatially-distant events are present.

The alternative strategy, recall, is Counterargument, where presentists admit that it counts against them that STR can manage without a privileged reference frame, but argue that it has other independent advantages which outweigh the scientific support enjoyed by anti-presentism. This will be challenging, given the difficulty of establishing firm reasons for or against metaphysical views. In following either strategy, then, the prospects for presentism will depend partly upon its philosophical merits, as well as its scientific status, but these philosophical merits will have to be stronger in the case of Counterargument than they need by for Undermining.

9. Conclusions

Can science guide metaphysics? The choice between Radical Pessimism on the one hand and either Moderate Pessimism or Optimism on the other is an epistemological issue, in large part parasitic upon debates and decisions about scientific realism The choice between Moderate Pessimism and Optimism is to be taken on the basis of case-by-case examination of potential contributions of science to metaphysics. The work of scientific realists provides us with a methodology for examining such cases, and suggests rules for debate. Most crucially, defenders of traditional metaphysics challenged by science must do more than just construct an ad hoc account which renders their own beliefs empirically adequate. They must provide an independently-motivated alternative science, or else demonstrate the overwhelming philosophical merit of their view. We cannot simply dismiss the metaphysics of science as scientists' prejudices unless we work to justify this dismissal; but such work is not always doomed to fail. Science can be a guide to metaphysics, but it is not an infallible guide.

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