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SCIENTIFIC REALISM AND METAPHYSICS

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Abstract
The tendency to take scientific realism to be a richer metaphysical view than it ought to be stems from the fact that there are *two* ways in which we can conceive of reality. The first is to conceive of reality as comprising all *facts* and the other is to conceive of it as comprising all and only *fundamental* facts. I argue that scientific realism should be committed to the factualist view of reality and not, *in the first instance*, to the fundamentalist. An anti-fundamentalist conception of reality acts as a *constraint* on scientific realism, but it is a further and (conceptually) separate issue whether or not a scientific realist should come to adopt a fundamentalist view of reality. I argue that scientific realism is independent of physicalism and non-Humeanism and that the concept of truth is required for a sensible understanding of the metaphysical commitments of scientific realism.

1. Introduction

There are two ways to conceive of what scientific realism is about. The first is to see it as a view about scientific theories; the second is to see it as a view about the world. Some philosophers, most typically from Australia, think that the second way is *the* correct way. Scientific realism, they argue, is a metaphysical thesis: it asserts the reality of some types of entity, most typically unobservable entities. I agree that scientific realism has a metaphysical dimension, but I have insisted that it has other dimensions too. In my (1999), scientific realism is characterised thus:

> *The Metaphysical Thesis*: The world has a definite and mind-independent structure.
> *The Semantic Thesis*: Scientific theories should be taken at face-value.
> *The Epistemic Thesis*: Mature and predictively successful scientific theories are (approximately) true of the world. The entities posited by them, or, at any rate, entities very similar to those posited, inhabit the world.

These theses mesh scientific realism as a view about the world with scientific realism as a view about theories. They imply no deep division between the two ways of viewing scientific realism. Taking scientific realism as a view about theories is *not* metaphysically neutral. Yet, scientific realism does not imply *deep* metaphysical commitments. It does not imply commitment to physicalism or to a non-Humean metaphysics.

In 'Physical Realism', Brian Ellis takes my understanding of scientific realism to task. He takes scientific realism to be a view about the world and claims that taking it as a view about theories is wrong (and wrong-headed). He goes even further. He argues that scientific realism should be seen as a rich metaphysical world-view that commits its proponents to physicalism and non-Humeanism.

Though I think Ellis raises important challenges, I disagree with his overall perspective. I accept physicalism and am very sympathetic to Humeanism. But my prime concern here is whether scientific realism should be committed to any of these. I think it should not. These are important issues that should be dealt with independently of the issue of realism in general and of scientific realism in particular. This does not imply that there are no connections between these issues. But it is only when we put these connections into proper perspective that we see what they are.

To put my prime point in a nutshell, the tendency to take scientific realism to be a richer metaphysical view than it is (ought to be) stems from the fact that there are *two* ways in which we can conceive of reality. The first is to conceive of reality as comprising all *facts* and the other is to conceive of it as comprising all and only *fundamental facts*. I will explain these two senses shortly. But my diagnosis is that scientific realism should be committed to a factualist view of reality and not to a fundamentalist view of it. In the body of this paper I will explain and defend this view. On the way, I will argue that the concept of truth is required for a sensible understanding of the metaphysical commitments of scientific realism. I will also argue that an anti-fundamentalist conception of reality acts as a *constraint* on scientific realism, but that it is a further and (conceptually) separate issue whether or not a scientific realist should come to adopt a fundamentalist view of reality.

2. A factualist conception of reality

Ellis starts with a well-taken distinction between truth and reality. Truth is attributed to our *representations* of the world. Reality is attributed to the world. Yet, this difference does not foreclose a link between truth and reality. On the contrary, on the *factualist* conception of reality, that is that what is real is what is factual (reality being the totality of facts), there is a two-way traffic between truth and reality. Reality is the realm of facts (truth-makers)[1] and to say that a representation of it is true is to say that it represents a fact: we can go from truth to the facts and from the facts to truth.

This, we might say, is a *metaphysically loaded* conception of truth. Ellis favours a 'metaphysically neutral' conception of truth. He equates truth with epistemic rightness. But though cast in epistemic terms, this conception of truth is *not* metaphysically unloaded. Undoubtedly, judgements about the truth of a matter can (and should) be based on the empirical evidence there is for or against it. But judgements of truth are different from truth. The difference is already there in mundane cases, but it becomes forceful if we consider limiting cases. Suppose we are at the limit of scientific inquiry and claim that all evidence (empirical plus theoretical virtues) for the truth of a theory is in. Suppose we say this theory *is* true. When we reflect on this idealised situation, there are two possibilities. The *first* is that the ideal (epistemically right) theory cannot possibly be false. The *second* is that it is still possible that it is false. If we take truth to be an epistemic concept, it is no longer open to us to think of the second possibility as genuine. But this amounts to a certain metaphysical commitment permeating a seemingly metaphysically neutral conception of truth. The metaphysical character of this commitment becomes evident if we take seriously the second possibility noted above. It amounts to a possibility of a *divergence* between what there is in the world and what is issued as existing by an epistemically right theory, which is licensed by the (best) evidence or other epistemic criteria. I think this possibility captures in the best way the realist claim that truth is answerable to an independent world. (More on this in section 5). The pertinent point is that this is a metaphysi-

[1] Given the close link between propositions and facts, it's important to understand facts as the truth-makers of true propositions.

cal possibility (or a metaphysical thesis) and hence its negation (the first possibility noted above) is also metaphysical.

The foregoing possibility of divergence implies an evidence-transcendent understanding of truth. It might be argued, quite plausibly, that as a matter of fact, whatever is issued by an epistemically right theory is what *really* exists in the world. The realist can easily accommodate the envisaged possibility of convergence by taking the right side in the relevant Euthyphro contrast: Is the world what it is because it is described as thus-and-so by an epistemically right theory *or* is a theory epistemically right because the world is the way it is? At stake here is the order of dependence. Realists should go for the second disjunct. This move makes the world the determinant of epistemic rightness. But this move is not available if the conception of truth is epistemic. My first conclusion is two-fold. On the one hand, the conception of truth that Ellis favours is not metaphysically neutral. On the other hand, it is at odds with some basic commitments that realists should endorse.

I do not think that Ellis's project depends on his epistemic conception of truth. His main argumentative strategy stems from his claim that truth is not metaphysically transparent. To say that the proposition *p* is true is not yet to say *what it is* that makes it true. Or, to put it differently, it is not *ipso facto* clear what kinds of fact it commits us to.

3. A fundamentalist conception of reality

There is a kernel of truth in the claim that truth is not metaphysically transparent. To capture this kernel, let me introduce another way of conceiving reality (the first, recall, was the factualist way). We may think of reality as comprising only whatever is *irreducible*, *basic* or *fundamental*. Accordingly, reality can still be taken to be the realm of facts, but this is an *elite* set of facts. Under this fundamentalist conception of reality, the factualist conception of reality noted above is not enough to give realism. Some contested propositions are true; hence they represent *some* facts. But what facts they represent is *not* metaphysically transparent; they might represent different (more fundamental) facts than it appears. Differently put, truth is not metaphysically transparent for the following reason: a true proposition will represent some facts, but it won't necessarily represent them *perspicuously*. The very distinction between representing a fact and representing a

fact perspicuously is the kernel of truth in the claim that *truth is not metaphysically transparent*. This line of thought leads to a bifurcation: one might take a reductive or an eliminative attitude towards a set of putative facts.

Let's start with reductivism, as a form of (or a vehicle for) fundamentalism. A reductivist is not, *ipso facto*, an anti-realist. She will be an anti-realist only if she believes that the reduced facts somehow *lose* their factual status. But this is not necessarily so. If reduction is identity or supervenience, the reduced facts do not cease to be facts. On the contrary, far from having their factuality contested, the factuality of the reduced facts is legitimised. If reduction is taken to *remove* factuality, then it amounts to elimination, which is a totally different story. If elimination is taken seriously it should not be taken to imply that some putative facts are reduced to some other facts. It must be taken to imply that reality is empty of these putative facts. An eliminativist might (and most typically will) grant that there are facts in the world but she will deny that these facts are the truth-makers of the contested propositions. At the same time, an eliminativist will not necessarily deny that the contested propositions purport to refer to facts. She will claim that they *fail* to do so, since there are no relevant facts. That is, she will claim that the contested propositions are *false*. An eliminativist might also find some *use* for these false propositions, but this will not alter the claim that they are false.

If reductivism is distinguished from eliminativism, we can be clear on what reduction achieves: it removes the *sui generis* character of some facts. So for instance, there are no *sui generis* mental facts, if the identity theory of mind is true. Similarly, there are no *sui generis* mathematical facts, if logicism is true. But from the claim that '7 + 5 = 12' does not represent a *sui generis* mathematical fact it does *not* follow that it does not represent a fact. Reduction does not show that something is unreal. It shows that it is not *sui generis*. Differently put, it shows (or supports the claim) that the contested class of propositions is metaphysically *untransparent*; not that it is *untrue*. So reductivism is *not* anti-factualism.

4. Factualism vs fundamentalism

The factualist and the fundamentalist conceptions of reality are *not* the same: they are not logically equivalent. One can adopt a

factualist view without being *ipso facto* committed to the view that there is an elite class of fundamental facts (or a hierarchical structure of facts). One can be a pluralistic realist about facts. In fact, there is no logical obstacle in accepting that facts of a more fundamental level are suitably connected with facts of a less fundamental level, without thereby denying the reality of the less fundamental facts. The converse, of course, does not hold. Admitting an elite class of fundamental facts *entails* a factualist view of reality (though restricted to the truths about the elite class). But the difference between the two conceptions of reality suggests that there is need for an independent argument for the claim that facts can be divided into more and less fundamental or for the claim that the only facts there are are the members of the elite class of fundamental facts.

I take it that fundamentalism acts as a *constraint* on one's conception of reality. The primary component of realism is *factualism*. But in light of the possibility that a set of propositions may not perspicuously represent the facts, a realist about them must start with an anti-fundamentalist *commitment*. She must take it to be the case that, until further notice, she deals with *not-further-reducible* facts. To put it more linguistically, before one reads off any metaphysical commitments from a true proposition, one must choose to take this proposition at face-value. This is a commitment (hence, it can be revoked) to take truth as metaphysically transparent *in the first instance*. So though there is indeed a kernel of truth in the claim that truth is *not* metaphysically transparent, one *can* start with a commitment to its metaphysical transparency, if one starts with a factualist conception of reality and a face-value understanding of the propositions employed to represent it. Then, a *conceptually separate* debate can start. If the contested propositions turn out to be metaphysically untransparent, then a realist will not cease to be a realist if she argues that their truth-makers are not those implied by a literal reading of these propositions, provided she also holds that these truth-makers *ground* the facts that were taken to be implied by the literal truth.

If we keep the distinction between factualism and fundamentalism in mind, a number of philosophical benefits follow. *First*, we can put the realism debate in proper focus: realism is about what is real and not about what is fundamentally real. *Second*, we can become clear about the metaphysical commitments that accompany a realist stance about a certain domain: there are

genuine facts that make true the propositions of this domain. To say of a fact that it is genuine is to say that it cannot be eliminated from ontology. The right (realist) attitude for a given set of contested propositions is to start with a commitment that it *does* represent genuine facts and then to engage in the independent debate about whether they are *sui generis* or not. If it is shown that these genuine facts are not *sui generis*, if, that is, there are some more fundamental facts that render the contested propositions true, this might revise our deep metaphysical commitments but *not* our claims to truth and reality. *Third*, we can be realists about a number of domains (or subject-matters) without necessarily taking a stance on independent metaphysical issues. I would like to insist on the following point. The issue of whether some entities are basic, or derivative, or irreducible, or *sui generis*, is a *separate* concern and needs to be addressed separately. In general, it will stem from *other* metaphysical commitments that one might have, e.g., a commitment to physicalism, or naturalism, or materialism, or pluralism. *Fourth*, there is a clear sense in which one can be an anti-realist about a number of domains (or subject-matters). One will take the contested propositions at face value and *deny* that there are facts that make them true.[2] But an anti-realist need not be driven by a fundamentalist conception of reality. She need not think that the contested propositions are false because they fail to represent some *fundamental* facts. It is enough that they fail to represent any facts – more specifically, those implied by the literal understanding of them. Of course, someone might start with a fundamentalist conception of reality. But this would lead to anti-realism about a set of putative facts only if some eliminativist stance towards them was adopted.

Hence, though I agree with Ellis that 'the real work has yet to be done', I doubt that this real work falls within the (scientific) realism debate *per se*.

[2] Of course, there is another way to be an antirealist. This is to say that the propositions of the contested class are not *really* propositions: they are not apt for truth and falsity; they cannot admit of truth-values. Traditional syntactic instrumentalism, ethical noncognitivism and mathematical formalism might be classified under this view. I would call this view non-factualism (since the contested propositions are said not to be in the business of describing facts) and I would distinguish it from anti-factualism (which says that the contested propositions are *false*). But I will not discuss non-factualism further. For an important attempt to describe and challenge the metaphysics of non-factualism, see Devitt (2001).

5. Mind-independence

Plausibly, realism has been taken to assume that the real is mind-independent. This is partly for historical reasons. Realism has been taken to be opposed to idealism, the view, roughly put, that whatever exists is mind-dependent because only mental stuff exists. I think idealism is best construed as a kind of fundamentalism and that its proper contrast is *materialism*. Berkeley was an immaterialist, after all.

Though I think that a kernel of truth in the realist claim of mind-independence should be preserved, we should be clear about what this kernel is. It is not helpful to understand mind-independence in terms of some descriptions that facts should satisfy (or in terms of some characteristic that they may possess). That is, to describe the facts as physical (or material) or as non-mental does not help us understand what it is for them to be mind-independent. In support of this, let us consider the case of modern verificationists. They do *not* doubt that middle-sized objects exist and are irreducibly physical. Yet, they render their reality mind-dependent in a more sophisticated sense: what there is in the world is determined by what can be known (verified, warrantedly asserted) to exist. At stake is a *robust* sense of objectivity, viz., a conception of the world as the arbiter of our changing and evolving conceptualisations of it. It is this sense of objectivity that realism honours with the claim of mind-independence. The world is conceived as comprising the truth-makers of our propositions (allowing, of course, for the possibility that there are truth-makers for which we don't have, and may not have, truth-bearers).

How then should the claim of mind-independence be cast? It should be understood as logical or conceptual independence: what the world is like does not logically or conceptually depend on the epistemic means and the conceptualisations that are used to understand it. As noted already in section 2, this implies a commitment to the possibility of a *divergence* between what there is in the world and what is issued as existing by a suitable set of conceptualisations, epistemic practices and conditions. Modern verificationist views preclude this possibility of divergence by accepting an epistemic conception of truth. Can realists capture the kernel of mind-independence without taking a stand on the issue of truth? I doubt it, for reasons already canvassed by Taylor

(1987). If I am right in my suggestion, truth is required for realism. Realism, particularly the independence dimension in it, cannot be properly stated without reference to a non-epistemic conception of truth.

These points have an obvious bearing on Ellis's claim that realism is independent of (a substantive non-epistemic conception of) truth. Briefly put, there is no logical obstacle for a verificationist anti-realist to accept Ellis's physical realism if it is seen as issuing in claims about what exists. To ward off this possibility, a physical realist should appeal to the mind-independence of these entities (or facts, as I would put it) and, if what said above is right, this is best captured by means of a non-epistemic conception of truth.

Michael Devitt (1997), who, like Ellis, takes realism to be primarily a metaphysical position, has insisted on the claim that the doctrine of realism involves no theory of truth. What has been stressed above is that taking realism to involve a non-epistemic conception of truth captures the realist claim of mind-independence. Devitt agrees that realism involves this claim, but notes that this claim can be captured without reference to truth. He says that realists can simply deny '*all* dependencies of the physical world on our minds', allowing of course that there are 'certain familiar *causal* relations between our minds and the world' (1997: 306). This allowance of a causal interaction with the world is well-taken. Indeed, realists should presuppose it if they want to defend the possibility of knowledge of the physical world. My objection to Devitt's point is that, even if it were granted that it avoided the concept of truth in characterising realism about the *physical* world, it cannot characterise the realist stance *in general*. Someone who is a realist about morality, for instance, might concede that moral principles wouldn't exist if people with minds did not exist. So she might concede that there is a sense in which moral principles depend on minds. Yet, she could still be a realist if she thought in terms of the foregoing possibility of a divergence between what we (or people, or communities) take (even warrantedly) moral principles to be and what these moral principles are. Casting this possibility of divergence in terms of a non-epistemic conception of truth about moral principles (alongside with an acceptance of the right side in the relevant Euthyphro contrast) would secure her realism (that is, the claim that moral principles answer to some moral facts) and, with it, a certain plau-

sible understanding of the claim that moral principles are mind-independent.[3]

But can we grant that Devitt's claim avoids the concept of truth in characterising realism about the *physical* world? Devitt's realism implies certain existential commitments, and nothing more. His common-sense realism implies that cats exist, and tables exist, etc. His scientific realism implies that electrons exist and quarks exist, etc. Though existential assertions *are* existentially committing, there is an ambiguity in claims such as 'electrons exist'. The ambiguity does not concern electrons but *existence*. As noted above, a modern verificationist can (and does) accept that electrons exist. Their gloss on *existence* is that it does not make sense to talk about the existence (or reality) of electrons unless we understand this assertion to mean that . . . , where the dots are filled with a suitable epistemic/conceptual condition. Putnam's favourite replacement of the dots would be based on the condition of rational acceptability; Dummett's would relate to warranted assertibility; and Rescher's would relate to a cognisability-in-principle standard. Pretty much like realism, these views oppose idealism and phenomenalism. They entail (or at least are consistent with the claim) that material objects are real (be they the middle-sized entities of common sense or unobservable entities). The substantive disagreement between them and realism is bound to concern the *sense* of existence. In denying the anti-realist sense of existence, it is not enough for Devitt's realism to claim that electrons exist independently of all conditions an anti-realist might specify. There might be an open-ended list of such conditions (with more of those to be specified). What matters to their being *anti-realist* conditions is not that they make existence dependent on something but that they make existence dependent on suitable epistemic/conceptual conditions. It is this *core* of the anti-realist gloss on existence that realists should deny and the best way of doing it is to build into their realism a non-epistemic conception of truth.

As Devitt himself acknowledges (1997: 54, 109), existential assertions such as the above commit to the existence of the *enti-*

[3] Indeed, Devitt (2001: 591–2) has recently come very close to accepting a role for a substantive notion of truth in the characterisation of realism. It concerns what he calls 'atypical realism', the view that there are facts that make a set of propositions true but that these facts are not further explainable (or grounded). I claim that the general characterisation of realism must be broad enough to allow 'atypical' realists to be realists without any guilt.

ties they are about only if we take them at face-value. He might well be right in saying that taking them at face value does not imply that we endorse a full and developed semantic theory about them (cf. 1997: 51). It might be enough, as he says, to understand them. This is very close to the realist commitment mentioned above. But note that this commitment is not as innocent as it might seem. As stressed above, it implies that truth is metaphysically transparent *in the first instance*. So when I say that electrons exist, I take this to commit me to *electrons* and not, in the first instance at least, to something else. Semantics (and truth) enters the realist position from the front door, by issuing a literal understanding of the existential assertion.

6. What is scientific realism?

What it is to be a *scientific* realist? I now think that this question is not fine-grained enough to be *really* useful. I agree that by making a claim to *realism*, scientific realism must make a point about what there is. But how are we to understand the qualifier *scientific*? It refers to science, of course. But can we talk about science in general and what it commits us to? A coarse-grained sense that can be given to scientific realism is to say that it asserts the reality of *unobservable* entities: there are genuine facts that involve unobservable entities and their properties. But note the oddity of this way of putting scientific realism. I do not, of course, doubt that there are unobservable entities. But isn't it odd that the basic realist metaphysical commitment is framed in terms of a notion that is epistemic, or worse, pragmatic? This oddity can be explained by reference to the historical development of the scientific realism debate, and more particularly by the fact that some empiricists thought that it is problematic to refer to unobservable entities or that scientific assertions should be *epistemically* transparent by being made to refer to observable facts. These empiricist (mis)conceptions might explain why the scientific realism debate took the turn it did. But they do not justify thinking of scientific realism as having to do with the reality of *unobservable* entities.

Note also that, as it stands, the coarse-grained view of scientific realism does not commit a scientific realist to any particular unobservables. It implies only the claim that facts about unobservable entities are among the set of facts. To say something more

specific, as I think we should, (say, about electrons or tectonic plates or genetic inheritance) we need to start with a more determinate view of reality. The issue is not really whether unobservables are real, but rather whether electrons, etc., are real. To start from a more *determinate* conception of reality means to start with scientific theories (or subject-matters, if you like). We should declare our commitment to take them at face-value and make a factualist claim about them (which amounts to arguing that they are true).

This can be done at two levels of generality. The *less* general level concerns individual subject-matters, say physics or economics or biology. This is where the debate should turn. What is it to be a realist about physics, or biology or economics? I will not try to answer these questions now. But the points I made above suggest that to be a realist about a subject-matter is to take a face-value factualist stance towards it. Specific commitments to the reality of electrons, etc., follow by virtue of the two-way traffic between truth and reality. It is then clear how one can be a realist, say, about biology without also being committed to fundamentalism. Biological facts *might* be reducible to physical facts, but a) this is a separate issue; and b) it does not entail that there are no biological facts or entities.

The *more* general level concerns scientific theories (or subject-matters) in general. The question is: what is it to be a realist about scientific theories? Here the only essential difference between the less general questions asked above concerns the *scope* of the question: it is addressed to *any* scientific theory. The realist stance is essentially the same: face-value factualism. Given this level of generality, the realist commitment is to the reality of the entities posited by the theories (whatever those may be).

If I am right in this, it is *not* an accident that scientific realism starts with theories and takes the course for which I have argued in my (1999). Perhaps it was unfortunate that I called the last dimension of scientific realism 'epistemic'. I was carried away by sceptical anti-realist attacks on realism. I would now call it: the *factualist* thesis. With this in mind, my characterisation of scientific realism summarised in section 1 is not far from what I now call face-value factualism. One of its attractions, I flatter myself in thinking, is that it separates the issue of realism from the issue of fundamentalism. Besides, if we take the above line, it transpires that the issue of (un)observability is really spurious when it comes to the metaphysical commitments of realism. What difference

does it make to the factual status of claims of modern science that they are about unobservables? None whatsoever. The real issue is whether there are facts about electrons, and not whether electrons are unobservables. In a parallel fashion, the real issue is whether there are facts about tracks in cloud chambers and not that these tracks are observable.

Ellis notes that my argument for scientific realism is a two-stage one: from the empirical success of science to the truth of its theories, to the reality of the things and processes that these theories appear to describe. He raises some worries about the concept of truth (in particular about whether it can carry the 'metaphysical burden' bestowed on it by the above argument) and then suggests that there is a way to cut out the middle-man (truth) and offer a direct argument for the metaphysical thesis concerning the reality of the entities posited by science.

Let me first offer a *qualified* defence of my argument. I do not agree that I offered a two-stage argument. Instead, I offered *two* arguments. This is because I took seriously another version of anti-realism: sceptical anti-realism. Let's not quarrel about whether van Fraassen's constructive empiricism is really sceptical. The point is that there have been significant arguments challenging science's capacity to track truth. The argument from the underdetermination of theories by evidence and the pessimistic induction are the primary ones. Oversimplifying, their joint message is that the claim that scientific theories are true is not (never) warranted. Again oversimplifying, my argument from (novel) empirical successes to the truth of theories (in respects relevant to the explanation and prediction of these successes) was meant to block the sceptical onslaught. This is what Ellis considers as the first stage in my two-stage argument. But it is an independent (and distinct) argument. My current concern is not with the success of this argument (though I still think it is successful); just that it had a certain distinct aim. I admit that I *might* have taken the sceptical challenge more seriously than it deserves. But then I still think that the realist victory cannot be complete if the sceptical challenge is not met.

Yet, there was another (distinct) argument that I offered (and this corresponds to the second stage of what Ellis takes my two-stage argument to be). In fact, I offered a battery of arguments for the literal reading of scientific theories (against reductive empiricism and instrumentalism), for the claim that the realist conception of truth should not be epistemic and for the claim

that truth issues in existential commitments. I will not repeat them here. Suffice it to stress the following. Strictly speaking, what scientific realism needs is the truth of the following conditional: if scientific theories are true, then the entities posited by them are real. Its antecedent, to be sure, requires a literal understanding of theories and a non-epistemic conception of truth. So, I took it that what realists need to do is defend *literal reading plus non-epistemic truth*. And that's what I did. It is then a separate and empirical issue (taken care of by my first argument) whether the antecedent of the foregoing conditional is indeed true. If it is, by *modus ponens*, we can detach its consequent. That's how I perceive the dialectic of the two arguments I offered and the state of play in the scientific realism debate.

7. How strong is the metaphysics of scientific realism?

The real issue between Ellis and myself is whether there can be an argument for realism that avoids reference to truth. So what should this direct argument for realism look like?

Ellis is very explicit:

> For the question that needs to be addressed is this: How is the sophisticated, relatively stable, scientific image of the world that is the result of the last two or three centuries of scientific work to be explained? Don't look at it theory by theory, I say, and seek to justify the ontologies of the most successful ones in terms of what these theories are able to predict. Look at the picture as a whole (2005: p. 381).

What then should we be committed to? Ellis says:

> The emergence of this scientific image of the world really has only one plausible explanation, viz. that the world is, in reality, structured more or less as it appears to be, and, consequently, that the kinds distinguished in it (the chemical substances, particles, fields, etc.) are, for the most part, natural kinds, and that the causal powers they appear to have are genuine (2005: p. 382).

I fully agree with the *type* of argument Ellis puts forward. In fact, I think it rests on the only workable criterion of reality. It is the *explanatory criterion*: something is real if its positing plays an indispensable role in the explanation of well-founded phenom-

ena. I take it that it is primarily Sellars's (1963) criterion. Yet, there is a *difference* between the explanatory criterion and Ellis's argument. The explanatory criterion is permissive: it does not dictate the status of the facts that are explanatorily indispensable. Nor is it committed to a hierarchical conception of these facts. The explanatory criterion is at work behind well-known indispensability arguments. This is to say that reality is one thing, fundamentality is another. Differently put, it is one thing to say that *x* is real because it meets the explanatory criterion, it is quite another thing to say that *x* is *sui generis* physical, or abstract or mental. Ellis's argument runs these two things together. Otherwise, Ellis needs to offer an independent argument as to why *all* the entities the scientific image is committed to are physical. If there is such an argument, it is only in tandem with it that the explanatory criterion yields physical realism. Recall that physical realism is the view that the world is basically a physical world. As he says: 'It is a world in which all objects are really physical objects, all events and processes are physical, and in which physical objects can have only physical properties' (2005: p. 375). I happen to believe that this right. But this is not the issue we are discussing. Rather, the issue is whether this conclusion follows from Ellis's argument. I claim it does not. It needs an independent argument for physicalism.

Physicalism (for that's what physical realism amounts to) *can* be argued for independently. But it is, I take it, an important conclusion that it is independent of realism and of scientific realism in particular. Can we get an argument for physical realism from current science? Suppose we can. I see no other way of doing it, apart from taking current science (as a totality) at face-value and claiming that it is true. The argument would be something like this. Current science posits

> things belonging to an elaborate, strongly interconnected, hierarchical structure of categorically distinct kinds (of chemical substances, particles, fields, etc.), and involved in natural processes which themselves are organised in a natural hierarchy of categorically distinct kinds (Ellis, 2005: p. 382);

current science should be taken literally; current science is true; *ergo* these things are real.

In any case, I doubt that we can get a *direct* argument for physical realism from current science. Does biology imply that there are no *sui generis* biological facts, or does physics imply that *all*

facts are physical? Perhaps, physics does imply that *all* entities are physically constituted. But a fact can still be biological if there are biological properties. And I doubt that physics *implies* that there are no *sui generis* biological properties. Or, does physics imply that there are no numbers? Hardly. Ellis claims that the move from truth to reality licenses the view that all sort of things are real (platonic numbers, geometrical points, the theoretical entities of abstract model theories etc.) but argues that 'there is no plausible ontology that would accommodate them' (2005: p. 377). Here one can turn the tables on him: doesn't that show that the physicalist ontology is too narrow anyway? To avoid misunderstandings, I too favour a non-eliminativist physicalism. But I disagree with Ellis that the case for it has been settled by his argument.

Things become worse, it seems to me, if physical realism is taken to include an essentially non-Humean metaphysics. Ellis claims that the physicalism of the 1960s needs to be supplemented in various matephysically inflationary ways and takes it to be the case that the scientific image posits causal powers, capacities and propensities. But even if it can be accepted that the scientific image implies that all things are physically constituted, can it also be taken to imply that their properties are powers, that they have essential natures, that there is real necessity in nature?

The idea that scientific realism must imply some strong metaphysical commitments is fostered (at least partly) by the tendency to associate scientific realism with naturalism. To put naturalism crudely, science is the measure of what is real. If naturalism is taken in its extreme form (physicalism), the implication is that only the physical can be real. The first thing to be said here is that scientific realism is independent of naturalism. One can be a scientific realist and accept *sui generis* non-physical entities. The second thing to be said is that, though independent, scientific realism and naturalism are good bed-fellows. So the important issue is whether naturalism dictates any strong metaphysical views. If you are a naturalist you should take current physics and biology seriously. But does current science imply any commitments to essentialism, dispositions, universals, natural necessity and the like? To put the question differently: does science imply a non-Humean view of the world?

Note, first, an irony. Answering this question requires taking science at face-value. That is, it requires that science implies that there is necessity in nature, that there are causal powers, essen-

tial properties and the like. But even if this were granted, it would still remain open whether these are *sui generis* entities. As noted above, this is an independent issue. A scientific realist can accept, say, causal powers, but argue (separately and independently) that they are reducible to categorical properties of the objects that possess them.

There is not an inconsistency in believing in electrons and in Humean laws and in all powers requiring categorical bases. But it may be thought that scientific realism (or naturalism) is best viewed in tandem with a non-Humean metaphysics. For the time being, I want to remain neutral on this. I don't think science *implies* a non-Humean conception of the deep metaphysical structure of the world. If, for instance, we take the Mill-Ramsey-Lewis view of laws as offering an *objective* and *robust* view of laws (see my 2002: 292–3), then one can be a scientific realist, accept that there are contingent laws of nature and take the aforementioned view of them. Or, if one is a scientific realist, one *must* accept the existence of natural properties, but take these properties to be Lewisian natural classes. Or, if one is a scientific realist, one may accept that some properties are powers, but deny that they are ungrounded powers.[4] Or, if one is a scientific realist, one should take causation seriously but think that, ultimately, it is a relation of probabilistic dependence among event-types. Despite all this, I think a scientific realist can be open-minded in the sense that there may well be independent reasons to take a stronger (non-Humean) view of laws, properties, necessity, causation, powers and the like.

8. Loose ends

Ellis might have a point when he says that if the semantic thesis of scientific realism is taken strictly, it is false. He presents lucid arguments against commitments to numbers, geometrical points, forces and theoretical ideals (such as Carnot engines). He claims that since theories, taken at face-value, imply their existence (if true), and since these things are not real, a face-value reading of theories should be rejected. To put his point more positively, a face-value reading of theories is not discriminating enough to tell us what we should be committed to.

[4] In my (2005) I claim that current science does not commit us to the view that the properties of the fundamental particles are ungrounded powers.

I will not address separately each of the cases Ellis discusses. The *general* point that needs to be made is that the suggested face-value reading of scientific theories is a principled claim: scientific theories *can* be true or false and their truth-makers need not be any others than those implied by the literal reading of these theories. This is *not* to say that a scientific realist should be committed to the reality of everything implied by a scientific theory. Commitment to *most* of the entities posited by theories is enough. The real issue, then, is how the line is drawn. There might be a *principled* way to draw this line, but I doubt that this is part of scientific realism itself. This principled way corresponds to taking a stand in related (but distinct) metaphysical issues. If only physical entities can be real, then numbers (as abstract entities) cannot be real. If only actual things can be real, then theoretical ideals (such as Carnot engines) cannot be real. These conceptions of reality are not necessarily the ones that a scientific realist ought to have. They are independent and independently motivated.

There is, I think, a deep problem in trying to fix our ideas on a very definite conception of what is real. Seen from within, that is from the perspective on the world opened up by our theories of it, the issue we are discussing amounts to this: which of our representations represent facts perspicuously and which do not? An external answer to this question would require some *independent* access to the facts. If we knew already that there were no numbers (as platonic entities) or that there were no ideal entities (such as Carnot engines), or if we knew already that the only facts there were are physical, then we could dismiss some representations of them as non-perspicuous. But I don't thing there is such a thing as independent access to the facts. I don't mean to imply that facts cannot be known, or worse, that they are somehow constituted by our representations of them. My claim is much more banal. It is that before we raise the distinction between perspicuous and non-perspicuous representations of facts we need to take a stand on what putative facts are indeed facts and what putative facts are impostors. But given that they do not have these characters inscribed on them, we need some criterion to help us decide. My point then is two-fold. First, the best criterion available is the explanatory criterion noted above. And this, as we have seen, does not dictate a physicalist conception of facts. Second, even if we were to take another criterion of reality (e.g., that a real object is

'anything that has energy, or consists of things that have energy') this would need to be independently motivated. Someone might cease to be a physicalist if she does not accept it, but I don't see why she would thereby cease to be a scientific realist.

The issues that Ellis raises can be dealt with more *locally*. I will restrict my attention to theoretical ideals. In most cases, most typically in the case of Carnot's engine, we do have some *local* independent criteria to take them as fictitious. It is that the concept of a Carnot engine is so built that it can have no worldly *exact* counterpart. If the real world is the way science describes it to be, there cannot be worldly *exact* counterparts of the Carnot engine. This was known to Carnot himself, as well as to anybody else, and this knowledge is independent of the theory one (say Carnot) might use to explain the workings of a Carnot engine. I think this knowledge is enough to justify taking the Carnot engine to be a theoretical fiction. It's not the fact that the Carnot engine does not possess energy that makes it a fiction. After all, if it existed in nature, it would possess energy. Rather, more local and independent reasons suggest its fictitious character. But this does not imply that one cannot take literally *other* parts of the theory in which (descriptions of) the Carnot engine is embedded. Nor does it imply that one cannot take literally the theoretical description of the Carnot engine. After all, if one does not do the latter, one cannot explain why this theoretical fiction is so useful. It is useful because some worldly engine can be an *inexact* counterpart of the Carnot engine. *Inexact* counterparts of the Carnot engine are less efficient than it (that is, from the efficiency a Carnot engine would have, were it real), but their efficiency is independent of the nature of the working substance and dependent on the temperature limits through which they operate, just as the (description of) Carnot engine predicts.

The problem that Ellis raises for scientific realism is an important one. It is not always the case that entities implied by a face-value factualist view of scientific theories are real (worldly) entities. This puts the pressure on realists to show which of them are and which are not. But two things need to be noted in response to Ellis. First, realists need not steal the scientists' prerogative in this matter. It is they who tell us (the lay people) that Carnot engines and ideal gases are (useful) fictions, but electrons and DNA replication are not. Second, realists need to insist only on the (philosophical) claim that there is no reason to take *all*

scientific posits as fictions and *all* scientific facts as impostors. This is, ultimately, what face-value factualism ensures.[5]

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