

# Non-competitor Conditions in the Scientific Realism Debate

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*A general insight of 20th-century philosophy of science is that the acceptance of a scientific theory is grounded, not merely on a theory's relation to data, but on its status as having no, or being superior to its, competitors. I explore the ways in which scientific realists might be thought to utilise this insight, have in fact utilised it, and can legitimately utilise it. In more detail, I point out that, barring a natural but mistaken characterisation of scientific realism, traditional realism has not utilised that insight regarding scientific theories, i.e., has not explicitly factored that insight into, and invoked it as justification for, what realists believe. Nonetheless, a new form of realism has. In response to a key historical threat, two of the most thoroughly developed contemporary versions of realism—one put forward by Jarrett Leplin, another by Stathis Psillos—are anchored on the sensible tactic of requiring that the theories to which realists commit themselves have no competitors. I argue, however, that the particular kind of non-competitor condition they invoke is illegitimate in the context of the realism debate. I contend further that invoking a non-competitor condition that is legitimate, sensible, and even, as it turns out, required in the context of the debate threatens to eliminate the possibility of scientific realism altogether.*

## 1. The Competition Insight and Standard Scientific Realism

An important general insight from the philosophy of science of the last, say, half-century is that various commitments made with respect to a scientific theory,  $T$ —for instance, that of *accepting*  $T$ —are founded on more than  $T$ 's relation to data. Those commitments are also significantly based on  $T$ 's competitive status: roughly  $T$  must have no available competitors or be superior—in respect to criteria relevant to the particular commitment made—to those competitors that are available. The broad goal of this paper is to explore the extent to which this insight can be factored into, and invoked as justification for, the particular commitment made by scientific realists. More

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specifically, this paper will examine the way in which scientific realists might be *thought* to have utilised, *have* in fact utilised, and can *legitimately* utilise this insight regarding the importance of competition, or lack of competition, between scientific theories.

Scientific realists claim that science seeks truth—truth for realists pertaining to, not only the realm of observables, but also, significantly, to the realm of unobservables. Claiming further that science makes progress toward this goal, realists espouse a strong epistemic commitment, belief, which they claim we can justifiably direct toward scientific theories. Alongside these foundational theses, realists tend to construe the mode of reasoning employed *within science* as an inference to the best explanation—a construal that takes theory competition into account, so accords well with the above insight. Noting this, the precise way in which epistemic scientific realists *utilise* that insight may appear obvious and be expressed as follows: ‘realists claim that we can justifiably believe the theories that offer the best or only available explanation for a given set of phenomena’. On this description the realist theses cohere so well that realists may happily welcome it as accurate. And non-realists will readily attribute this view to the realist. P. Kyle Stanford, for instance, notes that the realist ‘justification for believing’ a scientific theory ‘is abductive or eliminative in character’. Describing that justification, he writes, ‘we think [*T*] offers the best available explanation for the empirical evidence we have and ... we regard rival or competing explanations of that same evidence as convincingly eliminated or discredited’ (Stanford 2006a, 122). Surprising though it may be, however, we have not properly located a way in which realists have utilised the insight regarding competition. That is, we have not properly revealed here how (or that) the above insight is factored into, and invoked as justification for, what realists believe. For here we have mischaracterised contemporary realism. Specifically, if we think that realists do, or can plausibly, espouse this position—that we can justifiably believe the scientific theories that offer the best or only available explanation for a given set of phenomena—we have ignored the implications of two crucial and, once we are reminded of them, readily granted points.

First, the theories to which realists extend their epistemic commitment are not merely those that offer explanations superior to their competitors; in fact, even theories taken to have no competitors may fail to qualify. When pressed, realists will grant that the theories they favour must, on their own, be attributed the property of being *successful*. To employ in this context Peter Lipton’s apt point, ‘the best’ must be ‘good enough’ (Lipton 2004, 56). The type of success demanded by most contemporary realists is novel success, where the relevant data are not used in the development of the theory (Leplin 1997; Psillos 1999; Sankey 2004, among others). Since not all sets of candidate theories include a theory that has attained novel success, the class of theories toward which realists are willing to direct belief is distinct from that class of theories that are merely without, or superior to, competitors. (Notice also: even if scientists themselves require that the best ‘be good enough’ by specific criteria, theories that have been accepted by scientists for being without, or superior to, competitors need not meet the realist’s more restrictive criteria for success.)

Second, even with respect to the restricted class of theories that attain novel success, we realise that few contemporary realists actually advocate *believing* those successful

scientific theories *per se*. To believe *T* is to believe that *T* is true. However, realists who are aware of even a superficial reading of the history of science will readily concede that successful theories may well be only approximately true. Even limiting consideration to the theories of contemporary science, realists are pushed to invoke (something like) approximate truth: for instance, because quantum mechanics and general relativity contradict one another, successful though they both may be, they cannot both be true; at least one is, at best, only approximately true. However, to believe that *T* is approximately true is to believe that *T* is strictly speaking false. Hence, to believe that *T* is *approximately* true is altogether distinct from simply believing *T*.

These points are subtle and ubiquitously overlooked; yet they are readily granted (once flagged) and very significant. Recognising them, it becomes clear that, to theories with a certain property, success, scientific realists claim we can justifiably attribute another property, approximate truth. And what realists claim we can justifiably believe is neither *T* nor the set of successful scientific *T*s but *something*—a second-order (or overarching) hypothesis—*about* that set. In short, realists do not claim we can justifiably believe the theories that offer the best or only available explanation for a given set of phenomena; what they claim we can justifiably believe is the *meta-hypothesis*, ‘our successful scientific theories are at least approximately true’.<sup>1</sup>

Similar points hold for the justificatory component of realism. Just as contemporary realists do not believe scientific theories themselves, the justification for realism is not that a given scientific *T* is the best theory among its competitors. That justificatory inference does not take place at the level of scientific theories. Rather, like the realist hypothesis, the justification for believing the realist meta-hypothesis is a *second-order* (or overarching) explanatory inference. Nonetheless, just as *T*’s status as, say, a theory that has been accepted by scientists is ultimately competitive (the insight with which we began), the two common variants of the realist’s *second-order* inference are fundamentally competitive. In the realist’s ‘no-miracles argument’, it is claimed that, barring miracles, aside from the approximate truth of scientific *T*s, there are *no* competing meta-explanations (let’s call them) for the success of scientific *T*s. In the *realist’s* (rather than the scientist-qua-scientist’s) ‘inference to the best explanation’, the approximate truth of scientific *T*s is said to better explain the success of scientific *T*s than any competing meta-explanations. In both of these variants of the realist inference, the realm of competition (or lack thereof) is entirely external to the domain of competition occupied by the scientific *T*s themselves.

We are attempting to locate how, if at all, realists have *utilised* the insight regarding the competitive nature of scientific *T*s. What we are discovering is that scientific realism in its standard form has not done so in any substantial sense. At the stage of the standard *realist’s* inference, only the meta-hypotheses, which *are about* scientific *T*s, are competing or being said to have no competition. The scientific *T*s themselves are not (or no longer) competing with any other scientific theories; they are simply successful. Nor, as has been indicated above, is *success* for the realist generally taken to have anything to do with competing scientific theories; it tends rather to be treated as a relation between the scientific *T*s and their respective data statements—e.g., as the relation that obtains when scientific *T*s accurately predict those data statements, or when

those data statements weren't used in the development of the scientific *Ts*, etc.<sup>2</sup> At the stage of the standard realist's inference, the *internal components* of the realist's meta-hypothesis (the correlates, the success of *Ts* and the approximate truth of *Ts*), and the *internal components* of the *overarching* explanatory inference (that which explains, the approximate truth of *Ts*, and that which is explained, the success of *Ts*) contain, in themselves, no reference to any competition between scientific *Ts*. The scientific *Ts* have been, at this stage, isolated from competition.

Putting the above considerations together: In the attempt to capture how scientific realism has employed the insight regarding competition between scientific *Ts*, we've noted that it is tempting to characterise the realist as believing those scientific *Ts* that offer the best available explanation for a given set of phenomena and to characterise the realist justification for believing those scientific *Ts* to be their status as the best or only explanations available. However, we now see that this is a mistaken characterisation of the precise belief realists maintain and of the means by which realists justify their belief. (Although this is not, in itself, meant to be a criticism of the general position taken in Stanford 2006a and 2006b, it is noteworthy that, contrary to Stanford's claims above, the justification for realism is not an eliminative inference at the level of scientific theories; the realist inference is only eliminative at the meta-level.) And traditionally, at least, realism has not utilised the above general insight about competition at the level of *scientific* theories—that varying degrees and forms of commitment embraced in respect to a scientific theory, *T*, are founded on, not merely *T*'s relationship with data, but, significantly, *T*'s lack of, or superiority over, competitors.

## 2. Non-competitor Conditions

Although traditional realism has not utilised the competition insight at the level of scientific theories, given the acknowledged importance of theory competition in various scientific commitments made with respect to scientific theories, and given that realists seek to justify the particularly strong commitment of *believing* a hypothesis *about* scientific theories, it is not surprising that recently, realists have invoked the following strategy: In their defences of scientific realism against a key historical argument, realists have packed into the *internal components* of their second-order hypothesis and second-order inference references to the scientific *Ts*' competition, or lack thereof. In contrast with standard realism, these realists explicitly utilise the insight regarding competitors; that is, they *explicitly factor* that insight *into, and invoke it as justification for*, the particular commitment they make. This strategy looks quite natural since, as just noted, at the stage of the realist inference, the favoured scientific *Ts* have already been isolated from any competition. It looks even more natural upon recognising the more specific point I will now make clear: believing the standard realist meta-hypothesis *entails* the belief that the scientific *Ts* picked out by that meta-hypothesis have no competitors that are (approximately) true.

We've seen that standard realists claim we can justifiably believe the meta-hypothesis that 'successful theories are approximately true'. Hence, of course, of a given successful theory, scientific realists claim that we can justifiably believe that

$T$  is approximately true.

Taking ‘distinct alternative’ to denote a theory such that, if it is (approximately) true,  $T$  cannot be (approximately) true, it is clear that realism requires *justification for believing* that

$T$  has no distinct alternatives that are (approximately) true.

That given, just in case  $T$  does have distinct alternatives, realism requires *justification for denying* that those distinct alternatives are (approximately) true. Of course, in the context of the realism debate, it is allowed that the empirical data we take to support  $T$  will justify our denial of the approximate truth of *some* of  $T$ 's distinct alternatives, for instance, those that fail to fit with any data. And of course it is not the latter subset that is of concern here; rather, it is the possibility of *competitors*, theories that belong to the subset of distinct alternatives and whose empirical predictions accord with  $T$ 's data. As just noted, claiming we can justifiably believe that  $T$  is approximately true, realism requires justification for believing that  $T$  has no distinct alternatives that are (approximately) true; and, since competitors stand as a subset of  $T$ 's distinct alternatives, standard realism requires justification for believing that

$T$  has no competitors that are (approximately) true.

I will trace crucial implications of this below. For now we see that, while standard realism requires justification for such a belief, the new versions of realism (mentioned above and discussed below) explicitly conjoin what I will call a non-competitor condition—a rule requiring that the scientific  $T$ s have no competitors—to the internal components of the realist meta-hypothesis. While standard realism *entails and requires* a non-competitor condition but *does not utilise* it, these sophisticated variants of realism explicitly factor a non-competitor condition *into*, and *invoke it as central to the justification for*, the particular commitment they make. This is a subtle tactic indeed: utilising a condition—within, and toward the justification of, the realist hypothesis—when realism requires (what at least appears to be something similar to) that same condition. And it is precisely the subtlety of this tactic that makes this tactic look perfectly natural and, so, appear acceptable. However, after making salient the way in which realists have employed this tactic of utilising non-competitor conditions, we will see that there are two kinds of non-competitor conditions. I will argue that, ultimately, the *particular kind* of non-competitor condition these realists employ is illegitimately invoked in the context of the scientific realism debate. I will also argue that invoking the non-competitor condition that *is* legitimate, and is in fact required of realism,<sup>3</sup> threatens to eliminate the possibility of realism altogether.

### 3. Packing Non-competitor Conditions into the Correlates of the Realist Meta-hypothesis

In the explanatory arguments for realism noted in Section 1, the correlates of the realist meta-hypothesis—the success of scientific theories and their approximate truth—become that which is explained and that which does the explaining, respectively. The

connection between them is essential. Larry Laudan (1981) has challenged that connection on historical grounds—pointing to theories positing phlogiston, caloric, a luminiferous ether, etc. The ubiquitous interpretation of Laudan’s argument is that it is a pessimistic meta-induction: from a list of past theories that were successful but which cannot be approximately true, we infer the conclusion that our present successful theories are (likely) altogether false. I’ve contended elsewhere (2002, 2006), however, that Laudan’s argument is properly understood not as a meta-induction but a meta-*modus tollens*. On this understanding, the successful theories that cannot be approximately true stand as

falsifying instances of the realist hypothesis—the non-realist’s conclusion being, not that contemporary scientific theories are false, but that the realist meta-hypothesis is false;  
 examples of ‘miracles’, hence, as challenging the argument intended to support the realist’s meta-hypothesis;  
 counterinstances to the purported explanatory breadth of realism;  
 evidence of non-realism’s explanatory breadth, since, barring genuine miracles, these successes must be explicable in some non-realist way, etc.<sup>4</sup>

This non-inductive variant of the historical argument is not threatened by the prevalent realist response of denying the legitimacy of an induction from past to present theories (a response invoked by both Leplin [1997] and Psillos [1999], two realists I will discuss below). However, it could nonetheless be answered by another general strategy employed to save realism from the pessimistic induction: In an effort to eliminate the theories on Laudan’s list, realists have been forced to modify the internal components of the meta-hypothesis they claim we can justifiably believe. Of course, in principle, one could immunise the realist meta-hypothesis by adding any number of otherwise diversionary restrictions to its internal components. My concern here, as I’ve indicated above, is the recent tendency to *pack into* the realist meta-hypothesis *non-competitor conditions*, i.e., conditions that block from that meta-hypothesis scientific theories that have competitors. And here we see the context and the way in which realists have, only recently, substantially utilised the insight with which this paper began regarding competition between scientific theories.

Since, in its basic form, the realist meta-hypothesis asserts a correlation between two properties—the success and the approximate truth of theories—there are, at least two ways one can pack non-competitor conditions into the realist meta-hypothesis. One way is embraced by Jarrett Leplin (1997). Leplin provides his own unique definition of novel *success*, imposing onto it a non-competitor (his ‘uniqueness’) condition. His two fundamental requirements ‘for the prediction of an observable result *O* to be novel for a theory *T*’ are:

*Independence condition*: There is a minimally adequate reconstruction of the reasoning leading to *T* that does not cite any qualitative generalization of *O*.

*Uniqueness condition*: There is some qualitative generalization of *O* that *T* explains and predicts, and of which, at the time that *T* first does so, no alternative theory provides a viable reason to expect instances. (Leplin 1997, 77)

In terms of the no-miracles argument, Leplin has redefined that *from which* realists make their inference—that which the approximate truth of *T* explains—success. This is one approach to packing non-competitor conditions into the realist meta-hypothesis. Another is embraced by Stathis Psillos (1999). While Psillos too specifies that success be taken to be novel success, he does not, like Leplin, employ non-competitor conditions to further define success. Instead, he packs non-competitor conditions into the other correlate of the realist meta-hypothesis. He specifies just what realists can or should take to be approximately true: specific theoretical constituents rather than scientific theories themselves. Here what is redefined is that *to which* realists make an inference—those components to be *credited with* success and whose approximate truth, in the no-miracles argument, *does the explaining*. Specifically, Psillos's non-competitor conditions are part of his definition of a constituent's 'essentiality' in bringing about a given successful prediction. 'Theoretical constituents which make essential contributions to successes are those that have an indispensable role in their generation' (Psillos 1999, 110). He asks, 'When does a theoretical constituent *H* indispensably contribute to the generation of, say, a successful prediction?' He answers:

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*. (Psillos 1999, 110; emphasis added)

Granting that we can always find a competitor or replacement for a given scientific hypothesis, Psillos elaborates his criterion further:

Clearly there are senses in which all theoretical assertions are eliminable, if, for instance, we take the Craig-transform of a theory, or if we 'cook up' a hypothesis *H\** by writing *P* into it. But if we impose some natural epistemic constraints on the potential replacement—if, for instance, we require that the replacement be independently motivated, non ad hoc, potentially explanatory, etc.—then it is not certain at all that a suitable replacement theory can always be found. (Psillos 1999, 110)

We saw in Section 1 that, barring a common but mistaken characterisation, realism has not traditionally utilised the insight with which we began regarding the importance of competition between *scientific* theories. (Again, the insight is that various commitments embraced in respect to a scientific theory, *T*, are founded on *T*'s lack of, or superiority over, competitors). However, we now see that Leplin and Psillos have recently packed into their versions of realism references to competition—or lack thereof—at the level of *scientific theories*. Notably, since Leplin and Psillos pack their respective non-competitor conditions directly into their realist meta-hypotheses (and the arguments meant to justify belief in those meta-hypotheses), and since the non-realist's historical argument stands as a refutation of the traditional realist meta-hypothesis (and its justification), their respective realist systems stand upon, and so fall with, the legitimacy of invoking those non-competitor conditions in the scientific realism debate.

#### 4. Non-competitor States and the Competitor Question at Issue in the Scientific Realism Debate

Toward an evaluation of the legitimacy of these efforts to pack non-competitor conditions into the realist meta-hypothesis, consider two types of non-competitor states (NS) that an accepted scientific theory,  $T$ , might enjoy.

$NS_1$ , a *temporally unrestricted state*: There are and can be no competitors to scientific theory,  $T$ .

$NS_2$ , a *temporally restricted state*: At time  $t$  no competitor was seriously developed, discussed, entertained, or recognised as being an alternative to  $T$ —at least as far as we can tell from our present vantage point.

Leplin's non-competitor condition includes the clause that a competing theory can *only* qualify as such if it was formulated 'when a result is first explained and predicted' (Leplin 1997, 65) by  $T$ . He is explicitly requiring a temporally restricted non-competitor state,  $NS_2$ . While Psillos's description of essentiality provides less clarity on this matter, one cannot apply his notion of essentiality to *any* constituent (in which case, one cannot be a realist at all) unless one of the options,  $NS_1$  or  $NS_2$ , is specified. For the moment, I will take Psillos's non-competitor condition to require  $NS_2$  (and will consider the possibility of his requiring  $NS_1$  in Section 6).

Let us turn to address the legitimacy of this strategy, the strategy of packing temporally restricted non-competitor conditions, those requiring  $NS_2$ , into the correlates of the meta-hypothesis that realists claim we can justifiably believe. With the historical argument, the non-realist is providing empirical evidence that the traditional realist meta-hypothesis, 'successful theories are approximately true', is false—with the implication that the traditional meta-hypothesis is not one we can justifiably believe. As noted above, one could, in principle, immunise the realist meta-hypothesis against the non-realist threat by packing into it any number of diversionary restrictions. I will argue, ultimately, that invoking non-competitor conditions that require  $NS_2$  constitutes a diversion from what is at stake in the realism debate. In this section, specifically, I will argue that these non-competitor conditions fail not only to offer an answer, but that they fail even to be *informative toward an answer*, to the question regarding competitors that is at issue in the scientific realism debate.

We may well overlook the problem if we are not clear on just which question *regarding competitors* is at stake in *that* debate. Were the competitor question in the realism debate, 'Which theory is it rational to choose?',  $NS_2$  may well be informative toward, and even offer, an answer: on the assumption that scientists should choose some theory for pursuit (an assumption, both realists and non-realists might grant), if no competitors are available at the time a choice must be made, scientists should choose the available theory. However, both sides in the realism debate take as given a positive answer to the question of whether theory choices in science are rational at time  $t$ —at least with the immediately relevant philosophers, such as Laudan and Bas van Fraassen. That given, this question fails to capture the point of contention between realists and



non-realists. And the question regarding competitors at issue in the realism *debate* is not, ‘Which theory is it rational to choose?’.

NS<sub>2</sub> might also be informative toward, or even offer, an answer were the competitor question at stake in the realism debate, ‘Which theory should be believed?’ On the assumption that some theory should be believed, if no competitors are available, the only theory available at *t* should be believed. However, upon positing this as the competitor question, an immediate problem presents itself: neither non-realists nor realists will *require* believing scientific theories *per se*. First, realists do not claim to be compelled toward, but only to be justified in, their belief. (Strictly speaking, they do not claim that scientific theories *should be* believed.) Second, as we saw in Section 1, what realists claim justification for believing is not ‘scientific theories *per se*’, but a *meta-hypothesis about* a restricted class of scientific theories—e.g. that theories (or specified parts of theories) are approximately true.<sup>5</sup> The question, ‘Which theory should be believed?’, is not one to which either side will (or should) offer an answer. It is clearly not then the question regarding competitors that is at issue in the *scientific realism debate*.

Recognising these points, we note that the last question can be modified into another toward which NS<sub>2</sub> might also be informative, or even offer an answer: ‘Which theory is a member of the class of theories that we can justifiably believe (or infer) to be approximately true?’ Again, on the assumption that some theory should be included as a member of this class, if no competitors are available, the only theory available at *t* should be included. However, non-realists explicitly deny the assumption on which this question is based. Challenging the claim that any theory belongs to the class of scientific theories that we can justifiably believe to be approximately true, non-realists will not accept that some theory should be included in this class. (We can now note that a parallel point holds for the question, ‘Which theory should be believed?’, addressed in the last paragraph.) That given, asking this question requires granting victory, in advance, to one of the positions in the debate. Without begging the question against the non-realist by assuming *some theory is to be included* in the specified class of theories, the question regarding competitors at issue in the realism *debate* is not, ‘Which theory is a member of the class of theories that we can justifiably believe (or infer) to be approximately true?’.

The competitor question we are after is one that does not require that we have already granted victory to one of the positions in the debate, one to which both sides of the debate will be willing to address, and one whose respective potential answers capture the point of contention between realists and non-realists. Cutting to the chase, since the question regarding competitors at issue in the realism debate is not about deciding between scientific theories, it is not a ‘which’ question at all. The proper competitor question at issue is *whether T has competitors such that we cannot justifiably deny that they are approximately true*. The endeavour to answer this question is neutral. In itself, it does not require that *T* is true, that *T* is approximately true, or that *T* can be justifiably believed to be approximately true; so it does not impose itself unfairly against non-realism. Yet it altogether allows that *T* is an approximately true theory and does nothing to deny that *T* could be justifiably believed to be so; hence, it does not

impose itself unfairly against realism. At the same time, it is a question both sides can and will be willing to address and whose potential answers mark the genuine point of contention. The realist answers no; the non-realist answers yes, or at least challenges the realist's answer. Finally, the discussion in Section 2 makes clear that this is the proper competitor question at issue in the realism debate: there I showed that scientific realism requires justification for believing that

$T$  has no competitors that are (approximately) true.

And, just in case  $T$  does have competitors, realism requires justification for *denying* their (approximate) truth. Hence, we arrive at the following as the question *regarding competitors* at issue in the *scientific realism* debate:

Does  $T$  have competitors whose (approximate) truth we cannot justifiably deny?

Or more carefully, as above,

Does  $T$  have competitors such that we cannot justifiably deny that they are approximately true?

Failing to recognise this as the proper competitor question in the scientific realism debate, we may well overlook the problem with invoking conditions that require  $NS_2$ , the temporally restricted non-competitor state. Were we *pressed* to choose a theory for pursuit, to believe a theory, or to specify a theory as a member of the class of theories that can we can justifiably believe to be approximately true, then  $NS_2$  may well be informative toward, or even offer, an answer to our question: no competitors being available at  $t$ , we would be compelled to select the theory available at  $t$ . But it is now clear that in the realism debate, we are addressing none of these situations and asking none of their corollary questions.

We ask, then, is the temporally restricted  $NS_2$  informative toward an answer to the question that *is* at issue—whether  $T$  has any competitors such that we cannot justifiably deny that they are approximately true? We note first that, in itself,  $NS_2$  does not offer an *answer* to this question. Since (the realist notion of) truth is not time dependent, the specific *time* at which a competitor might be developed has nothing whatsoever to do with whether  $T$  is, or whether it has competitors that are, (approximately) true. However, while  $NS_2$  does not, by itself, offer an answer, the temporally *unrestricted*  $NS_1$  does offer an answer to the realism question regarding competitors: should  $NS_1$  obtain, there can be no competing theories that are approximately true. And it appears that, were we to discover that  $NS_1$  obtains, the non-realist must surrender to the realist. That given, one might wish to say that we can justifiably take  $NS_2$  as *evidence for*  $NS_1$ , in which case we could say that  $NS_2$  at least provides *information that contributes toward an answer* to the realism question regarding competitors. Leplin hints at such an approach:

the unavailability of a rival to a theory that claims novel success *may not be a historical contingency*. There may be no rival, not because of where theorists happen to have directed their efforts or how resourceful they have been, but because [of  $NS_1$ , i.e., because] the world does not admit of any rival that can pass empirical scrutiny. Admittedly, our failure to have developed a successful rival does not establish this, but it can [justifiably] be [taken as] evidence of it. (Leplin 1997, 121)

Given the centrality of NS<sub>2</sub> to our realist's meta-hypothesis, NS<sub>2</sub> is central to just what our realist claims justification for believing. At the very least, then, our realist must offer, not merely a guess, but justification for believing that such an evidential relation obtains. I will now argue that our realist is not justified in taking NS<sub>2</sub> as evidence for NS<sub>1</sub>.

A preliminary but important problem arises here: the desired step from NS<sub>2</sub> to NS<sub>1</sub> requires, minimally, justification for believing that, from the present vantage point, we can discern that, at past time *t*, no competitors to then-accepted theories were available. (In other words, an intermediary step is required: going beyond the speculative 'as far as we can tell' [in NS<sub>2</sub>], we must, at the very minimum, *justify* the belief that *T* had no competitors at *t*.) This small but necessary step faces serious problems. Even assuming that competitors that were ignored or discarded by the scientific community were somehow published, our realist would need positive reasons for believing that, over later decades and centuries, the fringe texts containing them were reprinted and translated, or at least passed on in their original form through extant and accessible libraries. Yet this brings the further burden of justifying the view that (and perhaps an account of why) in general, past librarians and publishers worked to preserve texts articulating theories that were ignored or discarded by scientists. Assuming even that fringe texts would remain 'in the halls of academe', our realist commits to justifying the thesis that, if they were to exist, she would somehow be aware of those texts generally. And, since the theories they contain are precisely those ignored or discarded by the (past and present) scientific community, in order to ground the denial of their competitor status, it seems our realist must justifiably claim a privileged and thorough understanding of their entailed predictions and (inherent) empirical limitations. These points strongly suggest that it will be remarkably difficult to justify even the thesis that no competitors for a given scientific *T* were available at *t* (let alone the broader claim that NS<sub>2</sub> provides evidence for NS<sub>1</sub>). To put the present (preliminary) point another way: it is one thing to claim that a given historical *T* (favoured by the scientific community) enjoyed (standard) novel success; it is quite another to justify the thesis that *T* had no available competitor at *t*.<sup>6</sup> The considerations noted here offer, on the contrary, reasons to refrain from accepting, as justified, such a thesis.<sup>7</sup> And this is only a preliminary problem for the step from NS<sub>2</sub> to NS<sub>1</sub>.

Yet more pressing for the proposal that we can justifiably take NS<sub>2</sub> as evidence for NS<sub>1</sub> is the following: even if the realist could justify the thesis that *T* had no available competitors at *t*, the mere fact that scientists at *t* refrained from developing competitors does nothing to indicate that—with different interests, criteria, values, resourcefulness, and motivations—scientists could not have developed competitors.<sup>8</sup> In fact, since realists rightly impose stringent conditions on *T*, the context of these considerations is *T*'s empirical *success* rather than *T*'s empirical failure. This is crucial. Given that *T* was a successful theory, scientists would have had no reason to (and arguably had good reason *not* to) funnel their time, resources, and energy toward the development and application of competitors. (In this respect, the lack of an alternative does not constitute a 'failure', to use Leplin's term, at all.) Nor, finally, can we plausibly cite a record of genuine failure to find alternatives when the scientific community's time, resources,

and energy were directed toward their development and application. (Science has yet to freeze in its tracks.) I submit that, given the individual and especially the cumulative force of the above points, our realist cannot justifiably take  $NS_2$  as evidence for  $NS_1$ . In fact, those points stand as grounds to *deny* that  $NS_2$  is evidence for  $NS_1$ , i.e. to deny that  $NS_2$  is evidence that ‘the world does not admit of any rival that can pass empirical scrutiny’ (Leplin 1997, 121).

In the attempt to improve on traditional scientific realism, Leplin and Psillos embrace the insight with which we began, regarding the importance of competition or lack thereof between scientific theories. Given the many problems noted here, however, our realists cannot legitimately claim even that their non-competitor condition (requiring  $NS_2$ ) provides *information* that takes us *toward an answer* to the competitor question at stake in the realism debate: whether  $T$  has competitors such that we cannot justifiably deny that they are approximately true.

### 5. The Attempt to Eliminate Competition with Further Conditions, Such as Non-*Ad Hoc*ness and Independent Motivation

We’ve seen (in Section 3) that, alongside the non-competitor conditions our realists invoke, both Leplin and Psillos pack at least one additional condition into their respective realist correlates. We are prompted to ask how this strategy of conjoining such additional conditions relates to our concerns. Leplin defines success to include the ‘independence condition’. And Psillos’s definition of the essential constituents (to which we credit success and attribute approximate truth) requires of any competitor that it be non-*ad hoc*. Since Leplin’s independence condition is, essentially, the requirement that  $T$  makes use-novel predictions, and since Psillos’s non-*ad hoc*ness means, among other things, that the data predicted by  $P$  were not used in the generation of a theory or hypothesis (Psillos 1999, 106), both amount to a demand for use-novelty. Leplin is demanding use-novelty of  $T$  but not its competitors.<sup>9</sup> Psillos, however, is going further, requiring that the specific data of concern predicted by  $T$  also stand as use-novel predictions for any competitor.<sup>10</sup> In the last section I argued that  $NS_1$ , the temporally unrestricted non-competitor state, is the only non-competitor state that offers an answer, or is even informative toward an answer, to the competitor question at issue in the scientific realism debate. We must now ask, can our realist add this demand for shared novel success and (assuming no alternative theory can meet that demand) thereby justify accepting for a particular scientific theory that  $NS_1$  obtains?

While I’ve been challenging the legitimacy of packing temporally restricted non-competitor conditions into Leplin’s definition of novelty (and Psillos’s definition of essentiality), I now contend that standard use-novelty cannot legitimately be employed *to enforce* the temporally *unrestricted* non-competitor condition (on, say, the assumption that any alternative would have to accommodate  $T$ ’s novel predictions, so wouldn’t qualify as a genuine competitor).<sup>11</sup> To impose such a requirement is to insist that no theory that accommodates the specific data identified as novel for  $T$  can qualify as a genuine competitor. Yet, unless we are willing to suggest that scientists theorise with no reason for doing so, we can hardly claim of any historical theory that its author

was not mindful of, and so using, some data in conceiving of and developing the theory. Prior to applying a theory in novel ways, it is implausible that any theory (including any  $T$  we may favour) that failed to accommodate *any* data would have been taken seriously by its author, let alone by the scientific community. More specifically, exemplary hypotheses and theories such as those of Copernicus, Newton, Lavoisier, Darwin, Maxwell, Mendeleev, Rutherford, Lemaître, Gell-Mann, et al., were very explicitly conceived to accommodate significant quantities of data—data pertaining to heavenly bodies, combustion and calcination, diversity among living organisms, electrical and magnetic phenomena, the weights and chemical properties of elements, gold foil experiments, galactic redshifts, particle detectors, respectively. And while Geiger and Marsden's data accommodated by Rutherford, Hubble's data accommodated by Lemaître, and the massive amounts of data from particle detectors accommodated by Gell-Mann may have been rather new at the time they were accommodated, most of the data just noted had been well known and accumulating for centuries. Insofar as most, if not all, exemplary scientific theories accommodate at least some data, not only is  $T$  bound to share the very property our realist seeks to point to in rejecting  $T$ 's competitors, rejecting a theory as a genuine competitor merely because it accommodates some set of data leaves the realist rejecting most if not all exemplary scientific theories as unable to qualify, themselves, as genuine competitors.

Nor, moreover, can realists reject as competitors those theories that specifically accommodate data predicted in a novel way by their predecessor. For instance, while Newton's theory overthrew Kepler's elaborate theory of the *anima motrix*, Kepler's ellipse law and area law—many of whose corresponding data qualify as temporally novel predictions for Kepler's deeper theory—were very explicitly used or accommodated by Newton (1684) in arriving at his law of universal gravitation. (For details on both the novel successes of Kepler's theory and the use of Kepler's laws by Newton see Lyons 2006.) More generally, it is clear that the mere fact that a specific set of data is novel for  $T$  does not confer to that set of data some intrinsically distinctive quality; it does not endow that set of data with a nature such that, for *any* theory to be acceptable, that theory must predict that set of data in a *novel* way. Finally, of course, while the realist may be tempted to accord  $T$  a special status for predicting some set of data in advance of the development of an alternative, the truth itself does not 'care' just which is the theory at which *we* first arrive.

With the last point, it is imperative that we not forget what has been emphasised above. When considering competitors in the context of the realism debate, we are not asking which theory should be chosen for pursuit; nor are we assuming that some theory must be believed and asking just which among our theories should be believed, etc. Rather, as we've seen, the competitor question at issue in the realism debate is whether  $T$  has competitors such that we cannot justifiably deny that they are (approximately) true. And the specific question we now ask is whether we can justifiably deny the (approximate) truth of theories that accommodate a particular set of data. Very clearly we cannot. Being true (or approximately true) is, for the realist in particular, a property that a theory or hypothesis or statement has or does not have independently of what *humans do*. What humans do—e.g., the way in which humans develop the

theory, which data they draw on in formulating the theory, ‘the reasoning leading to  $T$ ’ (Leplin 1997, 77), etc.—has no effect on whether or not a theory is in fact (approximately) true. In fact, realists cannot but grant that, were one to accurately *describe* well-known and accurate data, one’s description would not only accommodate those data, it would also be true. Coupling this point with what we have noted above, that most if not all exemplary theories accommodate some data, no reflective member of the debate will or can accept that a theory that accommodates some or even all of its data cannot be (or is even unlikely to be, or can be justifiably denied to be) approximately true. And since the only pertinent concern is (approximate) truth, even assuming that alternatives to  $T$  would be limited to accommodating the relevant data, a demand for novelty or non-ad hocness (especially when required of the very same data novel for  $T$ ) cannot be legitimately invoked to eliminate those theories as genuine competitors. The novelty requirement—the requirement that the specific data of concern predicted by  $T$  must also stand as a use-novel prediction for any competitor—cannot then be imposed in an effort to ensure that a favoured scientific  $T$  meets  $NS_1$  (i.e., the only non-competitor state that is even informative toward an answer to the competitor question at issue in the realism debate). Because nothing about accommodation precludes truth, an accommodating competitor is exactly as significant a threat to scientific realism as a non-accommodating competitor. In fact, we cannot even justifiably deny the (approximate) truth of those competitors of whose details we are (largely) unaware. Provided one can give even a basic outline to reveal that a competitor is available, questions of when, how, and even whether it has been or will be generated provide no basis for denying a competitor’s (approximate) truth. Hence, such questions have no bearing on the competitor question relevant to the realism debate.

More broadly, we saw in Section 3 that, in order to dismiss the worry that ‘we can always “cook up” a competitor ‘by writing P into it’, Psillos invokes a set of what he calls ‘natural epistemic constraints’. He suggests, ‘we require that the replacement be independently motivated, non ad hoc, potentially explanatory, etc.’ (Psillos 1999, 110). However, given what we’ve just seen regarding use-novelty, it should be clear that, even if motivating factors, ad hocness, and the property of being ‘cook[ed] up’ bear on questions of theory choice—and even if they bear on the question of which theory we should believe, assuming that we should believe some theory—these requirements have no bearing on whether or not a theory is in fact (approximately) true. As above, we clearly cannot justifiably deny the (approximate) truth of competitors based on the way in which they are attained. Regarding the concern with motivations specifically, one need only consider here the contemporary proposal that Einstein’s self-admittedly ad hoc and ‘cooked up’ cosmological constant may have been no ‘blunder’ at all, revitalised as it has now been in the form of dark energy. Pauli’s neutrino postulate, unable to be ‘independently’ tested for decades, was very explicitly ‘motivated’ by nothing ‘independent’ of beta decay experiments—Pauli himself allegedly confessing that he had ‘done a terrible thing’. Yet no one in the debate will be willing to *deny* the (approximate) truth of these hypotheses merely because of the initial motivations that prompted their postulation. Hence, in the realism debate specifically, Psillos’s imposed constraint on the motivations of theorists cannot be legitimately employed to eliminate competitors.

Still to be addressed however is Psillos's demand that competitors be 'potentially explanatory'. The realist must not only clarify just what this vague property is, but must also show both that (approximate) truth *requires it* and that 'cooked up' competitors *cannot possess it*. If being 'potentially explanatory' pertains, on one hand, to the steps taken in theorising, it suffers the same fate as the three conditions just mentioned (which themselves, it will be noticed, are often considered 'explanatory' virtues). If, on the other hand, it is meant to denote a syntactic relation between a theory and data statements, then there is no reason to think that a competitor—no matter how we cook it up—cannot also enjoy that syntactic relation. Nor without far greater specification of what this property is could we justifiably *deny the approximate truth* of theories lacking that syntactic relation to data statements. (In fact, in line with a point made above, a large set of complicated statements that *accurately* describe a vast array of objects in the world may well be devoid of explanatory virtues; yet clearly the latter fact would not preclude the truth of that statement set.) Even if Psillos's proposed constraints were to pertain to which theories are, or even should be, chosen by scientists, etc., those constraints fail to justify denying the approximate truth of the very competitors whose existence Psillos grants. (See Lyons 2006, section 2, for a distinct yet supplementary critique of Psillos's specific criterion.) That given, even if we assume that no alternative theory can meet those conjoined conditions, those conditions fail to provide any indication that  $NS_1$  obtains— $NS_1$  being, as we saw in Section 4, the only non-competitor state that is even *informative toward* an answer to the competitor question at issue in the realism debate.

## 6. A Brief Diagnosis and Comments on the Implications of Requiring a Temporally Unrestricted Non-competitor State

In the face of the non-realist's very direct historical challenge against the realist's empirical meta-hypothesis (and the realist argument put forward to justify believing that meta-hypothesis), what our realists have invoked, albeit, perhaps, inadvertently, are conditions that, it now appears, serve only to divert us from what is at stake in the realism debate. To offer a few diagnostic comments, I suggest that, seeking to forge out a realism that is not refuted by the historical argument, our realists have packed into their meta-hypotheses remnants from other discussions in the philosophy of science—most notably discussions regarding the rationality of theory choice, discussions regarding the sorts of theories the scientific community tends to favour, etc. Yet it is a non-issue in the realism debate to claim that, at  $t$ , there was no alternative theory, or better alternative theory, available. For the realism debate occurs when time  $t$  has already passed,  $T$  has already been accepted (perhaps, partially replaced), more evidence has been obtained, etc. The core question is whether we can justifiably believe that a set of those rationally selected theories—those theories that both sides in the realism debate agree were, at their respective times, the best and possibly only available—are approximately true. Further, drawing on vague intuitions about some of the non-empirical properties of theories that the scientific community tends to prefer (but, as I've indicated above, apparently does *not require*), we've now seen that

realists unacceptably seek to go much further and *exclude* from the domain of competition theories that do not possess those qualities, in effect, and as we've now seen, illegitimately denying the approximate truth of those theories. More generally, moving from issues regarding the rationality of theory choice—in which, as we've seen, both realists and non-realists might accept the assumption that some scientific theory must be chosen—realists casually step to the issue of belief. Erroneously assuming a continuum, perhaps, they drag into the realism debate conditions inspired by discussions about theory choice, such as temporally restricted non-competitor conditions. Introducing these conditions, it now looks as though they tacitly and inadvertently bring along an assumption which, although arguably parallel to the agreed upon assumption 'some theory must be chosen', is one the non-realist patently denies: (something to the effect that) *some theory must be specified as a member of the class of theories we can justifiably believe (or infer) to be approximately true.*<sup>12</sup> As we saw in Section 4, invoking such an assumption in the course of attempting to save realism from the non-realist's historical refutation requires that realism be granted victory in advance. It is clearly, then, an illegitimate move in the context of the realism debate.

Setting the quest for a more thorough diagnosis to the side, let us now simply take Psillos at his word that 'we can always "cook up" a competitor 'by writing P into it'. Assuming this to be so, our realist is in serious trouble. First, adding to the set of objections made earlier against Leplin, the lack of a competitor at  $t$  can never be taken as evidence for the lack of a competitor *tout court* simply because the latter never obtains: at least as far as Psillos concedes, every theory will have competitors. Second, it is now clear that, insofar as the realist wishes to introduce non-competitor conditions that are informative toward an answer to the competitor question at issue in the realism debate, they must be temporally unrestricted: they must require the state captured in  $NS_1$ , 'there are and can be no competitors'. (As noted in Section 4, in contrast with  $NS_2$ , the temporally *unrestricted*  $NS_1$  is informative toward, and in fact offers an answer to, the relevant question regarding competitors.) However, with no way to justifiably deny the approximate truth of Psillos's 'cooked up' competitors, a realist who invokes the non-competitor condition that is truth informative (requiring  $NS_1$ ) can simply never find a theory about which to be a realist, rendering realism impossible. (We now see the consequence of taking Psillos's conditions to require  $NS_1$ .) Recalling that non-competitor conditions requiring  $NS_2$  fail even to offer information toward answering the relevant competitor question, it appears that the strategy of explicitly packing non-competitor conditions into the realist meta-hypothesis cannot serve to protect realism.

But in fact, the news is much worse than has yet been explicated. As we saw in Section 2, realism entails and hence *requires* a non-competitor condition. As noted there, this fact makes the strategy of invoking a non-competitor condition appear perfectly natural. However, what realism entails is a temporally *unrestricted* non-competitor condition, one that requires the state captured in  $NS_1$ . The problem, then, is not merely that a temporally restricted non-competitor condition, one requiring  $NS_2$ , fails to offer *information toward an answer* to the relevant competitor question (or that 'past  $T$  had no competitors at  $t$ ' is practically if not wholly immunised from refutation—see note 7



and its context in Section 4). Nor is the problem merely that, *if* realists *were* to invoke the non-competitor condition (one requiring  $NS_1$ ) that is truth informative, realism *would be* rendered impossible. Rather, because realism entails and so requires an  $NS_1$  non-competitor condition, there is no *if* about it. Accepting that there are competitors whose approximate truth we cannot justifiably deny, *realism*—requiring as it does that we can justifiably deny that there are any such competitors—*is refuted*. Above I challenged the legitimacy of invoking an  $NS_2$  non-competitor condition; to bring those challenges to completion here, we now see that, ultimately, invoking such a condition stands as little more than an empty gesture or mere lip service toward what realism actually entails—and, upon accepting that there are competitors, the refutation realism thus faces. In other words, although the above concerns have been unfolded in response to, and in the context of, a particular realist strategy (that of explicitly invoking non-competitor conditions), the threat now revealed extends well beyond that particular strategy. It strikes at the very heart of standard contemporary realism, irrespective of whether the truth-informative non-competitor condition, one requiring  $NS_1$ , is *explicitly* invoked in the realist meta-hypothesis. Since realism entails or requires an  $NS_1$  non-competitor condition, no theories or constituents qualify for the meta-hypothesis that our realists claim we can justifiably believe.

Setting aside the strategy of including non-competitor conditions in an overarching realist meta-hypothesis, let us, for the sake of completeness, recall the possibility (discussed in Section 1) of simply advocating belief in the scientific explanations for which there are no relevant competitors, i.e., the (much simpler) possibility of believing the only or best explanation for a given set of data. We now see that, if, as above, we accept that there are competitors, and if ‘only/best explanation’ requires  $NS_1$ , we cannot claim that any theory has ever qualified. Moreover, as we saw in Section 1, the mere ‘explanation of data’ does nothing in itself to restrict success (to, for instance, novel success), and to believe those explanations themselves is to believe that they are true (rather than say approximately true). Hence, barring any overarching qualified hypothesis and opting instead to believe the only or best (scientific) explanation for a given set of data commits one to the simple or unqualified thesis that ‘our only or best (scientific) explanations for given sets of data are true’. Having eliminated  $NS_1$ , as well as any restrictions on success, the most we can say in favour of each of our best explanations is that  $NS_2$  obtains. Yet, we’ve now seen that  $NS_2$  is not even *informative toward an answer* to the question of a theory’s truth (or for that matter approximate truth), the question at issue in the realism debate. And, finally, since this simple or unqualified thesis is unequivocally refuted by the meta-*modus tollens* (discussed in Section 3), at nearly every turn in the history of science, we must recognise that the simple unqualified thesis is wholly untenable.<sup>13</sup> Having now considered the use of non-competitor conditions as invoked in each correlate of an overarching realist hypothesis *and* at the level of the inferences made in science, it looks as though we’ve exhausted the pertinent ways in which realists might utilise non-competitor conditions. Surprisingly, perhaps, employing such conditions fails to offer any legitimate benefit to realism.

While I have not argued here that for any theory or hypothesis there are competitors, I confess that I agree with Psillos that there are. And although I have not explicitly been

concerned with the argument from the underdetermination of theories by data, I suggest that realist defences against that argument are in worse shape than we may have thought. The problem, as I see it, is that we have (often) been tacitly and wrongly asking questions flagged above as irrelevant to and illegitimate in the realism debate—asking which theory should be chosen for pursuit, which theory should be believed, or which theory is a member of the class of theories that we can justifiably believe (or infer) to be approximately true. For instance, realist articulations of the underdetermination argument commonly include a premise asserting, “empirically equivalent rivals are equally believable” (as found, for instance, in Kukla 1998, 58). But it is now clear that the relevant and legitimate question regarding competitors is, not, for instance, which theory should be believed, but instead whether a given scientific *T* has competitors such that we cannot justifiably deny that they are approximately true. And, as we’ve now seen, commonly imposed conditions regarding, say, the non-accommodation of data and the motivations of scientists cannot justify denying that competitors are approximately true.

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### Notes

- [1] It is important to remain mindful that this point is being made in an attempt to locate how, if at all, scientific realists utilise the insight regarding competing scientific theories. Notice that nothing here bars the realist from believing meta-hypotheses that attribute truth *simpliciter* to *certain parts* of *T* (and which, at the same time, refrain from attributing truth to other parts of *T*): as a consequence of believing a meta-hypothesis, realists may very well believe that some parts of *T* are true *simpliciter*. (Of course, to claim justification for believing those parts, realists must specify just which parts do and do not so qualify, and I will address a sophisticated proposal of a similar kind below.) Recognising this does nothing to hinder my claim that realists do not believe *T per se*. And, as we will see, the latter point brings clarification on how, if at all, the competition insight is utilised by (standard) scientific realism.
- [2] While embracing the no-miracles argument may ultimately entail holding that any *Ts* enjoying novel success can have no genuine competitors that also enjoy novel success, that success, in itself, does not pertain to competition.
- [3] As should be clear here, at no stage will I be denying that it is legitimate for realists to employ a non-competitor condition. I fully agree that they should and, for reasons just noted, even that they must.
- [4] Notice furthermore that modifying the realist meta-hypothesis to pertain to ‘most successful theories’ conflicts with the realist arguments themselves, conceding as it does to successes that are miraculous, or at least, for which there are better explanations. Moreover, the list of counterinstances directly challenges the common realist claim that the methods of science

- (such as inference to the best explanation) are reliable guides to truth. It is clear then that invoking the premise, 'the methods of science are reliable guides to truth', in any *defence* against the historical argument requires that realism be granted victory in advance.
- [5] In accord with note 1, these points hold irrespective of whether some meta-hypothesis (regarding say approximate truth) might as a consequence license belief in (even the truth of) some specific parts of theories.
  - [6] In the post-Kuhnian era, we have come (or at least begun) to recognise as skewed the historical perspective offered by science textbooks, as well as many texts dedicated to the history of science. And, when it comes to the question of whether there were competitors at *t*, we cannot justifiably ignore our recognised tendency toward presentism or whiggism.
  - [7] Also, and crucially, noting here the extraordinary difficulty in identifying even one instance of a past theory that had no competitors at *t*, we see that a realist meta-hypothesis containing such a requirement is rendered practically if not wholly immunised from the possibility of refutation. As a result, the legitimacy of such a meta-hypothesis as a response to the historical challenge is dramatically diminished, if not negated.
  - [8] In the next section I will address the proposition that realist's can justifiably deny a competitor's (approximate) truth by appealing to criteria such as non-*ad hoc*ness.
  - [9] For Leplin, the alternatives need not, themselves, meet all the strict details of his independence condition (Leplin 1997, 75). So I am here considering a demand stronger than any Leplin imposes.
  - [10] Since Psillos also packs novelty into his definition of success, we now see something we might otherwise fail to notice, that, in Psillos's desire to protect realism from the historical threat, he has packed a demand for novelty into *both* correlates of his realist hypothesis.
  - [11] It is important to recognise that the issue of concern here is *not* whether standard novelty can be employed to define *T*'s success in the realist's meta-hypothesis and no-miracles argument. (I am not denying here that it can.) What is at issue here is quite distinct: whether, in the context of the realism debate, novelty can be legitimately invoked to *eliminate* alternative theories as genuine competitors (And I will contend that it cannot.)
  - [12] Put another way, we might construe the realist as asking, under what conditions would it be reasonable to believe or infer a theory to be approximately true? (I'm indebted to David Harker for suggesting this sort of phrasing.) We see, however, that, in asking this, realists are presupposing that such a belief or inference is reasonable and, hence, requiring that victory against non-realism has been achieved prior to addressing the non-realist's challenge.
  - [13] From the standpoint of the distinction made in Section 1 and revisited in this paragraph, the 'argument from underconsideration' (Lipton 2004) can be seen (at least in its explicit form) as challenging a realism grounded on eliminative inferences at the level of scientific theories. Wray (2008) offers a recent defence of that non-realist argument that also draws briefly on the historical threat.

## References

- Kukla, A. 1998. *Studies in scientific realism*. New York: Oxford University Press.
- Laudan, L. 1981. A confutation of convergent realism. *Philosophy of Science* 48: 19–49.
- Leplin, J. 1997. *A novel defense of scientific realism*. Oxford: Oxford University Press.
- Lipton, P. 2004. *Inference to the best explanation*. London: Routledge.
- Lyons, T. D. 2002. Scientific realism and the pessimistic meta-*modus tollens*. In *Recent themes in the philosophy of science: Scientific realism and commonsense*, edited by S. P. Clarke and T. D. Lyons, 63–90. Dordrecht: Kluwer.
- . 2006. Scientific realism and the *stratagema de divide et impera*. *British Journal for the Philosophy of Science* 57: 537–560.

- Psillos, S. 1999. *Scientific realism: How science tracks truth*. London: Routledge.
- Sankey, H. 2004. Scientific realism: An elaboration and a defence. In *Knowledge and the world: Challenges beyond the science wars*, edited by M. Carrier, J. Roggenhofer, G. Küppers, and P. Blanchard, 55–74. Berlin: Springer.
- Stanford, P. K. 2006a. Darwin's pangenesis and the problem of unconceived alternatives. *British Journal for the Philosophy of Science* 57: 121–144.
- . 2006b. *Exceeding our grasp: The problem of unconceived alternatives*. New York: Oxford University Press.
- Wray, K. B. 2008. The argument from underconsideration as grounds for anti-realism: A defence. *International Studies in the Philosophy of Science* 22: 317–326.