

Lingnan University

Digital Commons @ Lingnan University

Staff Publications

Lingnan Staff Publication

2013

Three paradigms of scientific realism : a truthmaking account

Jamin ASAY

Lingnan University

Follow this and additional works at: https://commons.ln.edu.hk/sw_master



Part of the [Philosophy of Science Commons](#)

Recommended Citation

Asay, J. (2013). Three paradigms of scientific realism: A truthmaking account. *International Studies in the Philosophy of Science*, 27(1), 1-21. doi: 10.1080/02698595.2013.783971

This Journal article is brought to you for free and open access by the Lingnan Staff Publication at Digital Commons @ Lingnan University. It has been accepted for inclusion in Staff Publications by an authorized administrator of Digital Commons @ Lingnan University.

Three Paradigms of Scientific Realism: A Truthmaking Account

Forthcoming in *International Studies in the Philosophy of Science*

Jamin Asay
Lingnan University
jaminasay [at] ln.edu.hk

Abstract

This paper investigates the nature of scientific realism. I begin by considering the anomalous fact that Bas van Fraassen’s account of scientific realism is strikingly similar to Arthur Fine’s account of scientific non-realism. To resolve this puzzle, I demonstrate how the two theorists understand the nature of truth and its connection to ontology, and how that informs their conception of the realism debate. I then argue that the debate is much better captured by the theory of truthmaking, and not by any particular theory of truth. To be a scientific realist is to adopt a realism-relevant account of what makes true the scientific theories one accepts. The truthmaking approach restores realism’s metaphysical core—distancing itself from linguistic conceptions of the debate—and thereby offers a better characterization of what is at stake in the question of scientific realism.

1. Introduction

Here is a puzzle. According to Bas van Fraassen, to take a realist attitude toward science is to think that scientific theories aim at a literally true story of what the world is like, and that in accepting a scientific theory one believes it to be true (1980: 8). According to Arthur Fine, to take a *non*-realist attitude toward science is to take scientific theories “into one’s life as true, with all that implies concerning adjusting one’s behavior, practical and theoretical, to accommodate these truths” (1984b: 95-96). Constitutive of both positions is believing that the scientific theories one accepts are true. Where Fine sees quietism—an abandonment of both scientific realism and anti-realism—van Fraassen sees realism. How is this possible?

The key to understanding this puzzle involves uncovering the presuppositions about truth and ontology that Fine and van Fraassen bring to their differing construals of scientific realism. Fine argues that what turns his non-realist attitude into either a realist or anti-realist attitude is a particular theory of truth; in so doing, he places a burden on the theory of truth that it cannot bear. Van Fraassen presupposes a certain kind of connection between truth and ontology, and so sees realism where Fine—who rejects that connection—does not. Both thinkers come close to the truth about scientific realism; I shall take what is valuable from their accounts and construct a better understanding of what is at stake between scientific realists and their opponents. The trick to doing so is to appreciate the role that *truthmaker theory* can play in discussions of realism. Truthmaker theory shows the way to understanding how truth depends upon reality; as a result, it is perfectly suited for navigating the treacherous waters of scientific realism.

This paper explores what I call the three paradigms of scientific realism. There is the *truth-mongering paradigm*, which reduces the realism debate to a theory about the nature of truth. There is the *epistemological paradigm*, which sets up the debate in terms of the right epistemic attitude to take toward science. And, finally, there is the *metaphysical paradigm*, which construes the debate as one over how to interpret the metaphysical foundations of scientific theories. I advocate the third paradigm. Realism debates are about reality, and a thoroughly metaphysical enterprise like truthmaker theory is the best means for understanding what is at stake in the debate.

Truthmaker theory contributes to the topic of scientific realism in a number of ways. First, it provides the most tenable answer as to what is at stake in the debate, as offered by the metaphysical paradigm. As a result, it offers a better taxonomy of the terrain, not only accurately locating views on the appropriate side of the realist/anti-realist divide, but also explaining *why* they belong on the side they do. Also, by correctly identifying what is at stake in the question of scientific realism, the truthmaker theorist reveals that certain attitudes toward science—Fine’s non-realist attitude in particular—are untenable. Finally, by showing that the issues underlying scientific realism are alive and well, the truthmaker theorist can make a case for the relevance and importance of the debate, and so provide an answer to skeptics who seek to abandon the question of realism altogether.

2. The Truth-Mongering Paradigm

The truth-mongering paradigm reduces the debate over scientific realism to a debate regarding the nature of truth. The truth-mongering theorist not only thinks that certain views about realism require taking on a particular stance regarding truth, but also that the question of realism *just is* a question of which theory of truth is correct. Nothing separates the realist, the anti-realist, and the quietist besides their respective views on truth. The principal defender of the truth-mongering approach is Arthur Fine (1984a, 1984b, 1986). Fine’s portrayal of the debate bears an appealing theoretical simplicity. Common to all parties to the debate, Fine holds, is a rather “homely” attitude about science. This attitude—the *natural ontological attitude*, or NOA (pronounced as in ‘Noah’)—holds that “it is possible to accept the evidence of one’s senses and to accept, *in the same way*, the confirmed results of science” (1984b: 95). When I see an echidna in front of me, I believe that there is an echidna in front of me. Similarly, if science tells me that echidnas are made of atoms, then I believe that echidnas are made of atoms. NOA prescribes that I take the same attitude toward scientific findings that I do toward the ordinary observations I make with my own senses. NOA takes the findings of science at “face value”.

According to Fine, realists, anti-realists, and quietists alike can agree that our best scientific theories are (at least approximately) true. What distinguishes the various positions is what they add to the core doctrine of NOA. The realist adds a correspondence theory of truth: “The realist adopts a standard, model-theoretic, correspondence theory of truth; where the model is just the definite world structure posited by realism and where correspondence is understood as a relation that reaches right out to touch the world” (Fine 1984a: 52). The anti-realist adds some sort of pragmatic or epistemic theory of truth: “The antirealist may add onto the core position a particular analysis of the concept of truth, as in the pragmatic and instrumentalist and conventionalist conceptions of truth” (Fine 1984b: 97; see also Fine 1986: 157). The right attitude to take toward science, Fine argues, is simply NOA itself and nothing more. The basic idea is that if we want to understand the practice of science, we should take it simply on its own terms, and not try to add to it various philosophical theses; in particular, we should not attach any philosophical theory about the nature of truth. Hence, Fine writes: “NOA is inclined to reject *all* interpretations, theories, construals, pictures, etc. of truth, just as it rejects the special correspondence theory of realism and the acceptance pictures of the truth-mongering

anti-realisms” (1984a: 62).¹ NOA all by itself, unadorned by any philosophical theses, is the right attitude to take toward science: it is an understanding of scientific inquiry that is neither realist nor anti-realist.²

Other philosophers have argued (or even just assumed) that particular theories of truth are essential to particular views about realism.³ My goal is to diagnose, with an eye explicitly directed toward truthmaker theory, why the truth-mongering approach to scientific realism is incorrect. But there is plenty to be said in criticism of the truth-mongering approach independently of truthmaker theory.⁴

A first problem with the truth-mongering approach is that it turns the question of realism into a question of something else: *scientific* realism turns out to have nothing in particular to do with the philosophy of *science*. For Fine, realism is NOA plus a correspondence theory of truth. NOA is not up for debate; everyone who’s epistemically sensible embraces NOA, realist, anti-realist, and quietist alike. As a result, the truth-monger argues against realism and anti-realism simply by arguing against correspondence and epistemic theories of truth. There is no need to engage the arguments from underdetermination (e.g., Psillos 1999: 156-176), the pessimistic induction (e.g., Laudan 1981), the irrationality of scientific revolutions (Kuhn 1962), or the no-miracles argument (Putnam 1975). All we need to do to solve the realism debate in the philosophy of science is come to sensible conclusions about the nature of truth, an inquiry far removed from the philosophy of science.

Secondly, by turning scientific realism into something else, the truth-monger encounters what we may call the problem of inadvertent (anti-)realism. One of Fine’s main contentions is that science does not need to be supplemented by any philosophical theorizing. It does its task just fine without any help from philosophy. Let us admit the point. But we can be interested in the nature of truth for its own sake, not because we are interested in the nature of scientific

¹ Notice that I think it is Fine himself who is the truth-monger, for he thinks that truth is the notion that bears all the weight in the debate. I find it ironic that someone like Fine, who has a rather deflationary attitude about truth, puts so much theoretical weight on it nonetheless.

² Interestingly, Fine’s fellow truth-monger Putnam refers to just this kind of attitude as a species of realism. See Putnam 1975-1976: 193. For more truth-mongering, see Putnam 1982, Ellis 1985, and Jardine 1986.

³ See, e.g., Bonjour 1985: 160, Railton 1986, Wright 1986 and 1992, Fales 1988, Jennings 1989: 240, Matheson 1989, Bigelow and Pargetter 1990: 442, Musgrave 1996: 23, Timmons 1999: 36, Taylor 2006, Williams 2006, and Lynch 2009.

⁴ See also Jennings 1989: 237, Musgrave 1989, and Psillos 1999, chapter 10. For discussion and criticism of Putnam’s truth-mongering internal realism, see Field 1982, Newton-Smith 1989, Davidson 1990: 307-309, Sosa 1993, van Fraassen 1997, and Niiniluoto 1999.

inquiry. Theories of truth can be motivated independently of any interest in any realism debate. And once such views are formulated and defended, they will apply in any domain of thought possessed of any truth. Science is one such domain, at least in the eyes of any NOAer (pronounced as in ‘knower’). Hence, we accept science as providing us with some truth about the world (even if not the whole truth). Completely independently, we may come to have views about the nature of truth, which then apply to the truths we find in science as much as anywhere else. Here we just have two distinct things—the findings of science, and the findings of the theory of truth—overlapping in the appropriate places. Does science *forbid* us from asking about the nature of truth? Of course not. We may grant Fine’s point that science doesn’t *force* us to ask such questions. But if science involves making true claims (as NOA says it does), then the best theory of truth applies to those claims. Consequently, NOAers who for independent reasons accept certain views about the nature of truth will find themselves saddled with an inadvertent commitment to realism or anti-realism.

A third preliminary reason to be dissatisfied with the truth-mongering paradigm is that it makes it quite difficult to engage in local applications of realism. If realism or anti-realism about some domain requires adopting a particular theory of truth, then being a non-globalist about realism debates requires being a non-globalist (i.e., pluralist) about truth. For example, suppose I am a scientific realist but a moral anti-realist. As a scientific realist, I accept the natural ontological attitude for science and embrace a correspondence theory of truth. But when it comes to ethics, I am an anti-realist. Presumably, moral realism for the truth-monger is just a combination of the “natural ethical attitude” with a correspondence theory of truth. To maintain my ethical anti-realism, I must reject either the correspondence theory of truth for ethics (in which case I am forced to adopt a pluralist position about truth), or the natural ethical attitude, which presumably would involve accepting something like an error-theoretic attitude toward the domain. Now, these consequences do not refute the truth-mongering approach. Some philosophers defend pluralist conceptions of truth (e.g., Wright 1992 and Lynch 2009), and some embrace error theories (e.g., Mackie 1977 and Joyce 2001). Indeed, the truth pluralism of Wright and Lynch is motivated by their pluralism about realism debates. My point is merely that we should not constrain our choices so heavily from the outset. We need a more subtle understanding of the relationship between truth and realism. The crude identifications of the truth-mongering approach cannot handle such subtlety.⁵

⁵ Moreover, we may want to adopt localized realism *within* a domain. We might want to be realists about particles, say, but not fields. Such narrowly localized views are even harder to maintain for the truth-monger. (Thanks go to Marc Lange on this point.)

The fourth and final reason to reject the truth-mongering paradigm—and here we may segue into the discussion of truthmaking—is that it leaves no conceptual room for those who reject both correspondence and epistemic theories of truth, but yet do not give up altogether on the theory of truth. Specifically, it ignores *deflationary* theories of truth (e.g., Horwich 1990). Deflationists about truth generally agree that truth is not a metaphysically substantive property. Truth is an important expressive device—useful for disquotation, generalization, forming anaphora, etc.—but nothing more. As such, truth is not to be identified with any complex property such as *correspondence with the facts* or *practical utility*. As previously defined, the truth-mongering paradigm does not address deflationary views.⁶ But perhaps Fine would say that the deflationist about truth, like his own “no-theory” attitude about truth, belongs alongside him in the non-realism camp. So perhaps Fine’s apparatus for approaching scientific realism can easily accommodate the deflationist.⁷

The present suggestion is that NOA plus deflationism about truth, just like Fine’s own view, constitutes a kind of non-realism (and non-anti-realism). However, such a view is not sufficient for constituting a genuinely “beyond the debate” attitude toward realism. For whether or not one is a realist has nothing whatsoever to do with whether or not one is a deflationist about truth. To see why, we first need to appreciate the distinction between theories of truth and theories of truthmaking. Theories of *truth* aim to reveal the essence or nature of truth. They give an account of what property, if any, is held in common between all and only truths. Theories of *truthmaking* (e.g., Armstrong 2004) are up to a different task. They are ontological theories that offer accounts of what there has to be in the world to make truths true. Given some true claim, truthmaker theorists aim to say what it is in the world upon which that truth depends for its truth.

Truthmaker theory begins with the idea that truth is not a brute feature of reality. Truths are true in virtue of the way of the world—they are made true by reality. Truthmaker theory is an attempt to draw a bridge between what is true and what exists. When a claim is true—say, that some object *a* is red—truthmaker theorists argue about what it is in the world that is needed to account for its truth. Is ‘*a* is red’ true in virtue of the existence of a state of affairs (e.g., Armstrong 2004), a redness trope (e.g., Mulligan, Simons, and Smith 1984), or just *a* itself under

⁶ To be fair, when Fine and Putnam were putting forth their views in the seventies and eighties, deflationist views of truth did not have the same grasp on the philosophical mindset that they enjoy today. Nonetheless, the views of Ramsey (1927), Ayer (1952), and Quine (1970) were hardly unknown at the time (quite to the contrary), and it is surprising to see how their deflationary views seem not to earn a place in the truth-mongers’ setting up of the issue.

⁷ Indeed, at times Fine expresses sympathy with deflationary views (1986: 175).

a counterpart relation (Lewis 2003)? Our ontological inventories are filled by those objects we believe to be the truthmakers for the claims we take to be true. What is important to realize is that our ontological commitments are revealed by what we take to be the truthmakers for the claims we take to be true, not by what our theory of truth is. Deflationists about truth point out that ‘*a* is red’ is true if and only if *a* is red, but that biconditional leaves open the question of what it is in the world that makes true each side of the biconditional. As a result, being a deflationist about truth is consistent with taking on the kinds of substantive ontological commitments that are characteristic of truthmaker theory. To illustrate, consider David Lewis, whose deflationism about truth (see his 2001) in no way compromises his commitment to a pluriverse of possible worlds (see his 1986). Or consider Quine, who denies that ‘There are sets’ stands in any correspondence relation to any fact (he doesn’t believe in correspondence relations or facts), and yet admits that any believer of the sentence (like himself) is ontologically committed to the existence of sets (1948, 1960, 1970).

Now, it is sometimes thought that truthmaker theory just is a kind of correspondence theory in modern dress.⁸ This conflation is understandable; both theories are motivated by the idea that truth depends upon reality. In fact, it’s theoretically illuminating to interpret traditional correspondence theories as attempts to explicate the nature of *truth* by way of giving a theory of *truthmakers*. But doing so is optional at best: though one might approach the nature of truth that way, one doesn’t have to (e.g., deflationism). So even if traditional correspondence theories presupposed truthmaker theories, it does not follow that truthmaker theory presupposes or just is a kind of correspondence theory. Truthmaker theory is best understood as not offering a theory of truth at all.

To see why, first consider that not all truthmaker theorists believe that every truth has a truthmaker. (Negative existentials such as ‘There is no phlogiston’ are the familiar kind of example.) If some truths can be true in spite of not having a truthmaker, then what it is in general for something to be true cannot rest in terms of its having a truthmaker. Hence, those who do not accept that all truths have truthmakers cannot think of truthmaker theory as any kind of theory of the nature of truth.

Furthermore, even if all truths do have truthmakers, it does not follow that truth must be analyzed in terms of truthmaking. In fact, most accounts of the nature of the truthmaking relation already presuppose the notion of truth: some object *x* is a truthmaker for some proposition *p* just in case *p* is *true* in virtue of the existence of *x* (cf. the accounts given in

⁸ See, e.g., Mulligan, Simons, and Smith 1984: 288-289, Oliver 1996: 69, and Armstrong 2004: 16-17. In fact, Fine himself makes use of the language of “making true” when discussing correspondence theories (1984b: 97).

Armstrong 2004, Lowe 2007, Merricks 2007, and Schaffer 2010). After all, the truthmaking relation needs to account for why truths are *true*, and not their other features (like, say, their existence). As a result, truthmaking needs to be defined in terms of truth, and so we can't define truth in terms of truthmaking on pain of circularity (cf. Merricks 2007: 15). Truthmaker theory has to start with some notion of truth or other, and there is no reason why that notion cannot be deflationary. Truthmaker theorists locate ontological substance in the *truthmakers* they posit, and not necessarily inside any substantive notion of *truth* itself.

We have, then, two separate philosophical projects that have too frequently been conflated. First, we can inquire into the nature of *truth*. Second, we can ask what the ontological grounds are for *truths*. Even if we take a deflationary attitude toward the first topic, we are under no compulsion to take a deflationary attitude toward the second. Even if the truth of the claim that there are echidnas amounts to no more than there being echidnas (and so involves nothing like a correspondence relation or realm of facts), it in no way follows that the truth lacks a truthmaker. Quite to the contrary, the claim is made true by each and every existing echidna. Once we appreciate how truthmaker theory can and should be explored independently of the theory of truth (and, in particular, correspondence theory), we can see how deflationists about truth can freely engage in truthmaker theory. It is no tenet of deflationism that truths lack truthmakers.⁹ No deflationist *qua* deflationist should deny that the proposition that there are echidnas is true in virtue of the existence of echidnas. The important point to notice is that the ontological implications of a theory do not depend on what the correct theory of *truth* is for that theory. Rather, the ontological implications of a theory depend on what the correct theory of *truthmakers* is for that theory.

To be a deflationist about truth is not yet to take any stance on what truthmakers there are. Consequently, one can be a deflationist and take on all sorts of substantive ontological commitments, including those that are constitutive of realism. Imagine a NOAer who accepts deflationism about truth, but thinks that our best scientific theories are made true by unobservable entities like electrons, fields, forces, genes, and the like, and so commits to the reality of such entities. This is not a quietist understanding of science; it's a kind of realism. Hence, merely pairing NOA with deflationism is not sufficient to avoid both realism and anti-

⁹ Nor is it any tenet of deflationism that truths have truthmakers. Deflationary theories are built up around the T-sentences (i.e., "The proposition that *p* is true if and only if *p*"), which themselves are silent on the topic of truthmaking (*contra* Vision 2003). T-sentences merely express an equivalence between different sentences. Deflationism tells you that the proposition that Socrates was a philosopher is true if and only if Socrates was a philosopher. It doesn't tell you what the truthmaker is for the proposition, or even if it has one.

realism; one's views about what makes scientific theories true could easily place one in one camp or the other. To be above the debate, as Fine wishes, one must avoid taking on any such metaphysical commitments. Fine's NOAers, in other words, must eschew the theory of truthmaking just as they eschew the theory of truth. Now, Fine's setup of the realism debate predates the contemporary resurgence in truthmaking. Still, it is implicit in his view that the ontological questions of interest to truthmaker theory belong to the theorizing and interpretation of science that the NOAer rejects. It is not enough, then, simply to be a deflationist if one is to be a genuinely quietistic NOAer. One must also reject any theory of truthmaking; one must be fully agnostic regarding not only the nature of truth, but about what, if anything, makes truths true.

So suppose I uphold with NOA that 'There are electrons' is true, and reject all substantive theories of truth. It remains an open question as to what it is that makes 'There are electrons' true. Realists might say electrons. Positivists might say tracks in cloud chambers. Phenomenalists might say certain sequences of observations. Social constructivists might say our discovery of electrons. Notice how the views characteristic of the various parties to the traditional scientific realism debate reemerge when we ask the truthmaking question. They do this even if we are deflationists about truth. The real questions behind the debate persist, even when we set aside the theory of truth.

It would be a great offense to the spirit of Fine's attitude toward science if the NOAer held that while science needs no help from philosophy in understanding the nature of scientific *truth*, it could benefit quite greatly by being supplemented by a theory of scientific *truthmaking*. The genuine NOAer who is truly beyond the realism debate must also reject any theory of truthmaking. Science needs no interpretation, including no ontological interpretation of the sort offered by truthmaker theory. Consequently, we need to understand Fine as suggesting that his non-realist must make no claims at all about the ontology underlying the truths of science: the non-realist is a complete and total ontological agnostic. Hence, the non-realist is forbidden from making even the most modest of claims, such as that 'There are electrons' is true in virtue of the existence of electrons. To do so would be to supplement NOA with a distinctly ontological theory, and science, says Fine, needs no such supplementation.

Is Fine really forbidden from making such modest claims, such as that electrons are the truthmakers for 'There are electrons'? Can't Fine agree with me that 'There are electrons' is true in virtue of the existence of electrons? Can Fine not admit electrons into his ontology? After all, it seems that doing so is in accordance with good scientific thinking, and so is not to be rejected

by the NOAer.¹⁰ My response takes the form of a dilemma. If Fine accepts my truthmaking claim (and others like it), then I maintain that he counts as a realist, for he takes the claims of science to be made true by a mind-independent reality. Fine's ontology could then in principle match the realist's exactly, and that would be no form of quietism. Here we have all the realism anyone could ever want. So if Fine goes this way, he leaves behind his "above the debate" angle: the natural ontological attitude turns out to be sufficient for realism. If Fine rejects this truthmaking claim (and all other truthmaking claims), then we may take him at his word that he truly is above the realism debate. Accordingly, we should interpret him as thinking that the NOAer takes on no ontological commitments when taking on the truth of a theory (including the truth of its existential statements). One earns truth without ontology only by severing *all* bridges between the two, regardless of whether they are built by the theory of truth, truthmaking, or ontological commitment. Consequently, Fine must refuse to embrace any such theory, a consequence which he recognizes: "NOA, as such, has no specific ontological commitments" (1986: 176). Indeed, it cannot have *any* ontological commitments.

Still, it might be thought that it is simply inconceivable that one could accept the truth of 'There are electrons' without also taking on an ontological commitment to electrons. But here we must be careful not to import any assumptions about how truth depends upon reality, for those are precisely the assumptions that a true metaphysical agnostic must reject. If we assume that Quine (1948, 1960) is right about ontological commitment, then of course we will assume that anyone who accepts the truth of 'There are electrons' will take on an ontological commitment to electrons; *Fine*, however, cannot make this assumption and still claim to be an ontological agnostic. Besides, Quine's is not the only game in town. Jody Azzouni (2004) and Thomas Hofweber (2005) both argue, on separate grounds, that we can embrace the truth of mathematics (including its existential claims) without thereby taking on any mathematical ontology. Such theories might seem to be impossible, but they appear so only if we start with certain presuppositions about how truths connect with the world. The lesson for Fine is clear: he can stay above the debate while maintaining the truth of scientific theories only by remaining fully agnostic about the ontology that grounds the truth of those theories.¹¹

We can now appreciate why the truth-mongering approach to scientific realism should be rejected. By not sufficiently distinguishing issues concerning truth from issues involving

¹⁰ My thanks go to Marc Lange, Huw Price, and Keith Simmons for pressing me on this point.

¹¹ Alan Musgrave comes close to my interpretation of Fine, which he notes was not originally obvious to him. He describes NOA as "*a complete philosophical know-nothing-ism*. The NOA[er] is not committed to electrons, the moon, tables and chairs, physical objects, other people, his self, *anything at all*" (1989: 391).

truthmaking, the truth-mongers come to see the former as essential to the debate, whereas the latter is really the crucial notion. Once we relocate the debate to one about what makes scientific claims true, the possibility of debate between realists and anti-realists reemerges. For example, do we need unobservable entities as truthmakers for scientific claims, or can we make do with merely the realm of the observable? The truth-mongering approach never gets to the heart of the real metaphysical debate. When we expand the truth-mongering paradigm to include the theory of truthmaking, then we see that Fine's preferred non-realist stance loses its plausibility, due to its radical ontological agnosticism. Fine's approach is no longer the most homely game in town.

In closing, we may acknowledge something importantly right about the truth-mongering paradigm. Fine's insight is that the realist needs to add something that goes above and beyond NOA. Infamously, Fine describes that something more as "a desk-thumping, foot-stamping shout of "Really!" (1984b: 97). But there is no distinction between being *true* and being *really true*, and loud noises add no cognitive content to our utterances. What really needs to be added is a realism-relevant theory of truthmaking that will supply a realist ontology that grounds the true claims of science. That the distinction between truth and truthmaking is so easy to collapse is evident in the following observation of William Newton-Smith: the "realist wanted to say that our theories are true or false in virtue of an external reality and she or he used the vocabulary of correspondence in an effort to convey this" (1988: 188). Correspondence is *not* the way to convey this important idea; truthmaker theory offers the right way to understand what it is in virtue of which our theories are true or false.¹²

3. The Epistemological Paradigm

The epistemological paradigm of scientific realism treats the debate as one about the proper epistemic attitude to take toward scientific inquiry. This approach is advocated most prominently by van Fraassen, who writes that scientific realism "concerns our epistemic attitude toward theories rather than their internal structure" (1976: 632). According to van Fraassen,

¹² Related to the truth-mongers are the reference-mongers. Often, scientific realism has been defined with explicit connection to the theory of reference. The theory of reference has played a central role in both defenses (e.g., Boyd 1984) and critiques (e.g., Laudan 1981) of realism. Whether such reference to reference is essential to the adherents' arguments, or just a byproduct of more linguistic times, is an open question; certainly it is essential in the case of Kitcher's defenses of realism (1993, 2001, 2002), and in Hardin and Rosenberg 1982. In any event, I am even less moved by the thought of framing realism debates in terms of reference than I am by the thought of framing them in terms of truth. For critical discussion of the "flight to reference" in the philosophy of science, see Bishop and Stich 1998 and Bishop 2003.

scientific realism is the view that the aim of science is to produce literally true theories—theories that are true not only with respect to the observable facts, but to the unobservable facts as well—and that acceptance of a scientific theory involves the belief that the theory is true (1980: 8). Van Fraassen's favored anti-realist—the constructive empiricist—holds that the aim of science is to produce empirically adequate theories, where empirical adequacy is a matter of truth with respect solely to observable phenomena. All that constructive empiricism requires by way of belief is that when one accepts a theory one believes it to be empirically adequate.

Van Fraassen is happy to agree with his realist opponents on the meaning and interpretation of scientific theories. For van Fraassen, the primary difference between realism and empiricism involves the epistemological attitudes that science warrants. Fine detects some trickery behind van Fraassen's epistemological turn:

In redefining realism as a doctrine about truth and belief in the truth, van Fraassen set up the debate over realism as a debate over the reach of evidence. Does the evidence support belief in the truth of our theories or does it only reach as far as belief in their empirical adequacy? Notice that this is a purely epistemological question and this is the question on which almost all the recent literature in the realism debate has centered. Still, it really is a set up. Like a skilled magician doing slight [*sic*] of hand, van Fraassen's focus on the epistemological question has distracted us from what realism actually involves. Any student in a freshman philosophy course knows that realism is a metaphysical doctrine. It asserts the existence of a real, external world. In *The Scientific Image* van Fraassen made that world disappear from the debate. (2001: 120)

Along with my first-year students, I too stress the metaphysical core of scientific realism. But van Fraassen does not make the world disappear from the realism debate; rather, he simply assumes from the outset that it's there. If van Fraassen seems to be ignoring the older non-epistemological forms of anti-realism that actively denied the existence of a real, unobservable world, it's because the philosophical community is already happy to abandon them.

I have no objection to the importance of the central questions of the epistemological paradigm. The question of what sort of epistemic attitude science warrants us to take is an important one. My objection involves van Fraassen's analysis of *what realism is*. What van Fraassen needs to be able to explain is why believing in the literal truth of a scientific theory is a sufficient characterization of realism. (Remember: Fine thinks that the non-realist NOAer can do

the same.) Absent that explanation, it's not clear why van Fraassen's realist is deserving of the name.

To get clear on this objection, we should return to our initial puzzle: where van Fraassen sees realism (in taking scientific theories to be literally true), Fine sees quietism. The explanation for the puzzle deals with how the two understand the bridge between truth and ontology. Fine thinks that by eschewing any theory of truth, we sever any possible link between truth and ontology. By not accepting a substantive theory of truth, we can accept the truths of science without accepting any ontological commitments. But, as we have seen, what bridges truth and ontology is not the theory of truth, but the theory of truthmaking. Fine falsely sees quietism in taking theories to be true but not adorning them with a substantive theory of truth because he supposes that ontological commitments cannot be undertaken in the absence of a substantive theory of truth.

By contrast, van Fraassen sees realism in taking theories to be literally true because he is most likely assuming a fairly straightforward, realism-relevant conception of truthmaking. If theories are true, that is because there exists a mind-independent reality that makes them true. But notice that it is the commitment to that sort of reality, and not merely the commitment to the truth of the theory, that serves to explain why the realist is a realist. We can imagine competing theorists who brought anti-realist truthmaking accounts to the table; they would also believe that theories are literally true, but made true by something other than a world of mind-independent electrons, fields, forces, and genes. Realists must do more than believe that their theory is literally true. They must also have particular kinds of beliefs about what makes those theories true.

My suggestion, then, is that van Fraassen sees realism in his statement of scientific realism only because he is assuming an ordinary, realist account of truthmaking. (Just what this is we shall explore in detail in the next section.) He might, however, respond by arguing that the presence of "literal" truth in his account is what plays that role: a literally true theory just is a theory made true by a mind-independent reality. To motivate his view that realists believe in the literal truth of theories, van Fraassen gives the example of two empirically equivalent theories that nonetheless appear to disagree regarding the unobservable (1980: 10-11). One theory holds that all matter consists of atoms; the other replaces atoms with the existence of a universal continuous medium. A positivist who thought that statements like 'Atoms exist' and 'The universal continuous medium exists' bear meaning only through their connection with the observable consequences of their respective theories might hold that both theories are true, since they are empirically equivalent and hence "mean the same thing", appearances to the contrary.

Here we have a non-literal reading of the theories, for “two theories which contradict each other in such a way can ‘really’ be saying the same thing only if they are not literally construed” (van Fraassen 1980: 11).

There is something right about van Fraassen’s characterization of the literal construal of theories. By granting that realists and anti-realists alike can admit a literal reading of scientific theories, he helps to move the question of realism away from a question about language: “I do not conceive the dispute as being about language at all,” he says in distancing himself from Dummett’s semantic take on the debate (1980: 38). We can push the issue even further, for we can reconstruct the point about theories being true under literal or non-literal interpretations into a purely metaphysical point, and thereby distance ourselves even further from any linguistic approach to realism. Literal truth simply isn’t the issue, a point that can be appreciated in other realism debates as well. Azzouni freely grants that mathematical theories are literally true, but denies that this commits him to mathematical realism (2004). Blackburn would grant that his moral judgments are literally true, but that this is no obstacle to his ethical quasi-realism (1998). What makes it possible for these anti-realists to be anti-realists in spite of accepting the literal truth of their respective domains is that they don’t believe that the literal truth of the theories forces a realism-relevant ontology onto them. That ontology is the issue, not literality.

Returning to the scientific case, imagine a more traditional anti-realist (such as a conventionalist, positivist, or instrumentalist), constructive empiricist, and realist discussing ‘There are electrons’. Suppose they all accept some scientific theory of which it is a consequence. The anti-realist and realist agree that it is true, whereas the constructive empiricist announces agnosticism. Van Fraassen would say that the anti-realist thinks it is non-literally true, and that the realist thinks it’s literally true. But might it be possible for the two to come to agree upon its meaning after all? Suppose that the realist and the anti-realist come to the table with rather thin semantic theories, or with perhaps none at all. Perhaps they are both use-theorists, or agree on some sort of inferential role semantics (e.g., Brandom 1994). If so, we can still find room for non-semantic disagreement between them, and so we do not have to hold that they are simply talking past one another. The disagreement will be an ontological one. The realist thinks that ‘There are electrons’ is made true by electrons. But electrons, were they to exist, would be unobservable. So the anti-realist does not believe in such things. But the anti-realist does think that ‘There are electrons’ is true, and so must offer a competing story about what makes it true, since electrons aren’t around to do the trick. Just how the story goes might be quite complicated, perhaps involving cloud chambers, readings on galvanometers, and the like. In any event, the resources for making the sentence true will be limited to the observable. For the anti-realist, the

observable world itself suffices to ground the truth of ‘There are electrons’; the realist disagrees, and takes on an additional ontological commitment involving unobservable entities. Such ontological disagreements may persist even if there are no semantic disagreements involved.

As should now be clear, agreeing on the meaning and truth of claims need not coincide with agreeing on what the truthmakers are for those claims. The constructive empiricist may agree with the realist about what it is that would make ‘There are electrons’ true, if indeed it were true. Since our anti-realist and constructive empiricist may agree on what exists in the observable world, yet disagree over whether to believe ‘There are electrons’, they must disagree about what it takes to make it true (supposing, as we are, that they agree on its meaning). When it comes to other scientific truths, the truthmaking story may be more controversial. Whether ‘Electrons are negatively charged’ is made true by a state of affairs, relation between universals, collection of tropes, electrons themselves, or nothing at all is an open question. Here, a scientific realist who is also a realist about universals (e.g., David Armstrong) may disagree with a constructive empiricist who is also a nominalist (e.g., van Fraassen). But here the dispute is due to their differing stances on the realism/nominalism question, and not to their differing stances regarding scientific realism. Van Fraassen, surely, would have no truck with many of the debates that are internal to truthmaker theory. Nevertheless, even a nominalist of his radical stripe can agree that truths are grounded in the world (Quine thought so, as did David Lewis); he just disagrees with others about what exactly those grounds are.

We may now appreciate how we can more fully shed the trappings of linguisticism from the question of scientific realism. The dispute need not be over how to semantically interpret theories, or whether we should construe them literally or non-literally. The instinct behind van Fraassen’s appeal to literal truth is better satisfied by appeal to truthmaking. In the next section, we shall spell out this distinctly metaphysical approach to the topic of scientific realism.

4. The Metaphysical Paradigm

Our original puzzle involved how distinct theorists, both accepting the full truth of a scientific theory, could end up on very different sides of the realism debate. We now know the answer. To get from truth to realism, we need the right sort of connection. Let us now take a look at the field of views in the scientific realism debate through the lens of truthmaker theory. In so doing, we may offer a proper articulation of the metaphysical paradigm of scientific

realism, which will show just what is at stake in the debate between realists and their opponents.¹³

According to the metaphysical paradigm, our commitments with respect to scientific realism are determined by the metaphysical and ontological commitments that we take to accompany our scientific commitments. In accepting a scientific theory, to what metaphysical or ontological account of the world are we committed? Scientific realism is a commitment to the (at least approximate) truth of our best scientific theories, and a commitment to a realism-relevant set of truthmakers in virtue of which those theories are true. Scientific anti-realism either abandons the first commitment (thereby nullifying the second), or keeps the first, but supplements it with an anti-realism-relevant set of truthmakers. Truthmakers, then, are not exclusively for realists. Anti-realists, too, can admit that the truths they accept are made true. Their anti-realism will be due to the nature of the truthmakers they provide. Quietists, regardless of what they think about the truth of the theories they accept, must remain fully agnostic about what makes them true. According to the metaphysical paradigm, then, one's stance regarding scientific *realism* depends upon what one takes to be the *reality* underpinning scientific theories. The metaphysical paradigm rightly restores metaphysics to the center of the debate.¹⁴

So what makes for a realism-relevant or anti-realism-relevant theory of truthmaking? There may be no simple answer, and I do not intend to give a full analysis. Nor should we hope for one. Realism debates come in various forms, and are motivated by different considerations in different areas. Still, mind-independence of some sort seems to be of paramount importance in much of the scientific realism literature.¹⁵ The kinds of truthmakers relevant to realism are the kinds of things that would still exist even if we didn't. Truthmakers that are indicative of anti-realism, by contrast, are likely to be entities that somehow depend upon us for their existence. Rather than attempting to offer precise analyses of realist and anti-realist accounts of truthmaking, it will be more instructive to attend to specific views inside the realism debate, and see how their status *vis-à-vis* realism is best understood by attending to how they approach our

¹³ See also my 2012, which articulates my general truthmaking treatment of realism, of which the present account is an instance.

¹⁴ In this respect I am fully in line with Devitt's non-semantic approach to realism, according to which doctrines concerning truth and doctrines concerning realism do not entail each other (1984, 1991). Where I disagree with Devitt is over his claim that realism lends abductive support to correspondence theory, though it does not entail it (1991: 44). So on my view, I keep realism and truth even more separate from each other, precisely because I spell out realism in terms of truthmaking, and so the theory of truth simply doesn't come into play.

¹⁵ See Devitt 1984 and Jenkins 2005 for treatments of mind-independence. For a challenge to the notion of mind-independence, see Rosen 1994.

truthmaking queries. My claim is that we can best explain why we classify certain views as realist, and certain other views as anti-realist, by understanding how they offer competing accounts of scientific truthmaking.

Fine, recall, claims that the scientific realist “asserts the existence of a real, external world” (2001: 120; cf. Melnyk 2003: 229). Putnam also considers the idea, which he attributes to Dummett, that scientific realism involves the claim “that what makes [the sentences of scientific theories] true or false is something *external*—that is to say, it is not (in general) our sense data, actual or potential, or the structure of our minds, or our language, etc.” (1975: 70; see also Wright 1986: 253 and 1992: 158-159). Both of these remarks are close to the truth, and we may now elaborate upon them.

First consider the observable domain of scientific theories. Realists about the observable portions of scientific theories take those portions to be true, and to be made true by a mind-independent reality. Here we have little more than what Michael Devitt calls “common sense realism” (1984). There is still plenty of room within the realist camp for truthmaking disagreement. When it comes to the truthmaker for ‘There is copper’, any hunk of copper suffices. When it comes to the truthmaker for ‘This sample of copper is conductive’, the matter is more controversial. Perhaps we need a state of affairs, a trope, or an object under a counterpart relation. These familiar truthmaking accounts all rely on mind-independent entities to serve as truthmakers, and hence they all count as realist. Importantly, notice that nominalists and their opponents can disagree with each other about what makes such claims about the observable true without sacrificing their overarching realism about the observable. Anti-realists about the observable have to take a very different tack. What makes it true that there is copper is not the existence of that mind-independent element copper, but something else (see Putnam’s suggestions in his quote above).

Where scientific realism becomes controversial is in the realm of the unobservable. Realists maintain the reality of the unobservable world, and commit to it in order to find truthmakers for the truths they believe about the unobservable. The truthmakers realists offer are of the standard realism-relevant variety: the truthmakers for claims about the unobservable are just as mind-independent as are the truthmakers they posit for claims about the observable. The realist maintains, in other words, a kind of metaphysical continuity between the observable and unobservable. Constructive empiricists accept that same metaphysical continuity alongside the realists, and therefore can agree with realists as to what it would take to make truths about the unobservable true, if indeed they are. However, on epistemological grounds constructive empiricists remain agnostic about the reality of such truthmakers, and thus remain agnostic

about the truth of the unobservable portions of scientific theories.¹⁶ They earn their anti-realism by not taking on the metaphysical commitments that realists take on, even though they are in agreement as to what commitments they should take on, if they were epistemologically so inclined.

Other views about what makes statements about unobservables true, including anti-realist ones, are possible. What makes other views anti-realist is that they attempt to ground the truth of claims about the unobservable in something other than a mind-independent unobservable reality. Imagine a kind of phenomenalist who employed what we might call the “flight to counterfactuals”: What makes ‘There are electrons’ true is that it’s true that if we were to look at a cloud chamber in such-and-such experimental setup, then we would see certain kinds of tracks. That counterfactual could in turn be taken as a brute truth, made true by nothing at all, or the phenomenalist could attempt a (difficult, to say the least) truthmaking story that in turn relied on nothing unobservable (cf. Mill 1865 on “permanent possibilities of sensation”). The phenomenalist is here engaged in a distinctly anti-realist endeavor: trying to maintain truths about the supposed unobservable realm without adopting any unobservable ontology. A logical positivist, convinced that the very idea of an unobservable object is meaningless, might offer an account of what makes the unobservable portions of theories true simply by reference to observable objects and properties. Others are more cavalier. The French sociologist Bruno Latour argues that because the Egyptian pharaoh Ramses II died long before the 1882 discovery of the tuberculosis bacillus, he could not have been killed by it, for the bacillus did not exist prior to its discovery (1998). Hence, Latour thinks that what makes true ‘*Mycobacterium tuberculosis* exists’ is not just the bacterial species, but an event, namely, Robert Koch’s discovery of it. As regards its truth, Latour’s view has nothing to recommend it. But it is instructive as it offers a very clear competing anti-realist interpretation of what makes scientific truths true.¹⁷

As should now be clear, the metaphysical paradigm accurately locates the various views concerning scientific realism on the appropriate side of the realism/anti-realism divide. Realists are those who take on a commitment to a mind-independent unobservable reality that grounds the truth of scientific theories. Constructive empiricists maintain agnosticism with respect to such things. Because they do not embrace that reality, constructive empiricists are not realists.

¹⁶ To be more precise, constructive empiricists hold that all that *science* requires of us when we accept its theories is that we believe them to be empirically adequate. But there could be extrascientific reasons for believing in the unobservable portions of theories. Constructive empiricists *qua* scientific thinkers must remain agnostic about electrons, but they might renounce such agnosticism for other reasons external to the scientific enterprise.

¹⁷ I borrow the example from Boghossian 2006: 26, which in turn borrows it from Sokal and Bricmont 1998.

Other anti-realists may agree with the realists and empiricists about what would make true our scientific theories, but exchange the empiricists' agnosticism for atheism: such things do not exist, and so the theories that require them turn out to be false (even if perhaps useful for other reasons). Here we make room for scientific error theorists and fictionalists (e.g., Duhem 1954).

The other anti-realist option is to offer a competing anti-realist truthmaking account for the unobservable portions of scientific theories. Philosophical consensus leans against such views nowadays, but they remain theoretical possibilities. One might defend an account where the observable realm alone makes true the parts of scientific theories that deal with the (supposedly) unobservable. Here we still have an anti-realism about the *unobservable* for the view holds that there are no unobservable entities or properties. Or one might, with the phenomenalist, resort to counterfactuals involving possible observable experiences, and take those counterfactuals to be brute (true in virtue of nothing at all). Here we again have anti-realism about the unobservable, because the counterfactuals are grounded in no reality at all, and hence no unobservable reality. Or one might offer a deeply mind-dependent account of what makes scientific theories true, as with Latour's account above. Here, we have truths—existential truths, even—made true by anti-realist (i.e., mind-dependent) things.

The metaphysical paradigm also captures what is realist about structural realism. Structural realism maintains that despite the radical change to our scientific worldview that occurs during scientific revolutions, something at the level of structure remains constant. Hence, the structural realist relies on a distinction between *structure* and *nature*. There is structural continuity as we progress through different theories, even if theories change with respect to the nature of the entities that fill those structures. For example, in the shift from Fresnel's theory of light to Maxwell's, the structure of the theory (as given by Maxwell's equations) remained constant, whereas the nature of light on offer shifted (see Worrall 1989).

A variety of views exist within the structuralist camp. James Ladyman (1998) distinguishes between metaphysical and epistemological structuralism. Epistemological structuralists argue that all that can be known about the unobservable world is its structure (e.g., Russell 1927 and Maxwell 1970). These modest structuralists, given their epistemological scruples, claim to have evidence for the structure alone, and not for the nature of that which instantiates the structure. The metaphysical structuralist is less modest, and denies knowledge on metaphysical grounds: since there is nothing else to the unobservable besides structure, there is nothing else to be known. Here we have the “ontic structural realism” defended by Ladyman and Ross (Ladyman, Ross, Spurrett, and Collier 2007: 130).

Given the structuralist's distinction between structure and what fills that structure, we can now locate the various structuralist views on our map of the realism terrain. If indeed the unobservable may be divided into its structure and its non-structure (but see Psillos 1995 and 2001 for doubts), then there will be truths about both. The epistemic structuralist thinks that we can add to the knowledge admitted by the constructive empiricist. There are truths about the structure of the unobservable that science offers us, and so we must ask what the truthmakers are for those claims. The answer will most likely be an account of a mind-independent structure to nature, which is why the view is a species of structural *realism* (cf. Psillos 1995: 23). There is a real structure to nature which is discovered by the sciences, and this structure grounds the truths about it that we discover. (In principle, there could be a structural *anti*-realist, but I know of no one who adopts such a position.) The ontic structuralist, by contrast, is a full bore realist, in the sense that science captures all there is to reality; science leaves nothing out. What distinguishes the more traditional scientific realist from the ontic structuralist is that the former believes in more: unobservable structure *and* unobservable entities that fill those structures. By contrast, the ontic structuralist argues that once science captures the structure of the unobservable, it has captured everything. So the ontic structuralist is an anti-realist about whatever else it is that traditional realists believe in, and from which epistemic structuralists withhold judgment.

In summary, the metaphysical paradigm holds that what is at stake between realists and anti-realists in the philosophy of science is the kind of metaphysical commitments they take on when they accept a scientific theory. The notion of a mind-independent reality is important here, as so many in the literature are happy to observe. Where the literature goes wrong is in too quickly identifying the notion of a mind-independent reality with a correspondence theory of truth, or with some sort of pie-in-the-sky noumenal realm. Realists often make the first mistake, and thus find correspondence theories more plausible than they really are. Anti-realists often make the second mistake, and end up creating straw men for their opponents.¹⁸ Scientific realism, understood correctly, is a thesis about and commitment to the mind-independence of the reality that grounds the truth of scientific theories, standing in stark contrast to idealism, pragmatism, verificationism, and the others.

¹⁸ Such are the familiar tactics of Rorty (1972), Putnam (1978, 1981), and Fine (1986). For criticism, see Musgrave 1989 and 1996, Newton-Smith 1989, Niiniluoto 1999, and Psillos 1999 and 2000.

5. Conclusion

I have argued that we can reach a better understanding of what is at stake in the debate over scientific realism by viewing it through the lens of truthmaker theory. The positive results were as follows. First, we saw how Fine’s characterization of the realism debate puts all the theoretical weight on the theory of truth, which is a weight it cannot and should not bear. Fine’s interest in truth is misplaced; what his non-realist really needs to do is to abandon not just the theory of truth, but the theory of truthmaking as well. Once this correction is in place, Fine’s favored position becomes far less attractive. Second, I recommended to van Fraassen that he shed the linguistic notion of “literal truth” and adopt instead the position that the realist believes in realism-indicative truthmakers. This characterization is thoroughly metaphysical, and abandons the last vestige of unnecessary semantics in van Fraassen’s account. Finally, we articulated a thoroughly metaphysical understanding of what is at stake in scientific realism, and showed how it accurately categorizes the various views available in the literature. Realism about a scientific theory involves taking that theory not only to be true, but also to be made true by a mind-independent reality. Anti-realism consists in either not taking the theory to be true, or showing how the theory is made true by something other than a mind-independent reality. Perhaps, at the end of the day, my account can go some way toward convincing those who are skeptical (e.g., Blackburn 2002) that the realism debate in the philosophy of science is live and well.¹⁹

Acknowledgements

Many thanks go to a referee for the journal, and to Marc Lange, John Roberts, and Keith Simmons for reading and commenting on various drafts. A version of this paper was presented

¹⁹ I imagine that some of the figures I have here engaged—in particular van Fraassen and Ladyman—will be unmoved by the thought that their philosophy of science will be helpfully supplemented by my discussion of truthmaking. Both philosophers are highly skeptical of the significance of such “metaphysical” inquiry (where ‘metaphysical’ is taken to be a derogatory term). That van Fraassen is suspicious of any metaphysics incompatible with nominalism is fine as far as my project is concerned. Nominalists have a place in the truthmaking framework; they are fellow metaphysicians. On the nominalist’s view, all truths are grounded in particular objects, not universals. Ladyman would be suspicious of any metaphysical labor being performed by metaphysicians that goes beyond what is performed by physicists and philosophers of physics. So be it. On his view, we can understand the proper ontological grounds for truth by attending to physics and physics alone. His is a view about how we should go about accounting for what makes our theories true, not a rejection of the enterprise.

at the University of Sydney; my thanks go to that audience for their questions, comments, and suggestions.

References

- Armstrong, D. M. 2004. *Truth and Truthmakers*. Cambridge: Cambridge University Press.
- Asay, Jamin. 2012. A truthmaking account of realism and anti-realism. *Pacific Philosophical Quarterly* 93: 373-394.
- Ayer, Alfred Jules. 1952. *Language, Truth, and Logic*. Reprint ed. New York: Dover.
- Azzouni, Jody. 2004. *Deflating Existential Consequence: A Case for Nominalism*. Oxford: Oxford University Press.
- Bigelow, John, and Robert Pargetter. 1990. From extroverted realism to correspondence: a modest proposal. *Philosophy and Phenomenological Research* 50: 435-460.
- Bishop, Michael A. 2003. The pessimistic induction, the flight to reference and the metaphysical zoo. *International Studies in the Philosophy of Science* 17: 161-178.
- Bishop, Michael A and Stephen P. Stich. 1998. The flight to reference, or how *not* to make progress in the philosophy of science. *Philosophy of Science* 65: 33-49.
- Blackburn, Simon. 1998. *Ruling Passions: A Theory of Practical Reasoning*. Oxford: Clarendon Press.
- . 2002. Realism: deconstructing the debate. *Ratio* (new series) 15: 111-133.
- Boghossian, Paul. 2006. *Fear of Knowledge: Against Relativism and Constructivism*. Oxford: Clarendon Press.
- Bonjour, Laurence. 1985. *The Structure of Empirical Knowledge*. Cambridge: Harvard University Press.
- Boyd, Richard N. 1984. The current status of scientific realism. In *Scientific Realism*, ed. Jarrett Leplin, 41-82. Berkeley: University of California Press.
- Brandom, Robert B. 1994. *Making It Explicit: Reasoning, Representing, and Discursive Commitment*. Cambridge: Harvard University Press.
- Davidson, Donald. 1990. The structure and content of truth. *Journal of Philosophy* 76: 279-328.
- Devitt, Michael. 1984. *Realism and Truth*. Princeton: Princeton University Press.
- . 1991. *Realism and Truth*. Second ed. Oxford: Blackwell.
- Duhem, Pierre. 1954. *The Aim and Structure of Physical Theory*. Trans. Philip P. Wiener. Princeton: Princeton University Press.

- Ellis, Brian. 1985. What science aims to do. In *Images of Science: Essays on Realism and Empiricism, with a Reply from Bas C. van Fraassen*, eds. Paul M. Churchland and Clifford A. Hooker, 48-74. Chicago: University of Chicago Press.
- Fales, Evan. 1988. How to be a metaphysical realist. *Midwest Studies in Philosophy* 12: 253-274.
- Field, Hartry. 1982. Realism and relativism. *Journal of Philosophy* 79: 553-567.
- Fine, Arthur. 1984a. And not anti-realism either. *Noûs* 18: 51-65.
- . 1984b. The natural ontological attitude. In *Scientific Realism*, ed. Jarrett Leplin, 83-107. Berkeley: University of California Press.
- . 1986. Unnatural attitudes: realist and instrumentalist attachments to science. *Mind* 95: 149-179.
- . 2001. The scientific image twenty years later. *Philosophical Studies* 106: 107-122.
- Hardin, Clyde L. and Alexander Rosenberg. 1982. In defense of convergent realism. *Philosophy of Science* 49: 604-615.
- Hofweber, Thomas. 2005. Number determiners, numbers, and arithmetic. *Philosophical Review* 114: 179-225.
- Horwich, Paul. 1990. *Truth*. Oxford: Basil Blackwell.
- Jardine, N. 1986. *The Fortunes of Inquiry*. Oxford: Clarendon Press.
- Jenkins, C. S. 2005. Realism and independence. *American Philosophical Quarterly* 42: 199-209.
- Jennings, Richard. 1989. Scientific quasi-realism. *Mind* 98: 225-245.
- Joyce, Richard. 2001. *The Myth of Morality*. Cambridge: Cambridge University Press.
- Kitcher, Philip. 1993. *The Advancement of Science: Science without Legend, Objectivity without Illusions*. Oxford: Oxford University Press.
- . 2001. Real realism: the Galilean strategy. *Philosophical Review* 110: 151-197.
- . 2002. On the explanatory role of correspondence truth. *Philosophy and Phenomenological Research* 64: 346-364.
- Kuhn, Thomas S. 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Ladyman, James. 1998. What is structural realism? *Studies in History and Philosophy of Science* 29: 409-424.
- Ladyman, James, and Don Ross, with David Spurrett and John Collier. 2007. *Every Thing Must Go: Metaphysics Naturalized*. Oxford: Oxford University Press.
- Latour, Bruno. 1998. Ramsès II est-il mort de la tuberculose? *La Recherche* 307: 84-85.
- Laudan, Larry. 1981. A confutation of convergent realism. *Philosophy of Science* 48: 19-49.
- Lewis, David. 1986. *On the Plurality of Worlds*. Oxford: Basil Blackwell.
- . 2001. Forget about the 'correspondence theory of truth'. *Analysis* 61: 275-280.

- . 2003. Things qua truthmakers. In *Real Metaphysics: Essays in Honour of D. H. Mellor*, eds. Hallvard Lillehammer and Gonzalo Rodriguez-Pereyra, 25-42. London: Routledge.
- Lowe, E. J. 2007. Truthmaking as essential dependence. In *Metaphysics and Truthmakers*, ed. Jean-Maurice Monnoyer, 237-259. Frankfurt: Ontos Verlag.
- Lynch, Michael P. 2009. *Truth as One and Many*. Oxford: Clarendon Press.
- Mackie, J. L. 1977. *Ethics: Inventing Right and Wrong*. London: Penguin Books.
- Matheson, Carl. 1989. Is the naturalist really naturally a realist? *Mind* 98: 247-258.
- Maxwell, Grover. 1970. Structural realism and the meaning of theoretical terms. In *Minnesota Studies in the Philosophy of Science, Volume 4: Analyses of Theories and Methods of Physics and Psychology*, eds. Michael Radner and Stephen Winokur, 181-192. Minneapolis: University of Minnesota Press.
- Melnyk, Andrew. 2003. *A Physicalist Manifesto: Thoroughly Modern Materialism*. Cambridge: Cambridge University Press.
- Merricks, Trenton. 2007. *Truth and Ontology*. Oxford: Clarendon Press.
- Mill, John Stuart. 1865. *An Examination of Sir William Hamilton's Philosophy, and of the Principal Philosophical Questions Discussed in His Writings*. Volume 1. Boston: William V. Spencer.
- Mulligan, Kevin, Peter Simons, and Barry Smith. 1984. Truth-makers. *Philosophy and Phenomenological Research* 44: 287-321.
- Musgrave, Alan. 1989. NOA's ark—Fine for realism. *Philosophical Quarterly* 39: 383-398.
- . 1996. Realism, truth and objectivity. In *Realism and Anti-Realism in the Philosophy of Science: Beijing International Conference, 1992*, eds. Robert S. Cohen, Risto Hilpinen, and Qiu Renzong, 19-44. Dordrecht: Kluwer Academic Publishers.
- Newton-Smith, William H. 1988. Modest realism. *Proceedings of the Biennial Meeting of the Philosophy of Science Association* 1988.2: 179-189.
- . 1989. The truth in realism. *Dialectica* 43: 31-45.
- Niiniluoto, Ilkka. 1999. *Critical Scientific Realism*. Oxford: Clarendon Press.
- Oliver, Alex. 1996. The metaphysics of properties. *Mind* 105: 1-80.
- Psillos, Stathis. 1995. Is structural realism the best of both worlds? *Dialectica* 49: 15-46.
- . 1999. *Scientific Realism: How Science Tracks Truth*. London: Routledge.
- . 2000. The present state of the scientific realism debate. *British Journal for the Philosophy of Science* 51: 705-728.
- . 2001. Is structural realism possible? *Philosophy of Science* 68 (Proceedings): S13-S24.
- Putnam, Hilary. 1975. What is mathematical truth? In his *Mathematics, Matter and Method: Philosophical Papers, Volume 1*, 60-78. Cambridge: Cambridge University Press.

- . 1975-1976. What is “realism”? *Proceedings of the Aristotelian Society* 76 (new series): 177-194.
- . 1978. *Meaning and the Moral Sciences*. Boston: Routledge and Kegan Paul.
- . 1981. *Reason, Truth and History*. Cambridge: Cambridge University Press.
- . 1982. Three kinds of scientific realism. *Philosophical Quarterly* 32: 195-200.
- Quine, Willard Van Orman. 1948. On what there is. *Review of Metaphysics* 2: 21-38.
- . 1960. *Word and Object*. Cambridge: MIT Press.
- . 1970. *Philosophy of Logic*. Englewood Cliffs, NJ: Prentice-Hall.
- Railton, Peter. 1986. Moral realism. *Philosophical Review* 95: 163-207.
- Ramsey, F. P. 1927. Facts and propositions. *Proceedings of the Aristotelian Society, Supplementary Volumes* 7: 153-170.
- Rorty, Richard. 1972. The world well lost. *Journal of Philosophy* 69: 649-665.
- Rosen, Gideon. 1994. Objectivity and modern idealism: what is the question? In *Philosophy in Mind: The Place of Philosophy in the Study of Mind*, eds. Michaelis Michael and John O’Leary-Hawthorne, 277-319. Dordrecht: Kluwer Academic Publishers.
- Russell, Bertrand. 1927. *The Analysis of Matter*. London: Routledge and Kegan Paul.
- Schaffer, Jonathan. 2010. The least discerning and most promiscuous truthmaker. *Philosophical Quarterly* 60: 307-324.
- Sokal, Alan, and Jean Bricmont. 1998. *Fashionable Nonsense: Postmodern Intellectuals’ Abuse of Science*. New York: Picador USA.
- Sosa, Ernest. 1993. Putnam’s pragmatic realism. *Journal of Philosophy* 90: 605-626.
- Taylor, Barry. 2006. *Models, Truth, and Realism*. Oxford: Clarendon Press.
- Timmons, Mark. 1999. *Morality without Foundations: A Defense of Ethical Contextualism*. New York: Oxford University Press.
- van Fraassen, Bas C. 1976. To save the phenomena. *Journal of Philosophy* 73: 623-632.
- . 1980. *The Scientific Image*. Oxford: Clarendon Press.
- . 1997. Putnam’s paradox: metaphysical realism revamped and evaded. *Philosophical Perspectives* 11: 17-42.
- Vision, Gerald. 2003. Lest we forget ‘the correspondence theory of truth’. *Analysis* 63: 136-142.
- Williams, Michael. 2006. Realism: what’s left? In *Truth and Realism*, eds. Patrick Greenough and Michael P. Lynch, 77-99. Oxford: Clarendon Press.
- Worrall, John. 1989. Structural realism: the best of both worlds? *Dialectica* 43: 99-124.
- Wright, Crispin. 1986. Scientific realism, observation and the verification principle. In *Fact, Science and Morality: Essays on A. J. Ayer’s Language, Truth and Logic*, eds. Graham Macdonald and Crispin Wright, 247-274. Oxford: Basil Blackwell.

—. 1992. *Truth and Objectivity*. Cambridge: Harvard University Press.