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ARBITERS OF EXISTENCE AND TRUTH

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ABSTRACT

Call the epistemological grounds on which we rationally should determine our ontological (or alethiological) commitments regarding an entity its arbiter of existence (or arbiter of truth). It is commonly thought that arbiters of existence and truth can be provided by our practices. This paper argues that such views have several implications: (1) the relation of arbiters to our metaphysical commitments consists in indispensability, (2) realist views about a kind of entity should take the kinds of practices providing that entity's arbiters to align with respect to their metaphysical dependencies, (3) if realists take a kind of practice to provide grounds on which to affirm the existence of a kind of entity, they should turn to those same grounds when seeking to provide an epistemology of the relevant domain.

Keywords: naturalism; Carnapian realism; indispensability arguments; epistemic problems.

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Introduction

Call the epistemological grounds on which we should rationally hold (or withhold) ontological commitments to a kind of entity that entity's *arbiter of existence*. Roughly, an entity's arbiter of existence provides the primary reasons for which we should affirm or deny its existence.

Independently of whether we affirm or deny the existence of a kind of disputed entity, we might also be interested in affirming or denying sentences that syntactically appear to ascribe properties to those entities. Call the epistemological grounds on which we should hold (or withhold) alethiological commitments to such sentences the *arbiter of truth* of the relevant entities.[1] If we affirm or deny claims regarding what an entity is like, these affirmations and denials should rationally be justified with reference to that entity's arbiter of truth.

Three questions might be raised regarding arbiters of existence and truth:

(a) What provides an entity's arbiters of existence and truth?
(b) How do these arbiters inform our ontological and alethiological (non-)commitments?
(c) How are an entity's arbiters of existence and truth related?

According to some popular approaches to ontology, we can answer (a) by noting that some things we do—that is, some of our *practices*—are epistemologically privileged when it comes to our metaphysical commitments, and can provide arbiters of existence and truth. For instance, scientific naturalists hold that science, broadly speaking, should provide the epistemological grounds for many of our metaphysical commitments (Armstrong 1968; Quine 1951, 1963). Hence, scientific naturalists take our scientific practices to be able to provide arbiters. Carnap and his followers, alternatively, hold that with some disputed entities, our ontological commitments should correspond to the existential statements that meet the acceptability standards of our discourse (Carnap 1950; Thomasson 2014).

[1] To be precise, the class of sentences governed by an entity's arbiter of truth should be limited to just the property-ascription sentences that do not merely make claims about the existence of the entities in question—our attitude toward 'Phlogiston exists' should be governed by phlogiston's arbiter of existence, not its arbiter of truth. Also, this class should be delineated based on whether the relevant sentences have the *syntactic* structure of property-ascription sentences—our attitude toward 'Phlogiston has negative mass' should be governed by phlogiston's arbiter of truth, even if we wish to adopt a semantics under which 'Phlogiston has negative mass' does not actually ascribe properties to phlogiston. For brevity, this paper will refer to such sentences as sentences about the nature of a kind of entity, but this should not be taken to presuppose the existence of those entities. Thanks to a reviewer for pressing for clarity on this point.

Thus, Carnapians take our discursive practices to be able to provide arbiters of existence.

This paper will describe a general framework for views that take our practices to provide arbiters and discuss the implications of holding such views (remaining neutral on whether such views are in fact right). §1 will flesh out the above answer to (a) by describing more precisely what it would mean for some of our practices to be privileged in the relevant sense. We will also consider how this answer to (a) bears on (b). It will be argued that when our practices provide an entity's arbiters of existence and truth, the relation between those arbiters and our metaphysical commitments consists in indispensability. Namely, we can delineate our metaphysical commitments regarding that entity by considering the privileged practices to which that entity and sentences about it are indispensable. §2 then turns to (c), arguing that if we accept a realist commitment regarding a kind of entity, and the epistemological grounds for that commitment are provided by our practices, the arbiters of existence and truth for those entities should align in some way.

§§3–4 explore implications of these results for some attempts to separate arbiters of existence and truth. Let *metaphysical realism* about a kind of entity be a view that affirms the (objective, mind-independent) existence of those entities, and *semantic realism* about a kind of entity be a view that affirms the truth of some sentences concerning the nature of those entities.[2] §3 considers views that hold semantic realism about a kind of entity without committing to either metaphysical realism or metaphysical anti-realism about those entities. Such views have been considered regarding mathematics (Dummett 1979; Putnam 1979), ethics (Ridge 2019; Sayre-McCord 1986) and science (Devitt 1991; Leplin 1984). Views like these seem to take the arbiters of existence and truth for the entities in question to be somewhat independent, such that we can justify an alethiological commitment to the relevant sentences while remaining neutral on the ontological aspect. §3 argues that if proponents of such views have adequate grounds on which to hold semantic realism about the target entities, and they take such grounds to be provided by our practices, they can get a reasonably clear idea of how we may adjudicate between metaphysical realism and metaphysical anti-realism about those entities.

[2] The term 'semantic realism' has been used variously in the literature. For instance, Michael Dummett calls 'realist' any view under which sentences in a relevant class have determinate truth values (e.g., Dummett 1982), while Herbert Feigl uses the term to refer to a view on the relationship between sentences containing observational and theoretical terms (e.g., Feigl 1950). The term as used here is intended to be distinct from these other uses. Thanks to a reviewer for highlighting this point.

It is perhaps less common to find views that hold metaphysical realism about a kind of entity without committing to either semantic realism or semantic anti-realism about those entities. Nevertheless, nearby views have been advanced that affirm the existence of a kind of entity while remaining neutral on the truth of *some* sentences about the nature of those entities. §3 also argues that if proponents of such views have adequate grounds on which to hold metaphysical realism about the target entities, then they should also have a reasonably clear idea of how we may determine our alethiological commitments regarding sentences about their nature.

§4 considers epistemological objections against metaphysical realism. It is sometimes argued that because certain disputed entities are epistemically inaccessible in some way, metaphysical realism about those entities would make it difficult to provide a plausible epistemology of the relevant domain. §4 argues that if metaphysical realists take our practices to provide the relevant arbiters of existence, then in view of the relations that may be expected to hold between arbiters, they should turn to those same practices when responding to epistemological objections.

1. Arbiters from practices

To see how the things we do can inform our metaphysical commitments, consider the following pair of hypothetical scenarios.

Scenario 1. In our best scientific theories, some electromagnetic phenomena are explained in terms of the electron. Suppose that one purpose for which we have scientific theories is to explain observed phenomena. Further suppose that we are for now somewhat uncertain of our understanding of electromagnetic phenomena, but our past successes in understanding and navigating our world using our scientific theories somewhat (even if not completely) justifies our belief in our current best scientific theories. Under these suppositions, should we say that electrons exist? It seems that insofar as we are inclined to say that other scientific posits exist, we should say the same of electrons. Since explanation is among our purposes for having scientific theories in the first place, the explanations in our scientific theories are key components of those theories. So, the justification our best theories have extends to our explanations of electromagnetic phenomena. If we take such justification to be reason to affirm the existence of some other scientific posits, then, it seems we should do the same for electrons. In this case, the epistemological grounds for our belief that electrons exist is part of our

scientific practices, namely our use of electrons to explain electromagnetic phenomena.

Scenario 2. In our best scientific theories, some electromagnetic phenomena are explained in terms of the electron. Suppose that one purpose for which we have scientific theories is to explain observed phenomena by identifying the relevant dependency relations in the world. Further suppose that whether a scientific explanation succeeds in identifying dependency relations depends on the existence of its explanantia. That is, if it turns out that electrons do not actually exist, explanations of electromagnetic phenomena in terms of electrons would fail.[3] Under these suppositions, should we say that electrons exist? It seems that we should. Given that we intend scientific explanations to identify dependency relations in the world, our use of electron-based explanations assumes (perhaps tacitly) that those explanations can identify the relevant dependency relations. And since this assumption depends on the existence of electrons, we also tacitly assume in our use of electron-based explanations that electrons exist. It thus seems that we should affirm the existence of electrons to align our ontological beliefs with our tacit assumptions, at least for as long as we use electrons in scientific explanations. Here again, the epistemological grounds for our belief that electrons exist is provided by our scientific practices, namely by our use of electrons to explain electromagnetic phenomena.

These hypothetical scenarios illustrate two possible ways in which our practices can provide arbiters of existence. In both cases, our scientific practices can inform our ontological beliefs because they are somehow privileged with respect to our ontological commitments. In *Scenario 1*, our best scientific theories are privileged in the sense that their past successes justify our belief in them. In *Scenario 2*, our scientific explanations are privileged in the sense that their dependence on the existence of their explanantia implies that they carry tacit ontological assumptions. Either way, the fact that a scientific posit is involved in a particular way in our scientific practices can give us reason to affirm its existence.

Toward a generalisation, call a kind of practice *ontologically relevant* if an entity's involvement in that practice can constitute good reason to affirm the existence of that entity. The hypothetical scenarios above illustrate two (not necessarily exhaustive) ways in which some of our practices might be

[3] To be sure, even if there were no electrons in the world, we would still be able to perform the act of explaining electromagnetic phenomena in terms of the (hypothetical) electron. The sense in which these explanations would fail is that (under the supposition above) they would be unable to identify the relevant dependency relations correctly, and hence unable to attain the purpose for which we have scientific explanations. Thanks to two anonymous reviewers for pressing for clarity on this point.

ontologically relevant. In cases where we affirm the existence of a kind of entity, a necessary condition for our practices to provide that entity's arbiter of existence is ontological relevance. For example, we do not typically think that an entity's appearance in fiction is a reason to affirm its existence, so although we affirm that human detectives exist, the epistemological grounds for this affirmation cannot be that a human detective appears in stories about Sherlock Holmes—the things we do with fictional stories cannot provide arbiters of existence because they are not ontologically relevant.

It might be wondered if any of our practices are ontologically relevant. Given that ontological claims are claims about what exists in the world, and our practices consist in human activities that may have little to do with worldly facts, it might seem odd to think that our practices can justify ontological claims. The scenarios above, however, suggest that it can sometimes be reasonable to think that our practices bear an epistemic connection to worldly facts. Namely, if a kind of practice has had a track record of success that indicates reliability regarding worldly facts, or if it depends on worldly facts in such a way that it would not be rational to engage in that kind of practice without believing those facts, it seems reasonable to consider that kind of practice a reliable guide for what some of our ontological beliefs should be. Indeed, it will be seen shortly that many do argue for the ontological relevance for some of our practices.

Another similarity between the two hypothetical scenarios is that in both cases, electrons were stipulated to play a key role in contributing to the purpose of our best scientific theories. It was supposed, in both scenarios, that some of our best scientific explanations depend on electrons, and that part of the purpose of our scientific practices is to provide explanations. These suppositions imply that if our scientific practices were revised such that our scientific theories did not contain apparent reference to electrons (in *Scenario 1*) or our scientific explanations were not given in terms of the electron (in *Scenario 2*), our ability to attain the very purposes for which we do science would be compromised.[4]

In general, say that an entity is *indispensable* to a kind of practice if, were the relevant practices revised to avoid the use of that entity, or the use of theories containing apparent reference to that entity, the purpose for which we engage in those practices would be compromised. In the scenarios

[4] To be sure, our *ability* to do science would not be affected even if electrons did not exist—indeed, it is possible that we were in fact wrong about electrons all along. What would be affected is our attainment of the *purposes* for which we do science. If it turns out that we were wrong about electrons, our scientific theories would be unable to serve their intended purposes, and hence should be revised. Thanks to two reviewers for highlighting this point.

above, electrons are indispensable to our scientific practices.[5] In cases where we have reasons to affirm the existence of a kind of entity, a necessary condition for a kind of practice to provide that entity's arbiter of existence is for the entity in question to be indispensable to those practices. Someone having a hallucinatory experience might be justified in believing that there are tables in the world, but the epistemological grounds for their belief cannot be that they have table-like experiences, because tables are not indispensable for making sense of those experiences.

So when we are ontologically committed to a kind of entity, two necessary conditions for a kind of practice to provide that entity's arbiter of existence are ontological relevance and indispensability. It turns out that these conditions are also jointly sufficient. If a kind of practice is ontologically relevant, we have reason to affirm the existence of some entities involved in that kind of practice. And if a kind of entity is indispensable to that kind of practice, then we are justified in accepting an ontological commitment to those entities in particular.

In fact, some realist arguments in ontological debates proceed along these lines—they argue for an ontological commitment to a kind of entity on the grounds that those entities are indispensable to an ontologically relevant practice. Consider, as an example, the *Quine-Putnam indispensability argument* sometimes advanced in favour of mathematical Platonism, according to which we should affirm the existence of Platonic mathematical entities because those entities are indispensable to our best scientific theories (Quine 1981, 1986). The reasoning behind this argument is often understood in one of two ways. On one reading, the argument is that our scientific theories have some independent justification, which extends to mathematical entities on account of their indispensability to those theories (Baron 2013; Colyvan 2001). Alternatively, the argument may be understood as saying that our very use of scientific theories carries a metaphysical commitment to the mathematics on which those theories depend (Azzouni 2009; Panza and Sereni 2016; Resnik 1995). Either way, this argument attempts to make the case that our scientific practices are ontologically relevant, such that an entity's being involved in our scientific practices may be reason to affirm its existence (depending on which interpretation is adopted, the argument makes a case for ontological relevance similarly to either *Scenario 1* or *Scenario 2*, respectively). Then, according to the argument, mathematical entities are indispensable to our best scientific theories, from which it is concluded that we have reason to

[5] Some might think it more natural to describe Scenario 1 by saying that electrons are indispensable to our scientific *theories*. Given that we employ those theories as part of our scientific practices, it is also legitimate (albeit slightly less precise) to say of that scenario that electrons are indispensable to our scientific practices.

affirm the existence of mathematical entities, with our scientific practices providing their arbiter of existence.

Another example is David Lewis' (1986) argument for modal realism, according to which we should affirm the existence of concrete possible worlds because a realist view can provide a straightforward interpretation of our modal discourse. If this argument goes through, our discursive practices are ontologically relevant: the fact that we engage in modal discourse gives us reason to believe in the existence of some entities involved in that discourse. Lewis also argues that concrete possible worlds are indispensable to our modal discourse, in that interpretations of our modal discourse not involving concrete possible worlds are inferior in important respects to interpretations in terms of concrete possible worlds. From this it follows that we should affirm the existence of concrete possible worlds, with their arbiter of existence given by our modal discourse.

Apart from these examples, arguments have also been advanced for mathematical Platonism (Baker 2005; Colyvan 2010; Lyon 2011), moral realism (Enoch 2011; Majors 2003), scientific realism (Smart 1963), realism about grounding relations (Audi 2012), and theism (van Holten 2002) on the grounds that the respective entities are indispensable for some of our practices. The fact that connections between our practices and ontological commitments are often made via indispensability arguments lends further support to the idea that if our practices can provide arbiters of existence, the relation between those arbiters and our ontological commitments consists in indispensability.

We may also consider how this framework can be extended to cases in which we deny the existence of a kind of entity. To see how our practices can provide the epistemological grounds for such a denial, consider the following hypothetical scenario. Suppose we have reasons to reject an ontological commitment to phlogiston, and that phlogiston's arbiter of existence is given by our practices. Further suppose the following about three kinds of practices:

(i) Our discursive practices are not ontologically relevant.
(ii) Our practice of moral deliberation is ontologically relevant.
(iii) Our best scientific theories are ontologically relevant.

Which of (i)–(iii) can provide the epistemological grounds for denying the existence of phlogiston? It seems clear that (i) cannot. For, if our discursive practices are not ontologically relevant, they do not provide the epistemological grounds for any ontological commitments at all, so our

rejecting an ontological commitment to phlogiston has nothing to do with our discursive practices. This reasoning generalises: in cases where we reject an ontological commitment to a kind of entity, a necessary condition for a kind of practice to provide that entity's arbiter of existence is ontological relevance.

From (ii) and (iii) it follows that phlogiston is not indispensable to either moral deliberation or our best scientific theories, given the discussion above. There is a sense in which both are part of the reason for which we deny phlogiston's existence. If phlogiston had been indispensable to either, we would have had reason to affirm its existence. But we can be more precise in identifying phlogiston's arbiter of existence. Although we would have been ontologically committed to phlogiston had it been indispensable for moral deliberation, it sounds odd to say that we should not be ontologically committed to phlogiston because it is dispensable for moral deliberation. For, given the conditions under which our concept of phlogiston was introduced, if we had been ontologically committed to phlogiston, this ontological commitment is more likely to have been underwritten by our best scientific theories than by our moral deliberation.[6] So, it is more natural to say that our best scientific theories provide the *primary* reason for which we are not ontologically committed to phlogiston—(iii) rather than (ii) is our epistemological grounds for denying phlogiston's existence. This reasoning also generalises: in cases where our practices give us reasons to reject an ontological commitment to a kind of entity, that entity's arbiter of existence is provided by the practices to which it would have been indispensable, had we had reasons to affirm its existence; and the reason for our actually denying that entity's existence is that it is in fact not indispensable to its arbiter of existence.

Taking stock: if an entity's arbiter of existence is given by our practices, it is given by the ontologically relevant practices to which that entity would be indispensable, assuming we are ontologically committed to it. And, in these cases, the relation between arbiters of existence and our ontological commitments consists in indispensability: we should accept an ontological commitment to a kind of entity iff it is indispensable to the practices that provide its arbiter of existence. The discussion above suggests that these relations hold regardless of whether we have reasons to accept or reject an ontological commitment to the entity in question. Therefore, as may be expected, the identification of an entity's arbiter of existence can be

[6] Slightly more precisely, in terms of possible worlds: holding fixed the way our concept of phlogiston was introduced, some counterfactual world in which we are ontologically committed to phlogiston and phlogiston is indispensable to our best scientific theories is closer to actuality than any world in which we are ontologically committed to phlogiston and phlogiston is indispensable to moral deliberation.

epistemologically prior to the determination of our ontological commitments.

Three loose ends to tie up. First, the above account assumes that arbiters of existence are given by our practices. This might not always be the case. We might affirm the existence of some entities simply because of a favourable pre-theoretic intuition, or we might deny the existence of some entities because their existence would entail a contradiction. In such cases, our intuitions or logical constraints provide arbiters of existence, and the epistemological grounds for our ontological beliefs have little to do with ontological relevance or indispensability. The above account is not intended to apply to cases like these.

Second, whenever arbiters of existence are provided by our practices, entities can always be expected to have an arbiter of existence. Earlier, it was argued that a sufficient condition for accepting an ontological commitment to a kind of entity is that it be indispensable to an ontologically relevant aspect of our practices. This condition is also necessary: if a kind of entity is not indispensable to any ontologically relevant kind of practice, our practices would not give us reason to affirm the existence of those entities. For, in such cases, it would not make a significant difference to our practices whether the entities in question exist.[7] So if our practices do give us reasons to affirm the existence of a kind of entity (whether actually or counterfactually), that entity would be indispensable to some ontologically relevant practice, which would then be its (actual) arbiter of existence.

Third, it might sometimes be unclear how practices should be individuated. For instance, there might be several viable ways of delineating our scientific practices: our visual perception in ordinary contexts does not seem to fall squarely within our scientific practices, but it might be considered scientific under some broad construal of science. For the purpose of examining arbiters, what we require is a sufficiently fine-grained delineation of practices that respects epistemological differences. That is, practices should be treated as distinct insofar they provide different kinds of epistemological grounds for the existence of a kind of entity. To be sure, this is not a fully precise account of how to individuate practices, since there might be disagreement over whether some practices are sufficiently similar to be identified, or sufficiently different to be

[7] In cases where our practices give no indication as to the existence of a kind of entity, views are divided as to whether we should *deny* the existence of those entities (Field 1989, 45; Leng 2010, 258-260), or remain *agnostic* on their existence (Bueno 2009, 79; van Fraassen 1989, 193), or take there to be *no fact of the matter* (Carnap 1950; Yablo 2009). The argument here requires only the weaker conclusion, compatible with all three options, that we have *no reason to affirm* the existence of those entities.

distinguished. Nevertheless, this constraint provides a rough principle for assessing delineations, at least for present purposes, and rules out delineations that are arbitrary or gerrymandered.

Relatedly, under some delineations of practices, an entity might be indispensable to several ontologically relevant practices. The more precise way of stating the earlier result is to say that an entity's arbiter of existence is provided by the *disjunction* of all the ontologically relevant practices to which it is indispensable. If all our best scientific theories are ontologically relevant, and electrons are indispensable to both our best theory of electric fields and our best theory of molecular energy states, the electron's indispensability to *either* theory would have provided sufficient epistemological grounds on which to be ontologically committed to electrons. If we had been ontologically committed to phlogiston, this would have been because it is indispensable either to our best theory of combustion or our best theory of rusting; the reason we are not so ontologically committed is because phlogiston is indispensable to *neither*. For simplicity, we will speak of arbiters as though they are provided by particular practices, though in fact they may be provided by disjunctions thereof.

Having examined arbiters of existence, we can explicate the notion of an arbiter of truth analogously. There might be cases in which the things we do give us reason to affirm the truth of some sentences regarding the nature of entities involved therein—call such practices *alethiologically relevant*.[8] If we are somehow justified in believing our best scientific theories, those theories would be alethiologically relevant. If we use scientific theories for the purpose of prediction, and the predictive accuracy of a theory depends on the truth of sentences therein, those theories would again be alethiologically relevant. A necessary condition for a kind of practice to provide an arbiter of truth is that it be alethiologically relevant.

A kind of sentence is indispensable to a kind of practice if any revision of those practices to eliminate dependence on those sentences, if even possible, would compromise our ability to attain the purposes for which we engage in those practices. As we currently perform moral deliberation, we might rely on the idea of some outcomes being better than others. If it is not possible to perform moral deliberation without relying on this idea, or if any way of performing moral deliberation without relying on this idea is inferior in important respects to the way we presently perform moral deliberation, then sentences about the relative superiority of outcomes are

[8] That there are such sentences, or that such sentences are true, should not be taken to imply that the entities in question exist—see n.1.

indispensable to moral deliberation. By arguments similar to those above, a necessary and sufficient condition for us to be alethiologically committed to a kind of sentence is that those sentences be indispensable to an alethiologically relevant practice.

An entity's arbiter of truth is provided by the practices to which sentences about the nature of that entity would be indispensable if, whether actually or counterfactually, we have reason to affirm the truth of such sentences. We should accept an alethiological commitment to sentences about that entity iff that sentence is indispensable to that entity's arbiter of truth.

2. Relations between arbiters

We now turn to the issue of relations between arbiters. If an entity's arbiters of existence and truth are given by our practices, might we expect any relation between the two? It will be argued in this section that under either metaphysical or semantic realism about a kind of entity, the arbiters for that entity may be expected to align in some way.

To illustrate the difficulties that potentially arise for realist views if the two kinds of arbiters are misaligned, consider the mathematical Platonist view formulated (though not endorsed) by Penelope Maddy (1992), under which we should affirm the existence of mathematical entities on scientific grounds but be informed as to their nature on mathematical grounds:

> We could argue, first, on the purely ontological front, that the successful application of mathematics [to science] gives us good reasons to believe that there are mathematical things. Then, given that mathematical things exist, we ask: by what methods can we best determine precisely what mathematical things there are and what properties these things enjoy? To this, our experience to date resoundingly answers: by mathematical methods; the very methods mathematicians use. (Maddy 1992, 279)

This view takes our scientific practices to provide the arbiter of existence for mathematical entities and our mathematical practices to provide their arbiter of truth. The results in §1 imply that under this view, we should affirm the existence of all and only mathematical entities that are indispensable to our best scientific theories, and affirm the truth of all and only sentences about the nature of those entities that are indispensable to our best mathematical theories.

Now consider what would follow under this view if our scientific and mathematical practices are misaligned with respect to their dependencies on mathematical alethiology.[9] Suppose, for a simplified example, that only the real number structure, and no other mathematical entity, is indispensable to our best scientific theories. Depending on whether the continuum hypothesis is false, there might be a subset of the real numbers whose cardinality is strictly between the cardinalities of the natural numbers and of the real numbers. It is known that the continuum hypothesis is independent of the axioms of Zermelo-Fraenkel set theory with choice—the most widely accepted foundation for mathematics—so our present understanding of the real numbers underdetermines the existence of such a subset. Suppose mathematicians were to decide, on mathematical grounds, that we should take the continuum hypothesis to be false. It would then seem that we should be ontologically committed to a set of real numbers with cardinality between the naturals and the reals. For, we are ontologically committed to the real numbers on account of our scientific practice, and we should, on account of our best mathematical practices, attribute to the real numbers properties according to the falsity of the continuum hypothesis.

But on the view under consideration, our practices do not warrant an ontological commitment to such a set. Our scientific practices provide the arbiter of existence for mathematical entities, but a set with cardinality between the naturals and the reals is not indispensable to our scientific practices—the real numbers would be able to play their role in our best scientific theories even if the continuum hypothesis were true. The fact that mathematical practice assumes the falsity of the continuum hypothesis does not underwrite an ontological commitment to the sets in question, because our mathematical practices do not provide the arbiter of existence for numbers. In this way, the alethiological misalignment between the arbiters leads to a tension over whether to affirm the existence of some mathematical entities.

The scenario above was one in which sentences about a kind of entity are indispensable to the aspect of our practices providing the entity's arbiter of truth but not that providing its arbiter of existence. The reverse situation might also be possible. Suppose that mathematicians are indifferent as to whether we should take the continuum hypothesis to be true, but a set with cardinality between the naturals and the reals is indispensable to our best

[9] It might be argued that our mathematical and scientific practices are sufficiently similar that they may be taken to constitute just one kind of practice, under some broad delineation of practices. In that case, our mathematical and scientific practices will, trivially, be aligned in their dependencies. For the purposes of this section, we set aside this possibility and assume, as Maddy does, that our mathematical and scientific practices constitute different kinds of practices.

scientific theories. Here again, a tension arises between the arbiters, this time over whether to affirm the falsity of the continuum hypothesis. To say that the continuum hypothesis is false would be to affirm some sentences about numbers that are not indispensable to our mathematical practices. But not to say so would mean not accepting an ontological commitment to sets that are indispensable to our best scientific theories, which provides the arbiter of existence for mathematical entities.

In short, if we affirm the existence of numbers on scientific grounds and turn to mathematical practice when seeking to determine the precise properties of numbers, it seems that we are justified in following the dictates of mathematical practice only insofar as its claims about numbers have bearings on scientific practice. Attributing properties to numbers beyond that would seem to entail holding unwarranted beliefs about the existence of numbers. Similar considerations apply to views that affirm the existence of a kind of entity while taking our practices to provide its arbiters. Namely, if the kinds of practices providing each arbiter are misaligned with respect to their dependencies on the alethiology of those entities, tensions may arise over the precise set of properties to be attributed to the entities in question. One way to avoid these difficulties is simply to drop metaphysical realism.[10] Another way is to revise the target view such that the arbiter of existence for the entities in question is not given by our practices. Yet another way is to hold a view under which the kinds of practices providing the arbiters of existence and truth are aligned with respect to their alethiological dependencies. While this does not require that the *same* practices provide both arbiters, it requires that the same sentences regarding the target entities be indispensable for both kinds of practices. That is,

(i) if a view affirms the existence of an entity, and the adopted arbiter of existence is given by a kind of practice, then the view should affirm a sentence about the nature of those entities iff that sentence is indispensable to that kind of practice.

Returning to the Platonist view above, consider now what would follow if our scientific and mathematical practices differ in their ontological dependencies. For simplicity, assume for this and the next paragraph that we are ontologically committed to all and only mathematical entities that

[10] The argument above shows that difficulties arise even in cases where some sentences about the nature of the target entities are not indispensable to the aspect of our practices providing their arbiter of truth, so dropping semantic realism about the target entities would not avoid the difficulties completely. Both cases in the argument, however, assumed that the target entities are indispensable to their adopted arbiter of existence. Hence, the difficulties are limited to metaphysical realist views.

are the referents of mathematical sentences that we affirm.[11] One way for the two aspects of our practices to be misaligned is for there to be parts of mathematics that are indispensable to our best mathematical theories but not to our best scientific theories. Suppose, for instance, that some very large infinities in set theory have no application to our best science. Then, there would be tension over whether to affirm the existence of such numbers (and hence sentences about them). An ontological commitment to such numbers would be unwarranted by their arbiter of existence because they are not indispensable to our best scientific theories, but to reject an ontological commitment would be also to withhold affirmation from all sentences about those entities, violating the dictates of their arbiter of truth.

The opposite misalignment might also be possible: there might be mathematical entities that are indispensable to our best scientific theories but not our best mathematical theories. Suppose that our best scientific theories require the use of large cardinals that are not given by our current set theory. Similar tensions between the two adopted arbiters arise here. To reject an ontological commitment to large cardinals would be to violate the dictates of the adopted arbiter of existence, but to accept the ontological commitment would be also to affirm sentences about them, at least some of which are not indispensable to the adopted arbiter of truth.

So if we affirm the truth of number-sentences on mathematical grounds and turn to science to justify an ontological commitment to numbers, it seems that we are justified in following the dictates of science only insofar as its claims about which numbers exist agree with the sentences we know to be true from mathematical practice. This generalises to other views that affirm sentences about the nature of a kind of entity while taking its arbiters of existence and truth to be given by our practices. Namely, if the kinds of practices providing the two arbiters are misaligned with respect to their ontological dependencies, tensions may arise over the precise nature of the entities whose existence is to be affirmed. Analogous to the above, these difficulties can be avoided by dropping semantic realism or by locating the adopted arbiter of truth outside of our practices. Or, the view in question should take the target entity's arbiter of truth to depend on its ontology in the same way as does its arbiter of existence:

(ii) if a view affirms sentences about the nature of an entity, and the adopted arbiter of truth for that entity is given by a kind of

[11] A similar argument to what follows would go through without this assumption, albeit with the appropriate restrictions to mathematical sentences that are true in virtue of mathematical entities.

> practice, then the view should affirm the existence of that entity iff that entity is indispensable to that kind of practice.

3. Implications for realist views

(i) and (ii) bear most directly on views that, like the Platonist view considered in §2, hold both metaphysical realism and semantic realism about a kind of entity while taking different kinds of practices to provide arbiters of existence and truth for those entities. David Enoch (2007, 2011) argued for moral realism on the grounds that objective moral properties are indispensable for deliberation (Enoch 2011, 72-74), and suggests that our moral judgments are reliable guides to moral facts (ibid., 168). Enoch's view takes our deliberative practices and our moral judgments to provide the arbiters of existence and truth (respectively) for objective moral properties. Thus, if different moral properties or moral claims are indispensable to our deliberation and moral judgments, difficulties similar to the above might arise over whether to attribute those properties or affirm those claims. Another example is the Platonist view defended by the early Maddy, who argued that we should be ontologically committed to mathematical entities because they are indispensable to our best scientific theories, and that we can know about mathematical entities by sense perception (Maddy 1990). For this view to avoid difficulties analogous to those above, it will have to be argued that our scientific theories and sense perception have the same ontological and alethiological dependencies.

(i) and (ii) also have implications for views that either hold metaphysical realism about a kind of entity while remaining neutral on their alethiology, or hold semantic realism about a kind of entity while remaining neutral on their ontology. The latter is perhaps more common. Hilary Putnam, for instance, argued that we should affirm mathematical sentences because 'a reasonable interpretation of the application of mathematics to the physical world requires a realistic interpretation of mathematics' (Putnam 1979, 74). He also held, however, that the applicability of mathematics to science does not commit us to Platonism, because it is possible for mathematical sentences to be true in virtue of possible structures in modal space rather than Platonic mathematical entities (ibid., 72).[12] Together with this non-commitment to Platonism, it might be thought that there is also no good reason why mathematical sentences *cannot* be true in virtue of Platonic mathematical entities. (Putnam did not think this—he held that mathematical sentences are in fact true in virtue of possible structures.) So there might be a view that takes our best scientific theories to provide the

[12] Also see Putnam (1967) and (2006).

arbiter of truth for mathematical entities, holds semantic realism about mathematical entities, but remains neutral between metaphysical realism and metaphysical anti-realism about *Platonic* mathematical entities.

The argument of §2 implies that neutrality is an unstable position for such a view. In particular, (ii) implies that we should affirm the existence of Platonic mathematical entities under this view iff they are indispensable to our best scientific theories. Suppose first that Platonic mathematical entities are not so indispensable, say because our best scientific theories are indifferent between mathematical sentences being true in virtue of either Platonic mathematical entities or possible structures. It follows from this that sentences about mathematical entities that distinguish Platonic entities from possible structures (such as '2 is a Platonic entity') are not indispensable to our best scientific theories. This is a reason *against* an ontological commitment to *either* Platonic entities *or* possible structures. For, it implies that to affirm the existence of Platonic entities rather than possible structures (or *vice versa*) would be to affirm sentences about mathematical entities in violation of their adopted arbiter of truth. Now suppose that Platonic mathematical entities are indispensable to our best scientific theories. That is, our best scientific theories require that mathematical entities bear properties of Platonic entities rather than possible structures. In this case, since our best scientific theories provide the arbiter of truth for mathematical entities, we should identify mathematical entities with Platonic entities and accept an ontological commitment to the latter.

The upshot is that under the view in question, we should affirm the existence of Platonic entities iff they are indispensable to our scientific practices, which gives us a reasonably clear idea of what it would take for us to be ontologically committed to Platonic entities. This does not mean that we cannot be agnostic regarding this ontological commitment, to be sure, since we might not as yet have determined whether the indispensability claim is true. But it does mean that neutrality on the existence of Platonic entities cannot be the end of our inquiry.

Analogously, there might be views that adopt an arbiter of existence for a kind of entity and affirm the existence of those entities, but remain neutral as to whether we should affirm any sentences about the nature of those entities. Against such views, (i) says that we should affirm all and only sentences about the nature of those entities that are indispensable to the practices providing their adopted arbiter of existence. This yields a reasonably clear idea of what it would take to adjudicate between semantic realism and semantic anti-realism, implying that neutrality between the two is also unstable.

Views of the kind just described are less common in the literature, since it might seem rather odd to affirm the existence of a kind of entity without saying anything about what those entities are like. Nevertheless, nearby views have been advanced that affirm the existence of a kind of entity while committing to *little* by way of their alethiology. Consider, for instance, the form of Platonism defended by Mark Colyvan (2001), who argues for an ontological commitment to mathematical entities on the grounds that they are indispensable to our best scientific theories. Colyvan holds that the argument does not commit us to any particular view about the nature of mathematical entities:

> [The argument] simply asserts that there *are* mathematical objects. They might be constituted by more mundane items such as universals and/or relations…patterns or structures…or the part/whole relation. Perhaps they are constituted by *more* exotic items such as possible structures (…). In short, any (realist) account of mathematical objects is all right by the indispensability argument. (Colyvan 2001, 143; emphasis original)

This view takes our best scientific theories to provide the arbiter of existence for mathematical entities and affirms that we are ontologically committed to such entities. It also affirms mathematical sentences insofar as they are indispensable to our best scientific theories. The view is neutral, however, regarding whether we are alethiologically committed to sentences that have implications for the precise nature of mathematical entities. For instance, this Platonist view neither affirms nor denies '2 has two members', which would be true if the natural numbers are the von Neumann ordinals and false if they are universals.

The argument of §2 also implies that neutrality is an unstable position for such a view. If indeed sets and universals can play the role of mathematical entities in our best scientific theories equally well, then neither is indispensable to our best scientific theories. This would be a reason against alethiological commitments to sentences about mathematical entities that imply their being (say) universals. For, to affirm such sentences while holding an ontological commitment to mathematical entities would imply an ontological commitment to universals, which would be unwarranted by the adopted arbiter of existence. Conversely, if universals are indispensable to the role of mathematical entities in our scientific practices, then we should be ontologically committed to mathematical entities as universals, and affirm sentences attributing (or implying) all the relevant properties. Either way, our scientific practices under this view can provide

sufficient grounds to determine what we should hold about the precise nature of mathematical entities.

4. Implications for epistemological objections

(i) also bears on a line of objection sometimes raised against metaphysical realism. It is sometimes argued that we should not affirm the existence of a disputed entity because affirming its existence would make it difficult to account for our knowledge in the corresponding domain. For, if we affirm the existence of a kind of entity, it seems natural to hold also that some of our knowledge in the corresponding domain is knowledge regarding those entities. But in some cases, the entities in question might be abstract, causally isolated, unobservable, or epistemically inaccessible in some way. Consequently, it might be unclear how our beliefs about such entities can be reliable, and hence how knowledge about them is possible. Insofar as a plausible epistemology of the domain in question is not forthcoming under metaphysical realism, this casts doubt upon the view. Objections along these lines have been raised against metaphysical realism about mathematics (Benacerraf 1973; Field 1989), objective moral properties (Mackie 1977), concrete possible worlds (Peacocke 1997, 1999), and objective logical facts (Schechter 2010), among other things.

(i) implies that if metaphysical realists take our practices to provide the grounds on which to affirm the existence of a kind of entity, they should turn to those same grounds when responding to such objections. For, (i) implies that we should, under their view, affirm all and only sentences about the nature of the entities in question that are indispensable to the practices that provide its arbiter of existence. Thus, those practices may provide epistemic access to the target entities—insofar as our beliefs in the corresponding domain align with the alethiological dependencies of those practices, those beliefs reliably track what we should affirm about the nature of the entities in question.

As an illustration, consider a Platonist view under which our best scientific theories provide the arbiter of existence for mathematical entities. Under such a view, we can take our best scientific theories as a guide to what we should believe about mathematics. For, when our best scientific theories depend on the existence of mathematical entities, those theories also require that mathematical entities play a particular role, and whether mathematical entities can fulfil this role will depend on whether they bear certain properties. So our best scientific theories dictate not only that we affirm the existence of mathematical entities, but also that we take mathematical entities to exist with a particular set of attributes. Platonists

who hold this view may thus say that we can attain mathematical knowledge reliably by considering what mathematical entities have to be like to play their role in science. Indeed, some Platonists do account for our mathematical knowledge in this way (e.g., Colyvan 2001, 151-155).

To be sure, the practices taken to provide the arbiter of existence may, in fact, not be a reliable guide to knowledge in the target domain. However, the implication in this case is not that metaphysical realists should turn to other kinds of practices to construct an epistemology for that domain, it is that the realist view itself has been undermined. According to (i), if the sentences we should affirm about an entity is misaligned with the alethiological dependencies of a kind of practice, then that kind of practice cannot provide the arbiter of existence for those entities. For instance, if our best scientific theories are unreliable guides to mathematical truth, then those theories do not depend on how mathematical entities are like. But then the argument for (i) in §2 implies that the success of our scientific theories is also independent of the existence of mathematical entities, and hence that those theories are inadequate grounds on which to hold Platonism. So it would be mistaken for Platonists to continue holding their view on grounds of our scientific practices while acknowledging that those practices cannot provide a plausible epistemology. And in general, if the supposed arbiter of existence for a metaphysical realist view cannot provide an adequate response to epistemological objections, it in fact cannot support the view at all.

5. Conclusion

It is commonly thought that arbiters of existence and truth are given by certain privileged kinds of practices. This paper has attempted to flesh out this view of arbiters and draw its implications. The sense in which our practices may be privileged and in a position to inform our metaphysical commitments consists in ontological or alethiological relevance. And, the relation between arbiters and our metaphysical commitments consists in indispensability: we delineate our metaphysical commitments according to the entities (or sentences) that are indispensable to ontologically (or alethiologically) relevant aspects of our practices. Taking arbiters to be given by our practices has implications for how arbiters of existence and truth should relate: if a view holds a realist commitment to an entity, it should also take the kinds of practices providing that entity's arbiters to align with respect to their metaphysical dependencies. This has two further implications. First, views holding an ontological or alethiological commitment to an entity have sufficient grounds in principle to arbitrate on the other realist commitment, and thus should not seek to maintain

neutrality on the latter. And, metaphysical realists about an entity who take a kind of practice to provide its arbiter of existence should turn to those same practices when responding to epistemological objections.

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