



# Naturalized metaphysics or displacing metaphysicians to save metaphysics

Rasmus Jakslund<sup>1</sup> 

Received: 14 December 2022 / Accepted: 24 May 2023 / Published online: 2 June 2023  
© The Author(s) 2023

## Abstract

Naturalized metaphysics aims to establish justified metaphysical claims, where metaphysics is meant to carry its usual significance, while avoiding the traditional methods of metaphysics—a priori reasoning, conceptual analysis, intuitions, and common sense—which naturalized metaphysics argues are not epistemically probative. After offering an explication of what it means to do metaphysics, this paper argues that naturalized metaphysics, at the outset, is hospitable to doing metaphysics. The underdetermination of metaphysics by science, however, changes the picture. Naturalized metaphysics has to break this underdetermination, but the criticism of the traditional methods of metaphysics leaves no resources with which to do so. Naturalized metaphysics must therefore be more restrictive than originally intended to ensure that some metaphysical features avoid underdetermination. In this restrictive naturalized metaphysics, however, metaphysicians are only left the task of surveying the opinions of scientists which, it is argued, does not qualify as doing metaphysics. Thus, to fulfill its promise to save metaphysics, naturalized metaphysics displaces the metaphysician. Furthermore, the attempt to re-employ them via the principle of naturalistic closure is argued to fail. Metaphysicians should therefore not be happier with naturalized metaphysics than they are with the more explicitly eliminative trends in contemporary metametaphysics, such as neo-Carnapian deflationism, despite the promise of naturalized metaphysics, likely to Carnap's dismay, to deliver justified claims about ultimate reality.

**Keywords** Naturalized metaphysics · Metametaphysics · Underdetermination · Metaphysicians · Realism · Principle of naturalistic closure

---

✉ Rasmus Jakslund  
rj@ind.ku.dk

<sup>1</sup> Department of Science Education, University of Copenhagen, Copenhagen, Denmark

## 1 Introduction

Naturalized metaphysics is driven by a worry about the epistemic legitimacy of traditional analytic metaphysics and proposes to remedy this by a closer association between metaphysics and our current best sciences as prominently defended by Ladyman and Ross (2007). In contrast with the criticism of metaphysics found among the logical positivists, naturalized metaphysics does not, however, argue that metaphysics is semantically defective (Ladyman, 2017, p. 144). Ladyman and Ross insist that “[w]e cannot go back to anti-metaphysical positivism” and in their book *Every Thing Must Go: Metaphysics Naturalized* they remark that “[t]his book is not hostile to metaphysics; indeed, it is an exercise in metaphysics” (Ladyman & Ross, 2007, p. 26). Naturalized metaphysics is, as such, not eliminative of metaphysics. Metaphysics—in a sense carrying all its usual significance—is meaningful and some of its claims, though not all, can be justified if they are properly informed, motivated, and constrained by science. “Scientism is usually thought of as sinful but it can be redeemed for our salvation,” as Ladyman (2018, p. 106) writes.

Naturalized metaphysics thus promises to save (some of) metaphysics in the sense of showing how some claims about ultimate reality can be both meaningful and justified. This paper, however, argues that this salvation comes at the price of displacing the metaphysicians. This conclusion is, in a sense, anticipated by L. A. Paul when she worries about naturalized metaphysics that “[a]t best, metaphysics is a handmaiden to science” (2012, p. 2; see also Ney, 2019, p. 17). This paper can thus be seen as substantiating such worries. More precisely, it argues that the attempts within naturalized metaphysics to overcome the challenges resulting from the underdetermination of metaphysics by science leave nothing to do for metaphysicians, at least nothing to do that resembles the typical activities associated with *doing metaphysics* (more on what these activities are below). The metaphysicians are displaced in naturalized metaphysics in the attempt to ensure that (some) metaphysical claims can remain justified despite the underdetermination of metaphysics by science.

Thus, despite its explicit endorsement of metaphysical realism, naturalized metaphysics ends up in the company of more eliminative views of metaphysics—often associated with the most radical interpretations of Carnapian (1950) deflationism—which argue that anything resembling the existing *metaphysical practice* is “a waste of time, and should thus be deleted from our repertoire” (Kraut, 2016, p. 35). This paper therefore proposes that metaphysicians might be no better off with naturalized metaphysics than they are with Carnapian deflationism. This is so, even though naturalized metaphysics, in contrast with Carnapian deflationism, regards some metaphysical claims as both meaningful and justifiable. Metaphysicians who want to engage in the typical activities associated with doing metaphysics should not look to naturalized metaphysics for their salvation.

This is, of course, not an argument against naturalized metaphysics. Proponents of naturalized metaphysics might well consider metaphysicians a necessary casualty of the attempt to reestablish the epistemic legitimacy of metaphysics or, more precisely, metaphysical claims. The purpose here is therefore only to make this consequence of naturalized metaphysics explicit. Doing so is particularly relevant since one might initially be hopeful that naturalized metaphysics could salvage metaphysicians as

well as metaphysical claims, for instance when Ladyman and Ross say that “[w]e cannot go back to anti-metaphysical positivism” and that their “book is not hostile to metaphysics; indeed, it is an exercise in metaphysics.” However, as this paper will argue, when faced with underdetermination, metaphysicians must go.

Notice that this conclusion does not depend on advancing new challenges to naturalized metaphysics. Rather, doing anything that resembles the typical activities of metaphysicians becomes problematic as a result of the ambition within naturalized metaphysics to establish justified metaphysical claims without resorting to the traditional methods of metaphysics, an ambition Ladyman and Ross share with Bryant (2020), French and McKenzie (2012), Humphreys (2013), Maudlin (2007), Melnyk (2013), and Ney (2012).<sup>1</sup> The displacement of metaphysicians is, as such, internal to naturalized metaphysics.

Naturalized metaphysics also comes in moderate versions that are more lenient with respect to the traditional methods of metaphysics. In the terminology of Alexandre Guay and Thomas Pradeu, the naturalized metaphysics program under study here therefore exemplifies the “strong version” of “scientific metaphysics” where “our worldview must be based *only* on current science” (Guay & Pradeu, 2020, p. 1850). As Guay and Pradeu make clear, this understanding of the relation between science and metaphysics is *not* ubiquitous, indeed they themselves reject this strong version in favor of a more “modest scientific metaphysics” that merely insists that “our worldview must take into account current science” (Guay & Pradeu, 2020, p. 1850; see also Morganti & Tahko, 2017). Importantly, these modest versions, as well as what Guay and Pradeu (2020, p. 1848) call “metaphysics applied to science,” are unaffected by the arguments of this paper. Instead, they only apply to the strong version of scientific metaphysics where metaphysics is viewed as epistemically credible if and only if it stays entirely clear of the traditional methods of metaphysics. This is the view that, following Ladyman and Ross, will be denoted by ‘naturalized metaphysics’ below.

The paper proceeds as follows. Section 2 gives a brief outline of the central commitments of strong naturalized metaphysics. These are taken to be the criticism of the traditional methods of analytic metaphysics and a strong deference to science to replace them. Section 3 explicates what ‘doing metaphysics’ means in the present context and argues that naturalized metaphysics, at the outset, is hospitable to much of this activity. Section 4 introduces the problem of the underdetermination of metaphysics by science. It explores various strategies for overcoming this problem within naturalized metaphysics but finds that looking for metaphysical features that are not in fact underdetermined is the only viable one. Section 5, however, argues that this strategy leaves no room for doing metaphysics. Section 6 adds that Ladyman and Ross’ proposed re-employment of metaphysicians through the principle of naturalistic closure does not change this, and the paper therefore concludes that naturalized metaphysics displaces metaphysicians to save metaphysics.

---

<sup>1</sup> There are notable differences between the views shared by these authors, some of which are discussed later on. For present purposes, however, the important commonality is their shared commitment to establishing justified metaphysical claims without resorting to the traditional methods of metaphysics.

## 2 Naturalized metaphysics

Naturalized metaphysics is propelled by a worry about the epistemic legitimacy of the methods traditionally employed when answering metaphysical questions. In justifying metaphysical claims, it is argued, one has largely depended on intuitions, common sense, conceptual analysis, and a priori reasoning but since these faculties are the results of biological evolution, naturalized metaphysics argues that they furnish no faculty providing insights about ultimate reality. Rather, these methods are adapted for “making navigational inferences in certain sorts of environments (but not in others), and [...] anticipating aspects of the trajectories of medium-sized objects moving at medium speeds” (Ladyman & Ross, 2007, p. 3). Furthermore, these traditional methods of metaphysics have had little success with their speculations about ultimate reality, and continuing such speculation is thus “ignoring the fact that science, especially physics, has shown us that the universe is very strange to our inherited conception of what it is like” (Ladyman & Ross, 2007, p. 10). On these grounds, Ladyman and Ross conclude that “there is no reason to imagine that our habitual intuitions and inferential responses are well designed for science or for metaphysics” (2007, p. 3; see also Bryant, 2020, pp. 1874–1875; Humphreys, 2013, pp. 56–58).<sup>2</sup> According to naturalized metaphysics, *autonomous metaphysics* based these traditional methods is too unreliable “to be an epistemically adequate form of inquiry that produces justified theories about the nature of the world” (Bryant, 2020, pp. 17–18; see also French & McKenzie, 2012, p. 55; Melnyk, 2013, p. 93; Ney, 2012, p. 66). Only metaphysics that avoids these methods is epistemically credible. Since the purpose of this paper is to investigate the consequences for metaphysics *assuming* this criticism of its traditional methods, whether this criticism is warranted will not be discussed any further here.

Naturalized metaphysics, like most other naturalisms (Jacobs, 2019), is a revisionary program that, though it identifies a problem in the existing practice, also offers a remedy: a closer integration between metaphysics and science. The proposal, however, is not that metaphysics should adopt the methods of science; the kind of naturalism that Quine (1969) proposes in the context of epistemology and which is often denoted as ‘methodological naturalism’ (De Caro, 2010; Papineau, 2021; Rea, 2002). Rather, naturalized metaphysics is committed to an ontological naturalism (in the terminology of Raley (2005) and Dieveney (2012)) which takes the findings rather than methods of science as its starting point.<sup>3</sup> More precisely, Ladyman and Ross qualify that their “[n]aturalism requires that, since scientific institutions are the instruments by which we investigate objective reality, their outputs should motivate all claims about this

<sup>2</sup> Dorr (2010) has argued that metaphysics does not employ these methods. Tallant (2013, 2015) objects that especially intuitions also plays a central role in physics. See Ladyman (2017) for a discussion of these criticisms.

<sup>3</sup> One might object that ‘ontological naturalism’ is a misnomer since, in being concerned with *how* to do ontology, this is a methodological rather than ontological thesis; indeed, it seems to fall under what Gabriele Gava (2019, p. 210) calls “moderate methodological naturalism.” This is to contrast it with the view that philosophy should adopt the *methods* of science and which Gava (2019, p. 210) calls “extreme methodological naturalism.” What is important for present purposes is not what to call these positions but to emphasize the contrast between them and that naturalized metaphysics promotes the use of the findings and not the methods of science in metaphysics. The argument of this paper is therefore not meant to apply to (extreme) methodological naturalism, though similar reflections might be relevant for such a position.

reality, including metaphysical ones” (2007, 30; see also French & McKenzie, 2012, pp. 56–57; Maudlin, 2007, p. 1; Melnyk, 2013, p. 94; Ney, 2012, p. 76). The proposal, in other words, is that metaphysical claims that are motivated, and arguably also constrained, by the *outputs* of our current best science can be justified while this is not so for metaphysics that appeals to the traditional methods for their justification.<sup>4</sup> Such naturalized metaphysics can generate justified claims about “objective reality,” as Ladyman and Ross put it above.

Thus, though proponents of naturalized metaphysics are critical of the traditional methods of metaphysics, they still seem to want to preserve metaphysics and its traditional aims. In contrast to eliminative programs such as logical positivism, Ladyman insists in his apology for naturalized metaphysics that “metaphysics should not be abolished but reformed” (2017, p. 143; see Soto, 2015, p. 47 for a discussion). The naturalization of metaphysics involves the introduction of new science-informed approaches to justifying metaphysical claims that can replace those illegitimate methods that have traditionally been employed while preserving the subject matter and thus ambitions of metaphysics. In agreement with a typical explication of metaphysics as “the study of ultimate reality” (van Inwagen, 2015, p. 1), Ney, for instance, sees the task of naturalized metaphysics to be “to establish conclusions about ultimate reality” (2012, p. 76) and Ladyman and Ross argue that “no other sort of metaphysics counts as inquiry into the objective nature of the world” (2007, p. 9). Other proponents of naturalized metaphysics emphasize that their use of ‘metaphysics’ is co-extensive with its traditional use: “*metaphysics* is whatever it is that we do in metaphysics anthologies, journal articles, and classrooms” (Bryant, 2020, p. 3; see also Hawley, 2006, p. 452). ‘Metaphysics’ in ‘naturalized metaphysics’ is meant to carry its usual significance.

Thus, naturalized metaphysics seems to endorse metaphysical realism and thus an inflationary conception of (the subject matter of) metaphysics. Naturalized metaphysics aims at justified claims about ultimate reality and in this respect, it differs from the attempts to salvage metaphysics that try to reconstrue its subject matter (e.g. Jenkins, 2014; Kraut, 2016; Strawson, 1959).

### 3 Doing metaphysics

Naturalized metaphysics, as discussed above, preserves the aim of metaphysics to produce justified claims about ultimate reality but criticizes the methods that have traditionally been employed by metaphysicians towards this aim. This promises two quick and opposing replies to the question whether naturalized metaphysics displaces the metaphysician. On the one hand, if a metaphysician is someone who does something that results in justified claims about ultimate reality, then naturalized metaphysics saves the metaphysicians as well as metaphysics (if, of course, naturalized metaphysics succeeds with this aim). On the other, if a metaphysician is someone who uses these

---

<sup>4</sup> McKenzie (2020) has argued that only the final scientific theory can serve to justify metaphysical claims about the world because only this theory is not subject to change. Since our current best scientific theories are expected to change, they cannot provide such justification, and naturalized metaphysics is therefore currently on par with autonomous metaphysics. This concern about naturalized metaphysics will, however, be bracketed here.

traditional methods of metaphysics to answer questions, then it is hardly surprising if naturalized metaphysics eliminates the metaphysician. The aim here, however, is to propose a more subtle understanding of what a metaphysician does that, at the same time, is tolerant of changes to the metaphysical practice but remains continuous with it.

Metaphysicians have often expressed dissatisfaction with attempts by so-called “reformers” (Manley, 2009, p. 4) to save metaphysics by altering the aims of metaphysics. Jonathan Lowe, for instance, considers the proposal “to understand the aim of metaphysics [...] as the attempt to analyse our currently accepted ways of talking” (1998, p. 2) but forcefully dismisses anyone undertaking such a project with the proclamation: “let us not pretend that in doing so we would be doing anything worth dignifying by the name ‘metaphysics’” (1998, p. 2; see also Bloomfield, 2005, sec. 3; Cameron, 2010, p. 17; Poidevin, 2009, p. 20). Likewise, the otherwise well-meaning proposals following Rudolf Carnap (1950) that metaphysics might be reconstrued as metalinguistic negotiation (e.g. Jenkins, 2014; Kraut, 2016, 2020; Plunkett, 2015; Thomasson, 2017a, 2017b) are, for instance, dismissed by Jessica Wilson. She distinguishes between “investigation into and disagreement about what it is most useful for us to take to exist, as opposed to investigation into and disagreement about what really does exist” but insists that “[m]etaphysics involves the latter, not the former” (Wilson, 2011, p. 184; see also Hofweber, 2016a, p. 26). For metaphysicians to recognize themselves in an attempt to revise metaphysics, the revision must keep with the traditional aim of metaphysics.

The point of some reformers, of course, is that the activity of metaphysicians can largely continue as before if it is only recognized that the description of what is going on must be altered; for instance from investigating reality to investigating useful ways of talking (see in particular Kraut, 2016). A way of capturing metaphysicians’ resistance to such reforms is through the condition that the reformed description of the activity must be dependent on the truth of metaphysical realism, i.e., dependent on the “availability of a ‘God’s-Eye’ point of view, from which we could compare our theories and belief about the world to the world itself, as it is independently of our conceptual systems” (Haukioja, 2020, p. 67). While a discussion described as concerning the existence of numbers will be nonsensical if metaphysical realism is discovered to be false, a (re-)construal of it as the discussion whether number talk is useful will be left unscathed. In accordance with the intuition expressed by Lowe and Wilson, the former therefore qualifies as doing metaphysics but not the latter (irrespective of how similar the two activities are).

Since naturalized metaphysics preserves the commitment to metaphysical realism and makes no attempt to alter the content of metaphysical claims, this condition is satisfied by naturalized metaphysics. However, preserving the aims of metaphysics or equivalently, doing something that is dependent on metaphysical realism, is arguably not sufficient for the revised activity to qualify as doing *metaphysics*. Metaphysicians must also have a sufficiently distinctive role to fill as part of inquiry. Thomas Hofweber distinguishes such partaking in inquiry from contributing more generally with the example that “[w]ashing the test tubes of the chemists is a useful contribution to inquiry, but it is not itself a proper part of inquiry, only a supporting role” (2016c, p. 43). Thus, philosophers analyzing and improving the language of science are not *partaking* in

inquiry and therefore not doing metaphysics, even if the end result of the consequent scientific inquiry is truths about ultimate reality (Hofweber, 2020, p. 428). Likewise, just reporting on such truths is insufficient, according to Hofweber. A metaphysics that merely “looks at the results of the sciences and their consequences without adding to them” (Hofweber, 2016b, p. 296) is, in an echo of Lowe, “unambitious metaphysics [...] not worth the name” (Hofweber, 2016b, p. 297). For an activity to qualify as doing metaphysics, it is necessary that it partakes in the inquiry into ultimate reality *and* adds to it.

For this reason, Hofweber is also hesitant to regard it as doing metaphysics when the metaphysical findings are immediately derived, for instance, from science or, as Amie Thomasson’s (2015) easy ontology proposes, the application conditions for our everyday language. While, for instance, mathematicians do not typically inquire about the existence of numbers themselves, Hofweber finds that “a paradigm case of a pointless project is to ask whether there are numbers even though the answer ‘yes’ is immediately implied by the results of mathematics. If the metaphysical questions are just like that, then there is nothing left to do” (2016b, p. 299). Speaking more specifically about Thomasson’s easy ontology, Ross Cameron expresses the same sentiment when he notes that “[t]here is no work for the metaphysician here” (2020, p. 238). Ontology is easy, Thomasson (2015, p. 130) argues, since from the fact that a dress is red it follows that something has a property of being red which in turn implies that there are properties. Compiling the list of what thereby exists would, however, not qualify as doing metaphysics, at least if the rest of the ontology is immediately implied like this. Even though it is this compilation work that—if Thomasson is correct—would result in metaphysical truths, the problem, following Hofweber and Cameron, is that nothing is added by the metaphysician that was not otherwise immediately implied. In Hofweber’s analogy, the task of an easy ontologist is analogous to cleaning the tubes or, perhaps rather, copying down the readings from the displays of the scientific instruments which by Hofweber’s standards would not count as partaking in inquiry. The present discussion shall proceed on the assumption that the easy ontologist’s inference to the existence of properties from the existence of a red dress does not qualify as doing metaphysics, a view at least shared by Hofweber and Cameron. Someone disagreeing with this view can read the subsequent sections as arguing that the work of the metaphysician in naturalized metaphysics is comparable to that of the easy ontologist in that example [and without the possible subtle role for the metaphysician in the latter due to conceptual ethics identified by Thomasson (2017a)].

One might worry that a science-based metaphysics would fare little better. However, Hofweber, correctly I think, qualifies that there could be a substantive task for the metaphysician to undertake as soon as the answers to some metaphysical questions are not immediately implied by other parts of inquiry. Already “[i]f there was such an implication, but it was hard to see whether it obtained, then this would be different” (Hofweber, 2016b, p. 298). Thus, the issue with easy ontology is not that the answers are ultimately implied by the application conditions for our everyday language but that it is too easy. Thus, to preserve the metaphysicians, and not only metaphysics, it is necessary for a revision of metaphysics, such as that proposed by naturalized metaphysics, to leave some substantial work to do for the metaphysicians where they partake in and add to the inquiry into ultimate reality.

This job description, however, might as well be given of (semantic) realist physics as of metaphysics. But re-employing displaced metaphysicians as physicists can hardly qualify as leaving a place for doing metaphysics. Since Hofweber's primary concern is to argue that metaphysics is a distinct discipline, he sidesteps such worries arguing that metaphysics is characterized by asking questions not asked by any other inquiry, though it has "no distinct subject matter, nor a distinct methodology" (2016b, p. 311). Thus, on Hofweber's account, though he does not admit this possibility explicitly, one could be doing metaphysics through equations and experiments, if only the right questions were pursued. However, here I shall claim—and I allege that this is the attitude of most metaphysicians—that something cannot qualify as doing metaphysics if those who used to do it are now unable to, even with some retraining. To qualify as doing metaphysics, the revised metaphysical practice should be sufficiently continuous with the existing one.

So what is the existing practice? Karen Bennett provides some indication when she asks "[h]ow do metaphysicians go about their business?" and answers:

They use a priori reasoning. They also use empirical claims [...]. They use thought experiments. They engage in counterfactual and modal reasoning. They track what entails what, and also use inference to the best explanation. They tease out consequences of views, and hidden contradictions. They reckon costs and benefits. They counterexample each other. They postulate entities to do various theoretical jobs, or account for some phenomenon. And so forth (Bennett, 2016, p. 25).

To this list, we might add some themes from Daniel Nolan's (2016) account of the methods in analytic metaphysics (which otherwise overlap with Bennett's list): conceptual analysis, consulting intuitions, and reflecting on common sense. With the criticism of the traditional methods of metaphysics it is hardly surprising that not all of these practices can continue in naturalized metaphysics. However, the remainder of this section will argue that it is not *prima facie* ruled out that naturalized metaphysics can be hospitable to doing metaphysics in the sense of it being a practice that partakes in and adds to the study of ultimate reality while being continuous with the existing metaphysical practice.

Many of the listed metaphysical activities could be categorized as a priori. Apart from explicit a priori reasoning itself, thought experiments, looking for contradictions, finding counterexamples, teasing out consequences, analyzing concepts, and reflecting on intuition might be given this label. If naturalized metaphysics finds all such a priori activities illegitimate, then there will after all be very little left that metaphysicians can legitimately do. Naturalized metaphysics, however, is specifically critical of the reliability of a priori reasoning and the traditional methods of metaphysics more generally *as evidence* for metaphysical claims. More precisely, metaphysics cannot be based on alleged synthetic a priori truths, intuitions, insights from conceptual analysis, or common sense if the aim is justified claims about ultimate reality. These, however, are not problematic because naturalized metaphysics generally doubts our ability to reason well. Irrespective of how good a conceptual analysis is, it will never, according to naturalized metaphysics, provide any justification for metaphysical claims. Indeed, in all four cases, the problem is that the source, in a sense, is contaminated from



the outset. Nothing, by contrast, is inherently problematic about looking for contradictions, finding counterexamples, and teasing out consequences, even though these activities take place in the armchair. Though we are of course fallible when reasoning like this, any mistake can be identified and remedied by others. Denoting the latter ‘a priori methods,’ Tahko (2020) reserves the name ‘a priori reasoning’ (as also done here) for those activities that allege to produce insights about the world (sufficiently) independently of experience, though Tahko (2020, p. 355) adds that the boundary may not be sharp.

At the very least, this tolerance for a priori methods should extend to the use of deductive inferences, and some proponents of naturalized metaphysics might extend this tolerance to abduction and even induction as well. Whether this allows for the use of thought experiments will likely depend on what one purports that thought experiments can show. But developing thought experiments should be an admissible activity even for the naturalized metaphysician if they are merely regarded as a vivid way to demonstrate consequences or contradictions of some set of propositions, what Häggqvist (2009, p. 60) denotes “the argument view.”

Of the remaining activities mentioned by Bennett, Ladyman and Ross (2007, p. 12) dismiss cost–benefit considerations as an example of the use of intuitions. Relating to counterfactual and modal reasoning, Ladyman and Ross “deny that a priori inquiry can reveal what is metaphysically possible” (2007, p. 16). For all they say, however, if counterfactual and modal reasoning is regimented by the results of science, then it might be acceptable. Inference to the best explanation and the related positing of entities to do theoretical jobs is arguably borderline since they are not so different from cost–benefit analyses, but Ladyman and Ross (2007, p. 69), at the same time, explicitly use inference to the best explanation in their defense of scientific realism. Despite these unclarities, the above seems to show that the criticism of the traditional methods of metaphysics does not defeat the possibility of continuing aspects of the existing metaphysical practice within naturalized metaphysics.

This, however, will be of little comfort to the metaphysician if these activities never come into play. The principal commitment of naturalized metaphysics is that the results of science must replace all other evidence in metaphysics, but this raises a worry—analogues to that realized in easy ontology—that science immediately answers all the admissible metaphysical questions. Two interrelated circumstances speak against this worry, though the subsequent sections will ultimately show that this worry is real in naturalized metaphysics. First, naturalized metaphysics is not—and should not be—eliminative of metaphysical questions, as I argue elsewhere (Jaksland, 2021, sec. 3). Thus, there should be ample room for questions that are not immediately answered and where the implications of science for that question are at least “hard to see,” as Hofweber puts it above. This is especially so since scientific theories are typically constructed to answer questions internal to science that rarely coincide with the questions of interest to metaphysics. Scientific theories will therefore rarely answer metaphysical questions explicitly (see, e.g., Jaksland, 2021, pp. 11–12). Thus, to “tease out consequences” of science for our metaphysical questions is a central task for the metaphysician in naturalized metaphysics and, importantly, one that the scientists neither have an interest in carrying out themselves nor the skills since it will require doing metaphysics. That doing metaphysics is not ruled out in naturalized metaphysics is

well illustrated by Ladyman and Ross' (2007, chap. 3) defense of ontic structural realism in the light of quantum mechanics, which precisely seems to exemplify the activities that Bennett finds characteristic of metaphysics. Naturalized metaphysics does, in other words, not displace the metaphysicians at the outset, and it appears hospitable to doing metaphysics in the sense outlined above.

#### 4 Naturalized metaphysics on the underdetermination problem

Naturalized metaphysics hopes to answer some of the same questions that are traditionally raised in metaphysics, but instead of appealing to intuitions, common sense, conceptual analysis, and a priori reasoning, naturalized metaphysics seeks to answer these metaphysical questions using the findings of our current best science. However, even assuming that doing so is, in principle, epistemically sound, a problem arises since metaphysics is generally underdetermined by science or more precisely by the empirically active components of scientific theories (e.g. Andersen & Becker Arenhart, 2016; Chakravartty, 2017; Dorato, 2013; French, 1998, 2011; Raley, 2005; Robus, 2015; Thomasson, 2017a).<sup>5</sup> There are, or so the argument goes, typically several metaphysical accounts that are consistent with the scientific theories and which can, at least in a minimal sense, explain the empirical success of the theory. By 'metaphysical account' is meant the kind of account that furnishes the world with elements and relations that can then feature as the foundation for a description of a series of events that capture the empirical findings. One example could be the availability of both deterministic—for instance Everett (see, e.g., Vaidman, 2014)—and indeterministic—for instance spontaneous collapse (see, e.g., Allori, 2021; Gisin, 2021)—interpretations of quantum mechanics.<sup>6</sup>

Such underdetermination immediately challenges the promise of naturalized metaphysics to deliver epistemically justified answers to metaphysical questions. In the concrete example, naturalized metaphysics cannot say whether the world is deterministic or indeterministic. This, of course, is no different from the *status quo* of autonomous metaphysics, so one might argue that we are requiring too much of naturalized metaphysics, if we ask it to *settle* such metaphysical debates. The problem with asking anything less of naturalized metaphysics, however, is that this would compromise its alleged epistemic superiority over autonomous metaphysics. If naturalized

<sup>5</sup> Scientific anti-realists have argued that even the scientific theories themselves are often, if not always, underdetermined by empirical data (see, e.g., van Fraassen, 1980; Stanford, 2006). For present purposes, this only makes matters worse for naturalized metaphysics. Each of the empirically underdetermined scientific theories will likely be compatible with several metaphysical accounts of the world. Consequently, naturalized metaphysics can only succeed if both scientific and metaphysical underdetermination can be resolved. However, since metaphysical underdetermination, as argued below, is sufficient to displace metaphysicians, scientific underdetermination will not be discussed any further here despite its relevance for challenging the general prospects of naturalized metaphysics.

<sup>6</sup> A possible objection to this example is that it still remains to be seen whether the deterministic and indeterministic interpretations of quantum mechanics are actually empirically underdetermined. There are, however, general mathematical theorems that indicate that an equivalent indeterministic model can always be found given a deterministic model (Werndl, 2011). Thus, even if the current deterministic and indeterministic interpretations of quantum mechanics prove not to be empirically equivalent, then one can construct other interpretations that are, and the metaphysical underdetermination therefore remains.

metaphysics only delivers disjunct possibilities, i.e., claims that one among a range of alternatives is true, then naturalized metaphysics provides precisely what we had already. To sustain its superiority, naturalized metaphysics would therefore have to insist that it has better epistemic warrant for such disjunctive claims, say, for the claim that either determinism or indeterminism is true (for further discussion, see Arroyo and Arenhart, 2022; Jaksland, 2022).

Naturalized metaphysics can appeal to the further evidence that the metaphysical alternatives they entertain are the only currently conceived alternatives compatible with science. ‘Currently conceived’ is an important qualification since it signifies that neither naturalized nor autonomous metaphysics can be certain that they have considered all possibilities. Neither party can, in other words, know that their disjunct is exhaustive which would have immediately warranted believing it true. Left is therefore the compatibility with science. In Bayesian terms, we inquire whether we should increase our credence, for instance, in the disjunction ‘either determinism (D) or indeterminism (I)’ when we discover that science is compatible with both alternatives (E). By the probability calculus, this is equivalent to asking whether the probability of this compatibility is larger than otherwise under the assumption that one of the alternatives is true.<sup>7</sup> However, if the underdetermination of metaphysics by science is assumed to be prevalent, then the prior probability that the metaphysical alternatives are compatible with science is arguably already close to one. Thus, even if it is granted that this probability is higher when one of the alternatives is assumed to be actual, the difference can at most be marginal since the probability is bounded by one. This in turn implies that evidence in the form of compatibility with science can only marginally increase our credence in the disjunction of the metaphysical alternatives whereby the epistemic superiority of naturalized metaphysics is at best minuscule. Things might be different if the prior probability that science is compatible with the metaphysical alternatives is not close to one. This, however, amounts to begging the question against prevalent underdetermination, let alone that further argument is needed for why the probability of compatibility with *both* alternatives should be significantly larger when one of the alternatives is assumed to be true.

In the absence of such an argument, naturalized metaphysics must break the underdetermination of metaphysics by science to secure significant epistemic superiority over autonomous metaphysics, and the literature contains several attempts at this.

- (i) Some argue that there are scientifically sanctioned means with which to overcome this underdetermination (e.g. Hawley, 2006).
- (ii) Some recognize that parts, but not all of metaphysics is underdetermined (e.g. Ney, 2012).
- (iii) Some argue that underdetermination of metaphysics by science is (often) in appearance only (e.g. French, 2011, 2014; Ladyman & Ross, 2007).

The first strategy is to break the underdetermination of metaphysics by science with a scientifically sanctioned method of choosing between the alternative metaphysical accounts (option (i)). Hawley, for instance, observes that, when it comes to scientific

<sup>7</sup>  $P(D \vee I|E) = P(D|E) + P(I|E) - P(D \wedge I|E) = P(E|D)/P(E) \cdot P(D) + P(E|I)/P(E) \cdot P(I)$ , assuming that the metaphysical alternatives in question, for instance determinism and indeterminism, are mutually exclusive such that  $P(D \wedge I|E) = 0$ .

theories, “the fact that empirical data are compatible with more than one theory does not mean that the data support each theory equally” (2006, p. 457; see also Morganti, 2016, pp. 86–87). Integration with other well-confirmed theories and the quality of the explanation of the empirical data are used for choosing one scientific theory over another despite their empirical equivalence. Based on this, Hawley speculates that also metaphysical theories could be prioritized by such considerations: “Although the empirical data and perhaps some of the lower-level scientific theorising are compatible with more than one metaphysical theory, they may nevertheless give us reason to prefer one metaphysics over another” (2006, pp. 457–458). Thus, the underdetermination of metaphysics by science might be overcome by additional scientifically sanctioned considerations not directly related to empirical adequacy.

The criticism leveled at the type of considerations alluded to by Hawley is, however, that it reintroduces a role for the contested traditional methods of metaphysics (Andersen & Becker Arenhart, 2016; Robus, 2015).<sup>8</sup> More precisely, the reasons beyond empirical adequacy that Hawley puts her faith in can only be those of simplicity, coherence, and explanatory power that are also the basis for adjudicating between theories in metaphysics. If these are illegitimate in the context of autonomous metaphysics, then this must also be the case when they are used in naturalized metaphysics. With this strategy, therefore, it is difficult to sustain the superiority of naturalized metaphysics over autonomous metaphysics. It is perhaps telling that others use this parallel to *vindicate* autonomous metaphysics, observing that in metaphysics, “just as in science, theories are compared with respect to the elegance, simplicity and explanatory virtues of their models, and theories are chosen over their competitors using inference to the best explanation” (Paul, 2012, p. 12). If these can be legitimately appealed to in science, then this should also be legitimate even in autonomous metaphysics. Ladyman (2012), however, argues that for instance explanatory power might not be as important in science as suggested by these continuity arguments and further, that the role of explanation in science and metaphysics is not similar enough to vindicate metaphysics (see also Huemer (2009) and Saatsi (2017)). For present purposes, the important point is that naturalized metaphysics must argue that the use of theoretical virtues and inference to the best explanation in metaphysics is different from their use in science to avoid that all of metaphysics can legitimately use these for theory choice. But in doing so, naturalized metaphysics seems to block Hawley’s strategy of using these to break the underdetermination of *metaphysics* by science: Why should naturalized metaphysics share in the legitimate use of these methods in science when choosing between metaphysical alternatives rather than their illegitimate use in other metaphysics? This is, in a sense, a version of the general challenge for the naturalized metaphysician identified by Ross who observes that “if her [the naturalized metaphysician’s] commitment to naturalism is serious, she needs a principled basis for staying out of non-naturalistic debates, which is complicated if she invites them herself” (2016, p. 222). Without such a principled argument, as Ross’ remark implies,

<sup>8</sup> Ribeiro (2015) and Morganti (2016) simply accept this and propose that the underdetermination of metaphysics by science can (and should) be broken using the traditional methods of metaphysics. Hawley (2006, p. 453) can be read as opting for this view as well. The point here, however, is that this move is not available to the proponents of naturalized metaphysics who argue that the traditional methods of metaphysics cannot provide epistemic warrant.

breaking underdetermination with appeal to theoretical virtues undermines the epistemic legitimacy of naturalized metaphysics. In sum, strategy (i) is either at the risk of relying on the illegitimate traditional methods of metaphysics or, if it is argued that they are not illegitimate after all, then this might validate those methods even in autonomous metaphysics.

A more promising resolution would be the idea that some metaphysics escapes underdetermination (alternative (ii)). Ney, for instance, argues that while physical theories often admit different interpretations with different metaphysical commitments, there are “representational features that are as a matter of fact indispensable to our best physical theories as they are actually understood” (2012, p. 60). These indispensable “representational features” include entities, structures, and principles that occur in all “rival formulations of our physical theories” (Ney, 2012, p. 61). Ney offers Lorentz invariance as an example of such an indispensable element on the grounds that physicists agree that any relativistic theory must be Lorentz invariant.<sup>9</sup> A metaphysical commitment to Lorentz invariance is therefore *not*, according to Ney, underdetermined by science.

However, there are Lorentz violating theories of gravity: for instance Hořava-Lifshitz gravity (Hořava, 2009; see Wang, 2017 for a recent review). This only testifies that there are physical theories that are Lorentz violating, and Ney [and other proponents of (ii)] might simply concede that also Lorentz invariance is underdetermined by science while insisting that other metaphysics escapes underdetermination. But the existence of Lorentz violating theories at least corroborates the general worry of underdetermination that there is a flexibility in the formulation of scientific theories such that most representational features can be dispensed with. Even the indispensability of numbers (mathematics) has been questioned (e.g. Field, 1980), though with disputed success (Bueno, 2003; Malament, 1982). Thus, the concern remains that all metaphysics is underdetermined by science.

Any attempt to a priori rule out for instance Lorentz violating theories with reference to scientific virtues would threaten to reintroduce a role for the disputed traditional methods of metaphysics and thus render (ii) vulnerable to the worries raised about (i). However, Ney instead proposes to limit the rival formulations entering the indispensability argument by other means: to those that are “endorsed as acceptable alternative formulations by the physics community as a whole” (2012, p. 63). It is up to the physics community to decide whether a formulation of physics is to be considered in the indispensability argument (more on this in Sect. 5). This seems to immediately disqualify Field’s nominalist physics, whereas Hořava-Lifshitz gravity is a borderline case. Still, this strategy of relying on the physics/science community should limit the number of “acceptable alternative formulations” of scientific theories and thus render it more likely that there are shared representational features such that science has metaphysical implications that are not underdetermined.

Finally, there is option (iii) and Steven French’s suggestion that “we should not accept the underdetermination, nor try to break it [...], but undermine it” (2014, p. 43). In order to convincingly reject or “undermine” the underdetermination problem, the

<sup>9</sup> One might object that a commitment to Lorentz invariance hardly qualifies as a metaphysical commitment, but this is of little consequence here since Lorentz invariance only serves as an example for Ney.

appearance of underdetermination must be explained away. To this effect, proponents of ontic structural realism argue that the appearance of underdetermination originates in a bias for object-oriented ontology (e.g. French, 2011). What is real is only the structure shared between the underdetermined metaphysical accounts, and the conflicting object-ontologies of these are merely artifacts of the respective (mathematical) representations used. Once this is realized and an ontic structural realism is adopted, there is no underdetermination of metaphysics by science, or so the argument goes. Notice that only *ontic* structural realism will suffice here. The epistemic variant that merely restricts its metaphysical commitment to the structures while remaining agnostic about the rest of the metaphysics does not, in fact, undermine underdetermination. Rather, it precisely breaks it by arguing that there are features—certain structures—that are not underdetermined, and epistemic structural realism is therefore a version of option (ii) rather than (iii).

Relating to ontic structural realism, French himself raises the question of “how we can be sure there is such a common underlying structure” (2011, p. 218), which is certainly a central concern for this attempt to undermine underdetermination and therefore for option (iii). By pointing to possible instances of *structural* underdetermination, Holger Lyre (2011) shows that this is indeed a relevant concern. Furthermore, any principled argument that there always is such a common underlying structure would have to limit itself to the scientifically sanctioned resources available to naturalized metaphysics to avoid vindicating, once again, the traditional methods of metaphysics. However, proponents of option (iii) might be able to do without such a principled argument if the cases of structural underdetermination are sufficiently rare (or even non-existing). But even so, the mere availability of epistemic structural realism as a way of interpreting these structural commonalities generates another problem for this attempt to undermine underdetermination.

As naturalized metaphysicians, proponents of (iii) have limited resources with which to show that only the shared structure is representationally significant, i.e., that ontic rather than epistemic structural realism is true. Some scientific theory might of course indicate that an object metaphysics is challenged and therefore suggest the adoption of a structural metaphysics. The quantum statistics of two entangled spin- $\frac{1}{2}$  particles (electrons) considered by Ladyman and Ross (2007, chap. 3) might well be such as case. These cannot be considered two related individuals but should rather be regarded as one whole. How exactly this cashes out as ontic structural realism is not important here since the point rather is that even assuming the validity of such arguments for *local* ontic structural realism, they are short of establishing the *global* version that only structure is real, always.

This absence of a justification for (global) ontic structural realism is also noticed by Morganti (2011). Morganti identifies two arguments to this effect in the literature: One from the (alleged) preservation of structure across historical theory changes and another arguing that global ontic structural realism is the only metaphysics that avoids underdetermination. Morganti (2011, p. 1170) analyses both in more detail, but relating to the latter, it suffices for present purposes to observe that this argument for ontic structural realism is simply begging the question. Given that the present concern is whether underdetermination occurs, the argument against this cannot be that ontic structural realism is the only metaphysics where underdetermination does not occur.

About the former, Morganti observes that even granting that structure is indeed preserved between theory changes, this cannot differentiate between ontic and epistemic structural realism. Choosing a general view of what is real “on the basis of contingent facts about what got preserved in the history of science may well lead one to ignore important metaphysical elements,” as (Morganti, 2011, p. 1167) argues. Rather, a principled argument for ontic structural realism seems to be needed if this view shall be the basis for rejecting apparent instances of underdetermination. Again, however, naturalized metaphysics does not have the resources to build such a principled argument. An appeal to theoretical virtues, for instance, would reintroduce the worry already raised about option (i). Morganti’s conclusion is therefore apt also for present purposes: “OSR [ontic structural realism] may well be a possible realist position, but it is far from clear that it has been supplied with a compelling justification” (2011, p. 1175). While one might undermine the underdetermination of metaphysics by science with ontic structural realism, naturalized metaphysics seems to have a hard time justifying ontic structural realism, at least over its epistemic version which, however, amounted to a variant of option (ii) and not (iii).

## 5 The role for the naturalized metaphysician

The underdetermination of metaphysics by science introduces a challenge to the promise of naturalized metaphysics to answer metaphysical questions, i.e., to produce justified claims about ultimate reality, based on our current best science and without any appeal to the epistemically problematic traditional methods of metaphysics. By the standards of naturalized metaphysics, the most promising strategy for overcoming the underdetermination of metaphysics by science seemed to be to search for metaphysical questions that are not in fact underdetermined by science, denoted (ii) above. Naturalized metaphysics should look for those representational elements—entities, structures, principles, etc.—that are indispensable to and therefore shared between all the alternative formulations of our scientific theories that are taken seriously by the scientific community. This latter qualification was included to avoid a proliferation of alternative interpretations or “formulations” whose only purpose would be to introduce underdetermination and which would, therefore, likely leave every representational element underdetermined. This qualification is, in other words, crucial for this strategy to successfully deliver answers to metaphysical questions as promised by naturalized metaphysics.

It may seem ad hoc to restrict the interpretations considered to those endorsed by the scientific community. Ney, however, finds warrant for this restriction in the general aim of naturalized metaphysics to inherit its legitimacy from the success of the scientific theories it is based on. As Ney argues,

the goal is to get out a metaphysics that has established its semantic and justificatory credentials via physical theory itself, without having to also develop a semantic theory and epistemology for physics. The more we depart from actual physical theories that are accepted by the physics community and conceptions

of what is and is not essential to actual physical theories according to the physics community, the more we stray from this goal (Ney, 2012, p. 63).

To preserve the integrity of naturalized metaphysics, it is, as Ney qualifies elsewhere, advisable to consider only those alternative formulations of the scientific theories that partake in the practice that generate the success of science. Unless the scientific community has adopted an alternative formulation, “it is not an alternative formulation of physical theory that has met the standards of acceptance and confirmation of science and so cannot have a bearing on which elements of physical theory are or are not dispensable” (Ney, 2012, p. 63).<sup>10</sup> This more restrictive approach to naturalized metaphysics has later been promoted by Ross (2016, p. 222) as “the Norman approach” reasoning that “[i]f one can do metaphysics this way, then the naturalist’s preferred approach is to restrict herself, as a methodological principle, to doing it only in this way” (Ross, 2016, p. 226). This more restrictive approach to naturalized metaphysics—needed to avoid underdetermination—can thus be motivated as part of the general aim of naturalized metaphysics to minimize the epistemic risk involved in doing metaphysics.

If metaphysicians cannot be trusted to ascertain what counts as a genuine alternative formulation, then the same reasoning arguably applies when determining what features are indispensable between these alternative formulations. Ney (2012, pp. 64–66) here refers to Maddy (1992) who, in the context of the Putnam’s ([1975] 1979) indispensability argument, argues that scientists do not regard all the (apparent) representational features of their theories as carrying metaphysical significance. Metaphysicians might look at these alternative formulations and posit that a certain metaphysical feature is indispensable to all of them but, Ney warns, “if the physics community does not build such things into its theories and thinks that its explanations are satisfactory as they stand, then we must conclude that such things are not indispensable to current physical theory” (2012, p. 62). The issue is, as above, that the metaphysicians have no resources with which to overrule science. In terms of the internal coherence of option (ii), it can be added that if the proliferation of metaphysical alternatives is limited to those alternatives that are endorsed by science to avoid underdetermination, then it seems incoherent to argue that metaphysics can subsequently overrule science when deciding what features are indispensable. The dilemma, in other words, is that this restrictive naturalism is needed if there is to be hope that some metaphysical features will not be underdetermined but with it one must be careful about anything that is added to the scientific theories by a priori reasoning. Proponents of naturalized metaphysics could of course devise other ways in which to restrict the number of alternatives that should be considered for underdetermination. However, Ney’s variant of naturalized metaphysics with its restriction to those alternative interpretations that are endorsed by the scientific community is currently the only variant of naturalized metaphysics that

---

<sup>10</sup> Ney does not provide any details on what grounds the physics community decides whether to endorse an “alternative formulation” or not. One might worry, therefore, that Ney’s naturalized metaphysics risks becoming a metaphysics of the unexamined metaphysical prejudices of scientists. However, the purpose here is, as announced, not to criticize naturalized metaphysics but to examine what role it leaves for the metaphysician.



can deliver on the promise to answer metaphysical questions in the face of underdetermination. Furthermore, it seems likely that other restrictions must be equally radical to succeed.

So where does this leave the prospects for doing metaphysics in naturalized metaphysics? A metaphysical commitment is justified only in those representational elements that are shared between all the alternative interpretations of our current best science that are endorsed by the scientific community, i.e., those genuinely representational elements that therefore avoids underdetermination. To find these metaphysical commitments, the naturalized metaphysician can begin by surveying the scientific communities for the interpretations they take seriously. Once these are in, the metaphysician can compile a list of representational elements in those interpretations, however, metaphysicians cannot be trusted to decide which of these representational elements that carry metaphysical significance. Instead, the metaphysician must once again turn to the scientific community—possibly with the list in hand—and ask them to underline those elements among all the representational elements that they consider real. Once this data is in, the metaphysician can run the indispensability machinery by investigating whether there are representational elements unanimously regarded as carrying metaphysical significance and if any of them are shared by all the interpretations endorsed by the scientific community. If so, then these can be put on the list of metaphysical commitments. However, this close reliance on the scientific community is for the greater good: to eliminate any contamination of naturalized metaphysics by elements foreign to science such as the pathologies inherent in autonomous metaphysics.

If this strategy devised by Ney is successful, then the result is justified claims about ultimate reality, and naturalized metaphysics therefore preserves the subject matter of metaphysical claims as it promises. Consequently, if doing metaphysics just means engaging in an activity that produces such justified claims about ultimate reality, then naturalized metaphysics is hospitable to doing metaphysics. However, Sect. 3 argued that there is more to doing metaphysics than being engaged in an activity that produces claims with the appropriate subject matter. To do metaphysics, the metaphysician also has to partake in and add to the inquiry into reality in a way that is continuous with typical metaphysical practice. The easy ontologist inference from the existence of a red dress to the existence of properties was given as an example where the metaphysician/ontologist cannot be said to do metaphysics despite the result being an alleged metaphysical truth. An analogous worry appears to apply to the restrictive naturalized metaphysics that is needed to avoid underdetermination. In Ney's strategy for generating justified claims about ultimate reality, the task of the metaphysician is reduced to polling the opinions in the scientific community, everything else is relegated to the scientists. While it is the metaphysician that eventually compiles the list of metaphysical commitments, this hardly qualifies as partaking in or adding to inquiry. It is more similar to Hofweber's example of washing the test tubes and the later example of copying down the reading of the scientific instruments. While these tasks are important, in fact essential, to generating the relevant results, they are not part of the inquiry into reality, and the same goes for polling scientists' opinions.

Furthermore, none of what the metaphysician does in this restrictive version of naturalized metaphysics resembles anything of what Bennett listed as typical activities for

metaphysicians. To the contrary, the metaphysician is actively restricted from looking for contradictions, finding counterexamples, teasing out consequences, and developing thought experiments. All, of course, with the well-meaning purpose of making sure that naturalized metaphysics maximizes its epistemic legitimacy by inheriting it directly from science. This ensures that naturalized metaphysics can succeed with generating justified claims about ultimate reality even in the face of underdetermination (assuming that science can justify such claims in the first place), but it is at the expense of the metaphysicians who can no longer practice their trade.

Besides these limits to what metaphysicians might do as part of naturalized metaphysics, one might furthermore worry that also very little of the content of metaphysics can be salvaged with the restricted version of naturalized metaphysics. Indeed, this version of naturalized metaphysics is arguably best suited to determine whether we are justified in believing in the existence of the representational elements of our scientific theories. It is suited to answer questions of ontology, in the terminology Hofweber, which aims to “to find out what the things or the stuff are that are part of reality” (Hofweber, 2016a, p. 13). Hofweber, however, proposes that this task does not exhaust metaphysics which is additionally aiming “to find out what these things, or this stuff, are like in general ways” (Hofweber, 2016a, p. 13). Hofweber’s description of the extra beyond ontology in metaphysics is somewhat vague, but building on Hofweber, Jonas Arenhart and Raoni Arroyo qualify that this extra involves “trying to describe more generally the nature of those items and their metaphysical relations (dependence relations, questions of priority, and so on” (Arenhart & Arroyo, 2021, p. 6). Metaphysics adds a “profile” to the ontology, Arenhart and Arroyo giving the example that a realist with respect to electrons has answered the ontological question of its existence but that, for instance, a metaphysical question about its status as an individual remains unanswered. If naturalized metaphysics, through its restrictive approach outlined by Ney, can only hope to compile a list of the features in our scientific theories that are truly representational, then there appears to be few epistemically legitimate resources with which to answer such additional metaphysics questions about these features. This conforms to the conclusion that Arenhart and Arroyo reach based on more general reasoning: While ontological posits, they argue, often “play a role in the economy of science,” “the metaphysical profiles are not directly involved in such theoretical constructs within science” (Arenhart & Arroyo, 2021, p. 42). Contrary to the ontology, the metaphysical profiles play, according to this argument, no role even in (virtue-based) “theory choice and in theory development” (Arenhart & Arroyo, 2021, p. 42). The prospects for a science-based *metaphysics*—as opposed to a mere science-based ontology—are therefore limited. When this paper argues that naturalized metaphysics, due to underdetermination, must restrict itself to the ontology-oriented approach suggested by Ney, then this can be seen as a further piece of evidence for Arenhart and Arroyo’s conclusion.

In response, proponents of naturalized metaphysics might say that they never promised to preserve all metaphysics. Indeed, Ladyman explains, after qualifying that naturalized metaphysics does not in general take issue with the meaningfulness of metaphysical questions, that “[t]hat is not to say that they [Ladyman and Ross (2007)] advocate answering all the same questions that are asked by analytic metaphysicians by different means, since they make it clear that they regard some of those questions

as meaningful, but as making insufficient contact with reality to be worth entertaining” (Ladyman, 2017, 143). Perhaps this insufficient contact is simply a feature for all of metaphysics that is not ontology (see, again Arenhart & Arroyo, 2021 for a more general argument why this could be so). But so be it, Ladyman and Ross might reply, since naturalized metaphysics, as Ladyman writes, makes no promise to answer all the questions asked by traditional/analytic metaphysics. What Ladyman and Ross do promise is that, whatever remains of the content of metaphysics in naturalized metaphysics, it still counts as “an exercise in metaphysics” (2007, p. 26). The argument of this section has been, however, that this exercise—the activities that are undertaken—does not qualify as doing metaphysics even though the result is metaphysics (in the form of an ontology, if nothing else).

## 6 Re-employing the metaphysician

Ladyman and Ross do propose a re-employment program for metaphysicians who, they argue, should focus their attention on “how the separately developed and justified pieces of science (at a given time) can be fitted together to compose a unified world-view” (2007, p. 45). They explicate this through “the principle of naturalistic closure”:

Any new metaphysical claim that is to be taken seriously at time  $t$  should be motivated by, and only by, the service it would perform, if true, in showing how two or more specific scientific hypotheses, at least one of which is drawn from fundamental physics, jointly explain more than the sum of what is explained by the two hypotheses taken separately (Ladyman & Ross, 2007, p. 36).

Only this unification program is, for them, a legitimate form of metaphysics.<sup>11</sup> However, the question for present purposes is again whether this re-employment of metaphysicians allows them to do metaphysics.

Ladyman and Ross (2007, p. 130) explain that their defense of ontic structural realism is in accordance with the principle of naturalistic closure. As the principle requires, ontic structural realism is motivated by two different scientific hypotheses, general relativity and quantum theory, both of them belonging to fundamental physics (Ladyman & Ross, 2007, chap. 3).<sup>12</sup> If this is indeed exemplar of metaphysics under the principle of naturalistic closure, then it may look promising for the metaphysicians. Developing this view based on the scientific theories seem, from Ladyman and Ross’ discussion, to require many of the skills typically employed in metaphysics, most prominently teasing out consequences of scientific theories and finding hidden contradictions in the metaphysical alternatives (apparently combined with inference to the best explanation). Likewise, the subject matter of metaphysics appears to be

<sup>11</sup> Indeed, Maclaurin and Dyke argue “that the PNC [principle of naturalistic closure] is too strong a principle to distil from L&R’s [Ladyman and Ross’] epistemic concerns” (2012, 299).

<sup>12</sup> How ontic structural realism “explain more than the sum of what is explained by the two hypotheses taken separately” is mostly left implicit in Ladyman and Ross’ account, and this aspect of the principle of naturalistic closure will not be discussed further here either (see, however, Melnyk 2013, 89–90). It seems in any case doubtful that there are resources in this additional requirement to change the picture outlined here.

preserved. This is perhaps most cleanly indicated by the fact that the question whether ontic structural realism is true, i.e., whether only structures are real, is at least rendered very differently, or perhaps even outright meaningless, if metaphysical realism is false. If there is “no point of view,” as Haukioja puts it above, “from which we [can] compare our theories and belief about the world to the world itself,” then it is rather unclear what a defense of ontic structural realism establishes. Thus, Ladyman and Ross appear to be doing metaphysics and the principle of naturalistic closure therefore seems hospitable to this activity.

The problem is that the principle of naturalistic closure, interpreted like this, merely takes the form of an additional robustness requirement for the naturalized metaphysics discussed in the preceding sections. A metaphysical claim is epistemically justified if it is derived from “two or more specific scientific hypotheses” rather than from only one such piece, the latter being the view of most other proponents even of strong naturalized metaphysics. Is there, however, any reason to suppose that these more robust metaphysical claims will avoid underdetermination? Section 4 already noted that ontic structural realism itself might be underdetermined. Thus, the robustness coming from adherence to the principle of naturalistic closure is no guarantee against underdetermination. Furthermore, this principle introduces several complications relating to underdetermination. Consider the underdetermined alternatives of determinism and indeterminism in quantum mechanics. Neither are based on more pieces of science, but both could be. The determinists could appeal to general relativity, but the indeterminists could likewise appeal to arguments that there is inherent indeterminism in the theory of evolution (Brandon & Carson, 1996; Glymour, 2001).<sup>13</sup> Both metaphysical claims would thus abide by the principle of naturalistic closure (under this interpretation of it) while nevertheless being underdetermined.

Perhaps, however, the principle of naturalistic closure could be interpreted in a way that is more resistant to underdetermination problems. When it tasks metaphysics with the unification of two or more scientific hypotheses, this might merely involve showing that the hypotheses are compatible and not contradictory. An example of this would be the apparent conflict between the need in the theory of evolution of random mutations and the determinism of the general theory of relativity. The former is a specific scientific hypothesis, and the latter is a hypothesis/theory of fundamental physics, in accordance with the principle of naturalistic closure. Following the task laid out by the modest interpretation of the principle, the metaphysician could, for instance, point out that what appears to be random mutations for a local observer could (partly) be accounted for by cosmic radiation which, however, from a global perspective could be entirely deterministic. As such, the metaphysician has contributed to “a unified world-view” by resolving this apparent conflict while avoiding underdetermination since the compatibility follows from the availability of this account and not from its uniqueness.

Since this does not appear to be Ladyman and Ross’ intended interpretation of the principle of naturalistic closure, only a brief remark will be made here on whether this more modest unification program qualifies as doing metaphysics. The issue is its

---

<sup>13</sup> Notice that this proposal is disputed and likely underdetermined itself (see, e.g., Graves, Horan, and Rosenberg 1999; Shanahan 2003).

dependence on metaphysical realism which Sect. 3 argued is important for an activity to qualify as doing metaphysics. If the hypotheses in question are empirically contradictory, then even (semantic) instrumentalists would find their reconciliation important. In this case, we do not have to assume metaphysical realism—indeed, instrumentalists reject this view—for this reconciliation to be meaningful and following Sect. 3, the subject matter of this work—and thus the associated activity—is therefore not metaphysics. The modest unification program exemplified by the case above, however, does not involve such direct empirical contradictions but only a more general incoherence. Psillos (1999, pp. 36–37), following Duhem, has proposed that only realism with its aim at truth can explain why we should be interested in such general incoherence. Margaret Morrison, however, suggests—in the context of the theory conjunction problem (see, e.g., Friedman, 1983; Putnam, 1973)—that unification is a rational pursuit also for instrumentalists because it is “crucial in the search for theories that are equipped to explain and predict a variety of phenomena” (Morrison, 1990; see Hendry, 2001 for a reply). Furthermore, unification has been argued to be a rational concern for instrumentalists since unified theories are more likely to be empirically adequate (Forster & Sober, 1994; Myrvold, 2003). By these arguments, the general coherence of hypotheses is important to instrumentalists as well as realists, an attitude impersonated, for instance, by Arthur Fine (1986, 2018) who explicitly rejects metaphysical realism. This at least indicates that establishing the compatibility of hypotheses—as the metaphysicians are tasked to do by the modest interpretation of the principle of naturalistic closure—does not qualify as doing metaphysics by the standards of Sect. 3 since this activity does not depend on metaphysical realism.

## 7 Conclusion

Naturalized metaphysics aims to establish justified metaphysical claims, where metaphysics is meant to carry its usual significance, while avoiding the traditional methods of metaphysics—a priori reasoning, conceptual analysis, intuitions, and common sense—which naturalized metaphysics argues are not epistemically probative. While naturalized metaphysics is, at the outset, hospitable to metaphysicians doing metaphysics, the underdetermination of metaphysics by science changes the picture. This paper has argued that naturalized metaphysics must limit its metaphysical commitments to those entities, structures, and principles that are not underdetermined and, for there to be any, restrict the underdetermined alternatives under consideration to those that are taken seriously by the scientific community. Otherwise, underdetermination variously leads naturalized metaphysics to use the traditional methods of metaphysics and therefore into incoherence.

While this strategy for breaking underdetermination might produce justified claims about ultimate reality, it leaves the metaphysician behind. The task of the metaphysician is merely to survey the opinion of the scientists and compile a list of metaphysical commitments from those features that all the scientists regard as indispensable for our best science. But this hardly qualifies as doing metaphysics as this paper has argued. Thus, even though Ladyman and Ross insist that we cannot “go back to anti-metaphysical positivism” and argue that theirs is “an exercise in metaphysics”

(2007, p. 26), when it comes to the activities of metaphysicians, naturalized metaphysics ultimately has to align itself with the more eliminative trends of contemporary metametaphysics. As Robert Kraut writes of one interpretation of Carnap's philosophy: "Carnap's goal, according to this prevalent picture, is to discredit ontology: to encourage us to stop doing it" (2016, p. 31). In a sense, naturalized metaphysics ultimately achieves precisely this. While naturalized metaphysics still alleges to deliver justified claims about ultimate reality, the latter being to Carnap's dismay, metaphysicians can neither partake in nor add to this inquiry because it risks inviting the epistemically problematic autonomous metaphysics back in. Thus, whether Carnap's deflationism or naturalized metaphysics is vindicated, the metaphysicians are nonetheless displaced.

**Acknowledgements** I would like to express my gratitude to Jonathan Knowles, Astrid Rasch, and Andreas Achen for their valuable feedback on and helpful discussion of earlier drafts of this paper.

**Funding** Open access funding provided by Royal Danish Library.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Allori, V. (2021). Spontaneous localization theories with a particle ontology. In V. Allori, A. Bassi, D. Dürr, & N. Zanghi (Eds.), *Do wave functions jump?* (pp. 73–93). Springer. [https://doi.org/10.1007/978-3-030-46777-7\\_7](https://doi.org/10.1007/978-3-030-46777-7_7)
- Andersen, F., & Becker Arenhart, J. R. (2016). Metaphysics within science: Against radical naturalism. *Metaphilosophy*, 47(2), 159–180.
- Arenhart, J. R. B., & Arroyo, R. W. (2021). Back to the question of ontology (and metaphysics). *Manuscrito*, 44(2), 1–51.
- Arroyo, R. W., & Becker Arenhart, J. R. (2022). The epistemic value of metaphysics. *Synthese*, 200(4), 337. <https://doi.org/10.1007/s11229-022-03833-5>
- Bennett, K. (2016). There is no special problem with metaphysics. *Philosophical Studies*, 173(1), 21–37.
- Bloomfield, P. (2005). Let's be realistic about serious metaphysics. *Synthese*, 144(1), 69–90.
- Brandon, R. N., & Carson, S. (1996). The indeterministic character of evolutionary theory: No 'no hidden variables proof' but no room for determinism either. *Philosophy of Science*, 63(3), 315–337.
- Bryant, A. (2020). Keep the chickens cooped: The epistemic inadequacy of free range metaphysics. *Synthese*, 197, 1867–1887. <https://doi.org/10.1007/s11229-017-1398-8>
- Bueno, O. (2003). Is it possible to nominalize quantum mechanics? *Philosophy of Science*, 70(5), 1424–1436. <https://doi.org/10.1086/377419>
- Cameron, R. P. (2010). Quantification, naturalness, and ontology. In A. Hazlett (Ed.), *New waves in metaphysics* (pp. 8–26). Palgrave Macmillan.

- Cameron, R. P. (2020). Truthmaking and metametaphysics. In R. Bliss & J. T. M. Miller (Eds.), *The Routledge handbook of metametaphysics* (pp. 233–244). Routledge.
- Carnap, R. (1950). Empiricism, semantics, and ontology. *Revue Internationale De Philosophie*, 4(2), 20–40.
- Chakravartty, A. (2017). *Scientific ontology: Integrating naturalized metaphysics and voluntarist epistemology*. Oxford University Press.
- De Caro, M. (2010). Varieties of naturalism. In R. C. Koons & G. Bealer (Eds.), *The waning of materialism*. Oxford University Press.
- Dieveney, P. (2012). In defense of Quinean ontological naturalism. *Erkenntnis*, 76(2), 225–242.
- Dorato, M. (2013). How to combine and not to combine physics and metaphysics. In V. Karakostas & D. Dieks (Eds.), *EPSA11 perspectives and foundational problems in philosophy of science* (pp. 95–305). Springer.
- Dorr, C. (2010). Review of every thing must go: Metaphysics naturalized, by James Ladyman and Don Ross. In: *Notre Dame Philosophical Reviews* June 16. <http://ndpr.nd.edu/review.cfm?id=19947>.
- Field, H. (1980). *Science without numbers* (Vol. 17). Princeton University Press.
- Fine, A. (1986). Unnatural attitudes: Realist and instrumentalist attachments to science. *Mind*, 95(378), 149–179.
- Fine, A. (2018). Motives for research. *Spontaneous Generations: A Journal for the History and Philosophy of Science*, 9(1), 42–45.
- Forster, M., & Sober, E. (1994). How to tell when simpler, more unified, or less ad hoc theories will provide more accurate predictions. *The British Journal for the Philosophy of Science*, 45(1), 1–35.
- French, S. (1998). On the withering away of physical objects. In E. Castellani (Ed.), *Interpreting bodies* (pp. 93–113). Princeton University Press.
- French, S. (2011). Metaphysical underdetermination: Why worry? *Synthese*, 180(2), 205–221. <https://doi.org/10.1007/s11229-009-9598-5>
- French, S. (2014). *The structure of the world: Metaphysics and representation*. Oxford University Press.
- French, S., & McKenzie, K. (2012). Thinking outside the toolbox: Towards a more productive engagement between metaphysics and philosophy of physics. *European Journal of Analytic Philosophy*, 8(1), 42–59.
- Friedman, M. (1983). *Foundations of space-time theories*. Princeton University Press.
- Gava, G. (2019). Peirce and methodological naturalism. In P. Giladi (Ed.), *Responses to naturalism: Critical perspectives from idealism and pragmatism* (pp. 208–229). Routledge.
- Gisin, N. (2021). Indeterminism in physics and intuitionistic mathematics. *Synthese*. <https://doi.org/10.1007/s11229-021-03378-z>
- Glymour, B. (2001). Selection, indeterminism, and evolutionary theory. *Philosophy of Science*, 68(4), 518–535. <https://doi.org/10.1086/392940>
- Graves, L., Horan, B. L., & Rosenberg, A. (1999). Is indeterminism the source of the statistical character of evolutionary theory? *Philosophy of Science*, 66(1), 140–157. <https://doi.org/10.1086/392680>
- Guay, A., & Pradeu, T. (2020). Right out of the box: How to situate metaphysics of science in relation to other metaphysical approaches. *Synthese*, 197(5), 1847–1866. <https://doi.org/10.1007/s11229-017-1576-8>
- Häggqvist, S. (2009). A model for thought experiments. *Canadian Journal of Philosophy*, 39(1), 55–76. <https://doi.org/10.1353/cjp.0.0040>
- Haukioja, J. (2020). Metaphysical realism and anti-realism. In R. Bliss & J. T. M. Miller (Eds.), *The Routledge handbook of metametaphysics* (pp. 61–70). Routledge.
- Hawley, K. (2006). Science as a guide to metaphysics? *Synthese*, 149(3), 451–470.
- Hendry, R. F. (2001). Are realism and instrumentalism methodologically indifferent? *Philosophy of Science*, 68(S3), S25–37. <https://doi.org/10.1086/392895>
- Hofweber, T. (2016a). Carnap's Big Idea. In: *Ontology after Carnap*. Oxford University Press. <http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199661985.001.0001/acprof-9780199661985-chapter-2>
- Hofweber, T. (2016b). *Ontology and the ambitions of metaphysics*. Oxford University Press.
- Hofweber, T. (2016c). How metaphysics is special: Comments on Bennett. *Philosophical Studies*, 173(1), 39–48. <https://doi.org/10.1007/s11098-014-0435-4>
- Hofweber, T. (2020). Is metaphysics special? In R. Bliss & J. T. M. Miller (Eds.), *The Routledge handbook of metametaphysics* (pp. 421–431). Routledge.
- Hořava, P. (2009). Quantum gravity at a lifshitz point. *Physical Review D*, 79(8), 084008. <https://doi.org/10.1103/PhysRevD.79.084008>

- Huemer, M. (2009). When is parsimony a virtue. *The Philosophical Quarterly*, 59(235), 216–236. <https://doi.org/10.1111/j.1467-9213.2008.569.x>
- Humphreys, P. (2013). Scientific Ontology and Speculative Ontology. In D. Ross, J. Ladyman, & H. Kincaid (Eds.), *Scientific Metaphysics* (pp. 51–78). Oxford University Press.
- van Inwagen, P. (2015). *Metaphysics*. Westview Press.
- Jacobs, J. (2019). Naturalism. In *The Internet encyclopedia of philosophy*. <http://www.iep.utm.edu/naturali/>.
- Jakslund, R. (2021). An apology for conflicts between metaphysics and science in naturalized metaphysics. *European Journal for Philosophy of Science*, 11(3), 74. <https://doi.org/10.1007/s13194-021-00390-5>
- Jakslund, R. (2023). A trilemma for naturalized metaphysics. *Ratio*, 36(1), 1–10. <https://doi.org/10.1111/rati.12344>
- Jenkins, C. S. I. (2014). Serious verbal disputes: Ontology, metaontology, and analyticity. *Journal of Philosophy*, 111(9–10), 454–460.
- Kraut, R. (2016). Three carnaps on ontology. In S. Blatti & S. Lapointe (Eds.), *Ontology after Carnap*. Oxford University Press.
- Kraut, R. (2020). Rudolf Carnap. In R. Bliss & J. T. M. Miller (Eds.), *The Routledge handbook of metametaphysics* (pp. 32–48). Routledge.
- Ladyman, J. (2012). Science, metaphysics and method. *Philosophical Studies*, 160(1), 31–51.
- Ladyman, J. (2017). An apology for naturalized metaphysics. In M. Slater & Z. Yudell (Eds.), *Metaphysics and the philosophy of science* (pp. 141–161). Oxford University Press.
- Ladyman, J. (2018). Scientism with a humane face. In J. De Ridder, R. Peels, & R. van Woudenberg (Eds.), *Scientism*. Oxford University Press. <https://doi.org/10.1093/oso/9780190462758.003.0005>
- Ladyman, J., & Ross, D. (2007). *Every thing must go: Metaphysics naturalized*. Oxford University Press.
- Lowe, E. J. (1998). *The possibility of metaphysics: Substance, identity, and time*. Oxford University Press.
- Lyre, H. (2011). Is structural underdetermination possible? *Synthese*, 180(2), 235–247. <https://doi.org/10.1007/s11229-009-9603-z>
- Maclaurin, J., & Dyke, H. (2012). What is analytic metaphysics for? *Australasian Journal of Philosophy*, 90(2), 291–306. <https://doi.org/10.1080/00048402.2011.587439>
- Maddy, P. (1992). Indispensability and practice. *The Journal of Philosophy*, 89(6), 275–289. <https://doi.org/10.2307/2026712>
- Malament, D. (1982). Book review: Science without numbers by Hartry H. Field. *Journal of Philosophy*, 79(9), 523.
- Manley, D. (2009). Introduction: A guided tour of metametaphysics. In D. Chalmers, D. Manley, & R. Wasserman (Eds.), *Metametaphysics: New essays on the foundations of ontology* (pp. 1–37). Oxford University Press.
- Maudlin, T. (2007). *The metaphysics within physics*. Oxford University Press.
- McKenzie, K. (2020). A curse on both houses: Naturalistic versus a priori metaphysics and the problem of progress. *Research Philosophica*, 97(1), 1–29.
- Melnyk, A. (2013). Can metaphysics be naturalized? And if so, how? In D. Ross, J. Ladyman, & H. Kincaid (Eds.), *Scientific metaphysics*. Oxford University Press.
- Morganti, M. (2011). Is there a compelling argument for ontic structural realism? *Philosophy of Science*, 78(5), 1165–1176. <https://doi.org/10.1086/662258>
- Morganti, M. (2016). Naturalism and realism in philosophy of science. In K. J. Clark (Ed.), *The Blackwell companion to naturalism* (pp. 75–90). Wiley.
- Morganti, M., & Tahko, T. E. (2017). Moderately naturalistic metaphysics. *Synthese*, 194(7), 2557–2580. <https://doi.org/10.1007/s11229-016-1068-2>
- Morrison, M. (1990). Unification, realism and inference. *The British Journal for the Philosophy of Science*, 41(3), 305–332.
- Myrvold, W. C. (2003). A Bayesian account of the virtue of unification. *Philosophy of Science*, 70(2), 399–423. <https://doi.org/10.1086/375475>
- Ney, A. (2012). Neo-positivist metaphysics. *Philosophical Studies*, 160(1), 53–78.
- Ney, A. (2019). Are the questions of metaphysics more fundamental than those of science? *Philosophy and Phenomenological Research*. <https://doi.org/10.1111/phpr.12571>
- Nolan, D. (2016). Method in analytic metaphysics. In H. Cappelen, T. S. Gendler, & J. Hawthorne (Eds.), *The Oxford handbook of philosophical methodology* (pp. 159–178). Oxford University Press.
- Papineau, D. (2021). Naturalism. In E. N. Zalta (Eds.), *Stanford Encyclopedia of Philosophy*, edited by. Vol. Summer 2021. <https://plato.stanford.edu/archives/sum2021/entries/naturalism/>
- Paul, L. A. (2012). Metaphysics as modeling: The Handmaiden’s tale. *Philosophical Studies*, 160(1), 1–29.



- Plunkett, D. (2015). Which concepts should we use?: Metalinguistic negotiations and the methodology of philosophy. *Inquiry*, 58(7–8), 828–874.
- Poidevin, R. L. (2009). What is metaphysics? In R. Le Poidevin, P. Simons, A. McGonigal, & R. P. Cameron (Eds.), *The Routledge companion to metaphysics* (pp. 18–22). Routledge. <https://doi.org/10.4324/9780203879306>
- Psillos, S. (1999). *Scientific realism: How science tracks truth*. Routledge.
- Putnam, H. (1973). Explanation and reference. In G. Pearce & P. Maynard (Eds.), *Conceptual change* (pp. 199–221). Springer. [https://doi.org/10.1007/978-94-010-2548-5\\_11](https://doi.org/10.1007/978-94-010-2548-5_11)
- Putnam, H. [(1975) 1979]. What is mathematical truth? In *Mathematics, Matter and Method*. (vol. 1, pp. 60–78). Cambridge University Press
- Raley, Y. (2005). Ontological naturalism. *Pacific Philosophical Quarterly*, 86(2), 284–294. <https://doi.org/10.1111/j.1468-0114.2005.00227.x>
- Rea, M. C. (2002). *World without design: The ontological consequences of naturalism*. Oxford University Press.
- Ribeiro, C. (2015). The complementarity of science and metaphysics. *Philosophica*, 90, 122.
- Robus, O. M. (2015). Does science license metaphysics? *Philosophy of Science*, 82(5), 845–855.
- Ross, D. (2016). Vikings or normans? The radicalism of naturalized metaphysics. *Metaphysica*, 17(2), 213. <https://doi.org/10.1515/mp-2016-0018>
- Saatsi, J. (2017). Explanation and explanationism in science and metaphysics. In M. Slater & Z. Yudell (Eds.), *Metaphysics and the Philosophy of Science*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199363209.003.0009>
- Shanahan, T. (2003). The evolutionary indeterminism thesis. *BioScience*, 53(2), 163–169. [https://doi.org/10.1641/0006-3568\(2003\)053\[0163:TEIT\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2003)053[0163:TEIT]2.0.CO;2)
- Soto, C. (2015). The current state of the metaphysics of science debate. *Philosophica*, 90, 121.
- Stanford, P. K. (2006). *Exceeding our grasp: Science, history, and the problem of unconceived alternatives*. Oxford University Press.
- Strawson, P. F. (1959). *Individuals: An essay in descriptive metaphysics*. Routledge.
- Tahko, T. E. (2020). A priori or a posteriori? In R. Bliss & J. T. M. Miller (Eds.), *The Routledge handbook of metametaphysics* (pp. 353–363). Routledge.
- Tallant, J. (2013). Intuitions in physics. *Synthese*, 190(15), 2959–2980. <https://doi.org/10.1007/s11229-012-0113-z>
- Tallant, J. (2015). Metaphysics, intuitions and physics. *Ratio*, 28(3), 286–301. <https://doi.org/10.1111/rati.12074>
- Thomasson, A. L. (2015). *Ontology made easy*. Oxford University Press.
- Thomasson, A. L. (2017a). Metaphysics and conceptual negotiation. *Philosophical Issues*, 27(1), 364–382. <https://doi.org/10.1111/phis.12106>
- Thomasson, A. L. (2017b). Metaphysical disputes and metalinguistic negotiation. *Analytic Philosophy*, 58(1), 1–28.
- Vaidman, L. (2014). Quantum theory and determinism. *Quantum Studies Mathematics and Foundations*, 1(1), 5–38. <https://doi.org/10.1007/s40509-014-0008-4>
- van Fraassen, B. C. (1980). *The scientific image*. Oxford University Press.
- van Orman Quine, W. (1969). Epistemology Naturalized. In *Ontological Relativity and Other Essays*. Columbia University Press.
- Wang, A. (2017). Hořava gravity at a lifshitz point: A progress report. *International Journal of Modern Physics D*, 26(07), 1730014. <https://doi.org/10.1142/S0218271817300142>
- Werndl, C. (2011). On the observational equivalence of continuous-time deterministic and indeterministic descriptions. *European Journal for Philosophy of Science*, 1(2), 193–225. <https://doi.org/10.1007/s13194-010-0011-5>
- Wilson, J. (2011). Much ado about ‘something.’ *Analysis*, 71(1), 172–188. <https://doi.org/10.1093/analysis/anq087>