

# **A curse on both houses: naturalistic versus *a priori* metaphysics and the problem of progress**

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*A priori* metaphysics has come under repeated attack by naturalistic metaphysicians, who take their closer connection to the sciences to confer greater epistemic credentials on their theories. But it is hard to see how this can be so unless the problem of theory change that has for so long vexed philosophers of science can be addressed in the context of scientific metaphysics. This paper argues that canonical metaphysical claims, unlike their scientific counterparts, cannot meaningfully be regarded as ‘approximately true’, and that this means that the epistemic progress that science arguably enjoys through episodes of theory change cannot be expected to transfer to its corresponding metaphysics. What the value of engaging in metaphysics of science before the emergence of a final theory becomes correspondingly unclear.

## **1 Introduction**

What’s the value of metaphysics? Given the chequered past of the field it is difficult not to interpret the question as hostile: whether from Hume, from Kant, or the positivists it is by now a cliché that attacks upon the very possibility of metaphysics define the major waystations through modern philosophy. But a lot has happened since positivism held sway, and the received wisdom is that metaphysics, largely thanks to Quine, has enjoyed something of a reinstatement.<sup>1</sup> Indeed, insofar as there is still an attack on metaphysics it is better viewed as a kind of civil war.

For over the last decade, certain factions within contemporary metaphysics been subject to excoriating critique by metaphysicians of science – philosophers who have accused it of being ‘irrelevant’, ‘frivolous’, ‘pseudoscientific’, ‘sterile and even empty’, ‘epistemically inadequate’,

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<sup>1</sup>But see Price 2009.

and overall something that has more in common with puzzles and crosswords than with serious intellectual enquiry.<sup>2</sup> While one can find these grievances scattered throughout the literature, its most remorseless expression is without doubt the opening pages of Ladyman and Ross' *Every Thing Must Go*. For one of that book's 'main contentions', as they open by stating, 'is that contemporary analytic metaphysics, a professional activity engaged in by some extremely intelligent and morally serious people, fails to qualify as part of the enlightened pursuit of objective truth, and should be discontinued'.<sup>3</sup> Now given that they themselves identify as metaphysicians, in their sights here is not professional metaphysicians *in toto* but rather a particular (if large) segment of them: a segment they variously refer to as 'analytic', 'a priori', or 'neo-Scholastic' metaphysicians. Whatever the term, what they mean it to pick out are those doing metaphysics without any meaningful reference to real science.

For go to the metaphysics shelf, say they, and take down the most popular books.<sup>4</sup> There you will find countless metaphysical questions raised regarding objects, such as whether they exist, what their nature is, and how they cohere to form complexes. You will find questions over properties, such as whether they are universals or particulars, how they are instantiated, and how they combine with each other. You will find questions over the nature of the fundamentality itself, of space and time, and why there exists anything at all. And what you will find is that these questions are addressed, by and large, without at any point engaging with contemporary fundamental science. (Flip through the index, for example, and you normally will not find a single reference to physics article or textbook.)<sup>5</sup> Rather, it seems the 'scientific' picture animating these works is one of little point-particles armed with well-defined little intrinsic properties banging into one another – a view they take to at best be a version of *classical* physics, a framework long-ago supplanted as a fundamental description of reality. Now given that pretty much to a one all contemporary metaphysicians are physicalists – that is, they take reality to be fundamentally physical in character – this situation is *prima facie* a bit strange. Ladyman and Ross don't just find it strange, of course: they think it's a scandal. And in calling for its discontinuation, it seems to me that they commit to a claim about *value*: there is no point, there is no purpose to it; there is no value in it going on.

Let this claim as to the value – or the lack of it – be the 'negative claim of naturalistic metaphysics', (NM-).

- (NM-) Metaphysics not informed by science is not worth doing.

Since much if not the majority of metaphysics is not much informed by science, (NM-) condemns the majority of practitioners in the field. Such disdain needs justification, of course, and the argument marshalled in support of it is simple. Metaphysics, say both the naturalists and their analytic counterparts, is a form of enquiry aimed at elucidating the fundamental nature of

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<sup>2</sup>Ladyman and Ross 2007, p. vii; French and McKenzie 2016, 28; Ladyman and Ross op cit. p. 17; Callender 2011, p. 34; Bryant 2017, p. 1.

<sup>3</sup>Ladyman and Ross 2007, p. vii.

<sup>4</sup>Ladyman and Ross op cit., Section 1.2 passim.

<sup>5</sup>See also Healey 2013 for a comparison of volumes representative of the two sorts of metaphysics.

reality.<sup>6</sup> But while analytic metaphysicians enact metaphysics in an a priori way, *the fundamental nature of reality cannot be discovered a priori*.

Now obviously this is not the first time such a complaint regarding the power of a priori reasoning to reveal contentful truths about the nature of reality has been mooted in the history of philosophy. But historically such complaints were typically grounded in certain highly principled views on the dependence that mental or semantic content ineluctably has on the human sensorium. Today, however – by which I mean after positivism – claims of this sort will mostly be held for rather more contingent and historical reasons: reasons more based on the ruptures that the scientific world-view has been sequentially subject to than anything to do with supposedly necessary constraints on human knowledge acquisition. For consider of how developments in physics have brought in their wake radical changes in our view of the deep nature of the world we live in. Think of the transition from classical to quantum mechanics and its implications for locality, determinism, holism; or the transition from pre-relativistic to relativistic physics and its implications for ideas about space and time that we long took to be indubitable; or of particle physics and its implications for our assumptions of the substantial and intransient nature of the fundament of the world. These changes, as Putnam noted, don't just involve changes in what claims we regard as true or false of nature, but that change our whole way of reasoning about it.<sup>7</sup> Moreover – and partly for that reason – it seems they involve changes in what we might naturally categorize as 'metaphysical' aspects of the world. But then the argument against a priori metaphysics is easy to see. For if physics is replete with metaphysical entailments, and clearly physics is an a posteriori venture, then in what sense could a purely a priori method, one that bypasses those empirical constraints, be expected to reliably arrive at those same conclusions?

While the subtleties there could be expanded indefinitely, that is the shape of the contemporary naturalist's argument. We can find it expressed explicitly in Tim Maudlin's collection of essays in naturalistic metaphysics *The Metaphysics Within Physics*:

[M]etaphysics, i.e. ontology, is the most generic account of what exists, and since our knowledge of what exists in the physical world rests on empirical evidence, metaphysics must be informed by empirical science.... Empirical science has produced more astonishing suggestions about the fundamental structure of the world than philosophers have been able to invent, and we must attend to those suggestions.<sup>8</sup>

The devil will be in the details, of course, but it is hard to deny that this all at least sounds very measured and reasonable. What we should be clear on, however, is that what is stated here is

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<sup>6</sup>This is a currently widely-held view; see e.g. Schrenk 2016, p. xii. And we will see plenty of examples of metaphysicians enacting this assumption below. Note that even if one adopts a less demanding conception of metaphysics, such as one according to which it is to elucidate the nature of reality whether fundamental or not, the skeptical conclusions of this paper will still go through so long as developments in physics change our conception of it. (Note that there is a sense in which the argument of this paper lends support to the more ambitious, fundamentality-centric view: for if right, it shows that metaphysics is an end-time affair that can only be conducted when we have a fundamental theory. This arguably metaphysics is about the fundamental if it is about anything at all.)

<sup>7</sup>Putnam 1961, p. 671.

<sup>8</sup>Maudlin 2007, p. 78.

just a necessary condition on a metaphysics with value. And it is a priori metaphysicians' failure to satisfy that condition that grounds the negative claim. But we have already noted that this critique is being made, by and large, by people who themselves go on to argue for big metaphysical conclusions. Thus in their work, Ladyman and Ross argue for the fundamentality of relational structure given the facts of modern physics; likewise, Maudlin argues for the fundamentality of laws, hence of modality, and the primitivity of the direction of time. As such, it seems there a stronger claim implicit at least *performatively* in the work of these naturalized metaphysicians; and this is that, while a wholly a priori metaphysics isn't worth doing, *ours is*. Thus as well as holding the negative claim, it seems naturalists will also want to endorse what we can call the 'positive claim of naturalized metaphysics', (NM+):<sup>9</sup>

- (NM+) Metaphysics that is informed by science *is* worth doing.

I'm going to take it, then, that implicitly or otherwise, both these are claims that would be endorsed by naturalistic metaphysicians. Meaningful engagement with real science is both a necessary and a sufficient condition for a metaphysics with value.

Now there are many critiques that can be made of both naturalism's positive and negative claims. Anjan Chakravartty's recent book, for example, focuses on the relation of 'being informed' that occurs in each case, arguing that it is so nebulous as to place effectively no constraint on acceptable metaphysics.<sup>10</sup> Timothy Williamson by contrast has focused on the relata, and pointed out that without a criterion for what is to be counted as 'science' the naturalists's critique is meaningless.<sup>11</sup> But this so-called question of 'demarcation' – does mathematics counts as science? Is string theory science? Is 'creation science' science? – is one that we largely threw up our hands over back in the 1980s, for all sorts of reasons. Here, however, I want to focus on is a different criticism – one that is aimed at the positive claim in particular.

This criticism is that there is a deep tension in the very concept of naturalized metaphysics once we take into account a certain inconvenient truth: namely, that these claims as to positive value are being made (implicitly, performatively) at a time when we do not yet have a truly fundamental physics. For while we have a well-confirmed framework for physics that is adequate to the sorts of energies accessible to the large hadron collider, namely *quantum field theory* (QFT), we do not yet have a theory of quantum gravity: indeed as of now our quantum and gravitational theories are flat-out inconsistent. But since we think our descriptions of the very large and the very small must ultimately be at least compatible with one another, for this and other reasons we do not think that we yet have a physical theory that really gets at the fundamental physics of the world. As such, physicists are working hard to produce a new and better framework for physics that will provide a coherent account of quantum gravity – one that we expect to displace both QFT and general relativity as our fundamental physical description the world.<sup>12</sup> This, I claim,

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<sup>9</sup>I rather hesitate to call it a 'claim' because it's rarely said out loud. But it's clearly at least a commitment of some kind.

<sup>10</sup>Chakravartty 2017.

<sup>11</sup>Williamson 2013.

<sup>12</sup>I will be sloppy about the distinction between physical 'theory' and physical 'framework' (cf. Shimony 1987, p. 209). But roughly, a physical 'theory' is a set of natural kinds together with a law for their interaction; a physical 'framework' is a set of over-arching principles that a theory has to satisfy in order for those kinds to be regardable

generates a profound problem for naturalists. For since physicists do not yet have a fundamental theory we expect our current physics theories to be replaced by other theories in future. But a prime motivation for naturalism is that our metaphysics can change radically as our physical theories do. Thus it seems that we expect our future science-informed metaphysics to be *radically different* from our current science-informed metaphysics: that is, by the lights of our future physics our current metaphysics is going to be viewed as very much the *wrong* metaphysical picture of the world. However, if our science-informed metaphysics will be shown to be wrong in the future then it cannot be correctly regarded as true of reality today. What, then, is the *value* of engaging in contemporary naturalistic metaphysics, and why think it is elevated with respect to its analytic counterpart? We think, after all, that contemporary analytic metaphysics is largely false because it is based on at best outdated science; we think that our metaphysics will be shown to be false at some point in the future since it is based on science that will itself be falsified. It is hard to see what the normative difference between them is if metaphysics is construed as an epistemic project transcending mere intellectual fashion.

The tension in naturalism that will be our focus here seems to me to pose a significant challenge to naturalism. But it also seems to me that this tension identified is rather an obvious one – so obvious that I find it strange that it barely been discussed in the literature.<sup>13</sup> For compare here the situation in canonical philosophy of science and the question of scientific realism. It is no exaggeration to say that the problem of theory change and its implications for our belief in the deep-theoretical portions of our theories simply dominated discussion for decades. Why is it that we philosophers of science forget all this when we put on a hat that says ‘metaphysics?’<sup>14</sup> However, when faced with a seeming tension in the practices of otherwise reflective philosophers our default should be that the tension is only apparent. And our worries here would be ameliorated were the two problems such that they need not be addressed independently. In particular, were the solution philosophers of science have offered to the problem of theory change in science to have clear implications for its correspondent in naturalistic metaphysics then the absence of discussion would not imply any act of philosophical neglect. So is this the case, or not?

The first thing to say here is that there are at least some metaphysicians of science who seem to firmly believe that it is. In fact, the clearest expression of this view, that I have found at least, may be found in Ladyman and Ross.<sup>15</sup> For not long after their excoriating critique of

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as *kinds of classical particles, kinds of quantum particles, kinds of quantum fields*, etc. Thus ‘quantum field theory’ is a really a *framework* for physics, specifying that laws must respect the principles of relativity and those of quantum theory if they are to describe quantum fields; quantum chromodynamics on the other hand, which describes the specific interactions between the quantum field theoretic kinds *quarks* and *gluons*, is a theory within that framework. The major questions of the metaphysics of physics tend to concern the broad frameworks and not the details of the theory (although there are of course exceptions to this rule).

<sup>13</sup>The most extended meditation on the issue I have found is Monton 2011; see also van Fraassen 2007 for the case of ontic structural realism, which serves as an example below.

<sup>14</sup>Note that I am here using the term to denote what Chakarvartty calls ‘big-M’ metaphysics; ‘small-m’ metaphysics is that which van Fraassen would regard any scientific realist to be guilty of. ‘Big-M’ metaphysics concerns the canonical metaphysical questions that we pose to the ontologies of scientific theories, which we ipso facto assume to exist.

<sup>15</sup>While I have managed to find few other examples, David Baker’s discussion the metaphysics of individuality is another clear case. In this context he writes: ‘These questions about the metaphysics of QM are of great

analytic metaphysics, and shortly before their defence of scientific realism, they put forward the following statement on the relation between truth in science and metaphysics:

One consequence of naturalism that cannot be avoided is that if our current scientific image of the world changes much, as we suppose it will, then it will then turn out that the best current metaphysics is substantially wrong. Neither we nor anyone else can do better than articulate the best metaphysical picture the current evidence suggests in attempting to sketch the image of the world that science presents to us now... *Note that to the extent that metaphysics is closely motivated by science, we should expect to make progress in metaphysics iff we can expect to make progress in science.* In Chapter 2 [in which they defend epistemic structural realism as a response to the problem of theory change] we indicate at length why we hold fallibilism about science to be compatible with optimism about epistemic progress in science. *This argument carries directly over to scientifically motivated metaphysics.*<sup>16</sup>

Now it must be admitted that the picture outlined here is an appealing one. It is one in which the sciences and metaphysics are seen as marching in lockstep towards their goals. Each of them, that is, is *making progress* toward what they seek. And it seems to me one in which metaphysics is making progress *because* the science it is based on is, in a kind of ‘trickle down’ effect.<sup>17</sup> Moreover, not only would the truth of this picture explain why metaphysicians of science don’t worry twice over about the problem of theory change, it would also explain why we naturalistic metaphysicians are so sanguine about the value we can attach to our line of work despite our frequent dismissals of the value a priori metaphysics. Progress is, after all, a normatively loaded term, so this idea that our metaphysical theories, even if they are substantially and extensively wrong, are at least *making progress* toward their aim would clearly confer a sense of value onto what we are doing.

What I want to argue here, however, is that this optimistic picture is likely something of a fantasy. As far as I can see, there is no obvious inference from the fact that science is making progress to the idea that what we are apt to call the metaphysics of that science is making progress too. At the root of the problem is the fact that there are some neglected but nevertheless fundamental disanalogies between scientific and metaphysical theories – even naturalistically

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intrinsic interest. Since QM has enjoyed great success, and was for a time the most fundamental theory of matter available, I see considerable value in determining what a purely nonrelativistic quantum universe would be like. But the correct metaphysics for our own universe is an even more pressing issue – and in the domains explored by experiment thus far, our universe appears to be relativistic. So it would be a mistake to ask whether (for example) there are individuals in our own world and turn to nonrelativistic QM for an answer. Of course, no final answer is available at present since the project of physics remains far from complete. But we may hope that a more fundamental theory like QFT can provide a *more reliable* answer to our metaphysical question than QM.’ (Baker 2013 p. 265; italics added.)

<sup>16</sup>Ladyman and Ross 2007, p. 35 (italics added).

<sup>17</sup>The dependence of metaphysics on science proclaimed by naturalistic metaphysicians suggests this. A different picture would arise if one thinks of metaphysics as having heuristic value for scientists themselves, for then the dependence would go the other way. Popper is well-known for holding this view, but see Stanford 2017 for an argument that while this may have been the case historically it is no longer tenable. In what follows, I proceed on the assumption that fundamental physics develops largely independently of metaphysicians’ arguments for Humeanism, ontic structural realism, etc. – though I would welcome being disabused of this assumption.

construed – that prevent this inference from going through. It is, in a way, unsurprising that these disanalogies have been neglected, as after Quine all the emphasis has been on the continuities between the two – indeed, by now a standard characterization of naturalized metaphysics is as one ‘continuous’ with physics. But I think that the constant emphasis on these continuities, which are largely *epistemic* in character, have obscured certain *theoretical* differences between these two sorts of theories – differences, that is, between the nature of the *claims* that they make and the *languages* in which they make them – that are of the greatest significance here. They are of the greatest significance because, I will argue, they obstruct the concept of *approximation* from applying to them. Since it is through *better approximations to the truth* that we take science to make epistemic progress, the fact that approximation seems inapplicable to canonical claims of metaphysics makes it very unclear how metaphysics could somehow inherit or participate in the progress enjoyed by science. And if that is true, then what the value of metaphysics is prior to the end of enquiry becomes, on reflection, deeply unclear.

Of course, since the news that there is no value in what many of us commit our working lives to is hardly welcome, I expect many will modus tollens my modus ponens and infer that something in this argument is drastically wrong. One potentially promising line of response would be to argue that the languages of science and metaphysics are not, or need not, be so fundamentally different as I will present them here. I will admit at the outset that my argument will be a bit procrustean, and I invite anyone to find counterexamples to the way I say metaphysics typically works. If that is right, there is hope that metaphysics can directly participate in the progress science has enjoyed. By contrast, one could accept my claims about the deep differences between theories of science and metaphysics but deny that it follows that metaphysics has no value. For there may be other sources of value – heuristic value and so on – that metaphysics could have independently of correctly describing reality. And if the value of metaphysics lies elsewhere than in correctly describing the world, then while we would still have to determine how, if it all, its progress was linked to that of science, we could still rest easy in the knowledge that there was some purpose to what we do.

I will briefly discuss both of these at the end. But interestingly both of these (not just the second) will require us to engage with teleological questions of the purpose of metaphysics, and force us to contemplate sources of value that go beyond insipid ambitions that it ‘describes the world’. Such a claim evokes the themes developed in the work of the positivists and the pragmatists, who really reflected on the ulterior motives that drive metaphysical speculation and the alternative purposes that metaphysics might more usefully be thought to serve. More than anything, what I intend with this argument is for us to have that conversation again, as practitioners of metaphysics after Quine and Kuhn and whoever else has left their stamp on us as contemporary metaphysicians of science. Certainly, given how scathing many naturalistic metaphysicians have been of the value of armchair metaphysics, it seems borderline hypocritical to blithely assume that there is value in what *we* do, insofar as we know that we routinely speculate on metaphysics of the fundamental while still bereft of the theory that seems so obviously needed in order for us to meaningfully do so.

The structure is as follows. In Section 2 I briefly survey how philosophers of science – primarily, philosophers of physics – defend the idea that science makes progress, emphasizing that it is by

utilizing an informal concept of approximate truth.<sup>18</sup> In Section 3 I argue that canonical metaphysical claims, using structuralist and Humean metaphysics as my examples, are not amenable to the language of approximation – making it entirely unclear how progress in science could have implications for that in metaphysics. Section 4 is a brief conclusion.

## 2 Progress in science

The question front and centre in this paper is whether metaphysics may be thought of as making progress if the science it is based on is making progress too. That the antecedent is satisfied here – that is, that science makes progress – is of course widely held. Indeed some take progress to be the defining characteristic of science, with Kuhn stating in *The Structure of Scientific Revolutions* that ‘we tend to see as science any field in which progress is marked’.<sup>19</sup> And the progress that science displays is often expressed in terms of its generation of *better approximations to the truth*.<sup>20</sup> Richard Boyd expresses the vision thus:

The *historical progress* of the mature sciences is largely a matter of successively *more accurate approximations* to the truth about both observable and unobservable phenomena. Later theories typically build upon the (observational and theoretical) knowledge embodied in previous theories.<sup>21</sup>

This picture of science as honing in on fundamental reality via sequentially better approximations to the truth is often dubbed ‘convergent realism’. But while often taken for granted, this convergentist picture is not obviously sustainable given what has already been said in the defence of naturalism. For as we there noted, as we have gone through the sequence of theories that define the timeline of modern physics our picture of the world has changed much. And the sheer scale of these changes threatens the idea that science does proceed by a sequence of approximations, or indeed made any real ‘progress’ at all with regard to understanding the world. Of course, that there has been progress at the purely empirical level – that is, progress when it comes to predicting and controlling the world around us – is no in any doubt. But epistemically things are different. After all, for us to be able to interpret the temporal sequence of science as an arc of epistemic progress, we need to be able to interpret each change as us learning *more* about the world, not just something *different* in each case. But if each theory is so radically different in what it has to say about the way that the world fundamentally is, there is the worry that all one can find here is displacement, us believing one thing and then another ostensibly totally different thing. So how can we maintain that here our knowledge *grows* – hence that something is retained through these changes?

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<sup>18</sup>I will treat ‘physics’ as broadly coextensive with ‘science’ here – only because it is the fundamental in particular that is our principal focus.

<sup>19</sup>Kuhn 1962, p. 162.

<sup>20</sup>What precisely the theoretical progress of science consists in is of course a topic of debate in itself: there are disagreements over whether it is best conceived of in terms of truth, knowledge, representation, or understanding, or something else again (see Delsén 2018 for a recent survey). But we may expect morals analogous to those drawn here to hold in all these cases.

<sup>21</sup>Boyd 1983, p. 1. Popper and Putnam are leading exemplars of this ‘convergentist’ view.



This is a big question – one that, as already noted, was central to philosophy of science for years. But ask a physicist, at least, how to answer this and they will almost invariably do the same thing: they will direct our attention to certain relations of continuity that exist between the central equations of those theories, relations that we call *correspondence*.<sup>22</sup> In this context, a pair of theories ‘correspond’ if the central equations of the old theory are *retained as approximations* to those of the new theory, when applied in the domains in which the old theory was empirically well-confirmed. This, they will say, is a pervasive feature of theory-change in physics, and one which arguably permits the ascription of the language of progress to it.

The basic idea here is best conveyed by example.<sup>23</sup> Back in the days of classical mechanics, whose kinematical structure was laid down by Galileo and Newton, it was thought that time was an absolute quantity ‘flowing equably’ for all observers. As such, any two observers will be in agreement as to how long a given event takes. Taking the time coordinates – the clock readings – of two observers moving relative to one another as  $t$  and  $t'$  respectively, and assuming they are coincident at  $t = t' = 0$ , this may be expressed as follows:

$$t' = t \tag{1}$$

This observer-independent sense of temporal passage is precisely what special relativity denies. In this theory, the clock readings of two observers are related via the Lorentz transformation:

$$t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2}$$

which makes their clock readings a function of their relative velocity. As such, two observers in motion with respect to one another are going to disagree on how long a given event lasts. It may immediately be seen that as their relative velocity increases towards the speed of light – perhaps one travels with a neutrino emitted in a beta decay, while one remains at rest in the lab – the  $\sqrt{1 - \frac{v^2}{c^2}}$  term will tend to zero and hence the whole expression begin to blow up, resulting in vast disagreements between the two observers. Conversely, however, when the difference between their velocities is small compared to the speed of light, the  $\frac{v^2}{c^2}$  term reduces to a trifling little fraction; for virtually all practical purposes, then, the denominator stays close to unity.<sup>24</sup> Thus in the limit in which  $v/c$  tends to zero the Lorentz transformation *deforms*, to a very good approximation, to the pre-relativistic expression.

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<sup>22</sup>The term ‘correspondence principle’ was coined by Bohr in connection with the classical limit of quantum mechanics. The general idea however is at least as old as the relativity revolution (cf. Post 1971, p. 234), with some claiming it has been ‘an important tool of scientific development since the seventeenth century’ (Fadner 1985, p. 837).

<sup>23</sup>This is a well-worn example; van Fraassen calls it an ‘especially nice’ case (2006, 300). That it is wholly representative of correspondence in physics is of course subject to dispute; but we will not get into these weeds here.

<sup>24</sup>This is an instance of a more general phenomenon – namely, that approximation is defined only relative to a given purpose. We will have more to say about this at the end.

$$t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}} \xrightarrow{v \rightarrow 0} t' \approx t \quad (3)$$

But that is the limit that takes us from more *recherché* and less experimentally accessible phenomena, such as neutrinos, to altogether more quotidian phenomena such as ships and cannonballs – that is, to the sort of systems that were involved in the confirmation of the classical world view. So what we have here, then, is a clear case in which central equations of a new theory reduce to an approximation of those of the previous theory, in the domain in which the old theory was empirically well-supported. For this reason, the two theories are said to *correspond*.

This transition from Galilean to special relativity is a stock example in this context, and serves as poster child for what Heinz Post termed the *generalized correspondence principle*: the doctrine that old and new theories are virtually always retained as approximations of the new.<sup>25</sup> This more general thesis is widely embraced by physicists, historians, and philosophers of physics. Thus we find Popper asserting that an ‘old theory, even when it is superseded, often retains its validity as a kind of limiting case of the new theory; it still applies, at least with a high degree of approximation, in those cases in which it was successful before.’<sup>26</sup> Similarly John Watkins, former president of the British Society for Philosophy of Science, affirms that ‘it typically happens in the history of science that when some hitherto dominant theory *T* is superseded by *T'*, *T'* is in the relation of correspondence to *T*’.<sup>27</sup> One can find physicist-philosophers such as Born and Whewell expressing the same idea; it is also to be found in Reichenbach.<sup>28</sup> And if this correspondence can indeed be discerned in the historical record, it seems that we may after all make the case that the history of physics, by and large, exhibits ‘continuous progress’.<sup>29</sup> For to speak of progress, something must be *retained* in the transition; and when theories correspond that is definitionally the case. The old theory is retained as a description of a special class of systems: not of all the systems the old theory was thought to describe, but an important class of them – those that provided the theory’s empirical support in the first place. Moreover, of those systems, the new theory offers us a more *refined* description than the old one: a *better approximation to the truth* about them. Thus where there is correspondence, we have a picture that is, at least in some – and some very important – respects, one of retention and refinement: that is, a picture of progress.

So this is all very nice. Of course, if things were really this simple then the question of progress would not have been so controversial for so long a time. But other historians and philosophers of physics have argued that the alleged generality of correspondence between theories either requires selective attention to history or comes at the price of vacuity.<sup>30</sup> Furthermore, many

<sup>25</sup>In fact, as standardly understood, the generalized correspondence principle has both descriptive *and* prescriptive aspects (cf. Saunders 1993, p. 1), as it functions both as a description on how science has evolved and as a methodological requirement on theory construction.

<sup>26</sup>Popper 1959, p. 250.

<sup>27</sup>Watkins 1978; quoted in Laudan 1981, p. 36.

<sup>28</sup>See e.g. Post op cit, p. 1; Fader op cit.

<sup>29</sup>Cf. Post op cit, p. 276.

<sup>30</sup>See for example van Fraassen 2006, p. 300; Radder 1991.

have argued that relations of correspondance are in the first instance purely formal in character, as they are silent on the interpretation of the equations; thus insofar as they have any worldly significance it is almost entirely at the empirical level.<sup>31</sup> This, however, is not the place to get into a defence of the realist significance of relations of correspondance. All I will say here is that given how significant the ‘central equations of a theory’ are to mathematical physics, it seems clear that to speak of progress in physics at all it must be the case that correspondance is generally exhibited in science; further, since the correspondance between theories that we find in practice generally requires us to view previous theories as *at best approximations* to the truth, we can speak of progress in physics as being *at best* the production of better approximations. (A chain cannot be stronger than its weakest link, and if a core part of physics is at best approximately true then so are the overall theories themselves.) Thus, since the present target of investigation is whether metaphysics can be thought of as making progress *on the assumption* that science is, we will assume that science makes progress by producing *better approximations to the truth*. Nor should this be taken as at all controversial in this characterisation: the production of better approximations to the truth is often presented as the core commitment of scientific realism.<sup>32</sup>

What I do wish to press here, however, is that the story about progress offered here does not have any clear analogue outside of mathematicalized disciplines. For relations of correspondance are defined between the central equations of a theory, with the one obtained as some parameter of the other is taken to a limit; when the theories concerned are not essentially expressed in this way then the doctrine simply does not apply. Thus consider a theory represented as they canonically are in philosophical discussions merely as a well-formed formula of the predicate calculus, such as the hallowed  $\forall x(Fx \rightarrow Gx)$ ; what would it even mean for such a thing to be ‘retained in a limit’ in which some quantities becoming infinitesimally small? Start pulling predicates out of such a formula and you’re very quickly left with something that is simply not well-formed. Thus as Saunders notes, the case of dynamical physics is ‘quite atypical’ of science in general in that such close continuities may be discerned in it, and ‘it seems unlikely that similar considerations will apply to any other branch of empirical science’.<sup>33</sup> So – like many other irresistible ironies of physics – while it has in some sense suffered the most significant changes in its theories, the very fact that it is so mathematicalized also allows us to find clear continuities within them. This nice story then is one we can perhaps tell about physics, but not clearly about anything else.

Physics, then, is special in the way that it exhibits progress, and perhaps also even in the fact that it does so. And I want to close this section by reflecting further on the sort progress that relations of correspondance make possible, and how they connect with the question of the value of our scientific activities today. Here we start by noting that what physics, like metaphysics, is working towards is a truly fundamental description of reality: a truly final theory, or ‘theory of everything’.<sup>34</sup> That is the goal of physics, and something that realist physicists take themselves to be progressing toward – that is, to be progressing toward *today*. Now consider, by means of

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<sup>31</sup>This is because it is claimed that purely structural claims, such as those concerning the approximate structure of the world, are essentially true a priori – a claim often dubbed the ‘Newman objection’. See Saunders and McKenzie 2014.

<sup>32</sup>See e.g. Chakravartty 2017b.

<sup>33</sup>Saunders 1993, p. 296.

<sup>34</sup>Countless quotations from the great and the good in physics could be enlisted in support of this claim, but here is

two analogies, two sorts of progress that we might be said to make towards our goals. Consider first that our goal is to be in California, and to be there for political reasons – to enjoy certain political protections, say. As I hack my way across the desert, there’s a sense in which I make progress toward my goal, in that I am getting ever closer to where I want to be. But suppose my efforts are frustrated and that I get stopped just before the border, as a border agent refuses me permission to proceed. In such a case, the refrain will be the familiar *I am so close, but yet so far*: for ultimately, despite all this seeming progress that I made, ultimately I have achieved nothing. Suppose on the other hand that I am climbing up Mount Whitney, the highest mountain in the state, with the goal of surveying as much of California as is possible. Supposing I get three-quarters of the way up before my knee gives way, then while I don’t get to survey as much as I had wanted I still got much of what I would have had I made it to the top, as what I have allows me to draw up a *partial* survey – a survey, moreover, that is *perfectly useful* in that partial domain. The sort of progress present in the first case makes progress a sort of ‘threshold’ affair: one which we get everything at the limit but nothing before then, and this even though in some sense progress was made toward the goal (in that *necessary conditions* for its fulfillment were sequentially met). In the second case, however, progress is ‘monotonic’, as the goods we seek are steadily accumulated. What I contend is that progress by correspondence amounts to progress in this second sense.<sup>35</sup> For from this perspective, our present theory is just a *special case* of the old theory, at least to a good approximation. In that sense, our present theory is a *part* of what we seek, something that is quite literally ‘contained’ within it. Thus for Popper, ‘a theory which has been well corroborated can only be superseded by one [which] *contains* the old, well corroborated theory – or at least a good approximation to it.’<sup>36</sup> Similarly Post, in his defence of the generalized correspondence principle, writes, ‘My claim is not merely that there is an element of continuity in change, which is necessarily the case in all human activity, but that in science *part of the content* of the old theory is preserved, as far as one can tell, for ever; not just in the next theory, but throughout all future theories.’<sup>37</sup> It follows that if physics progresses by correspondence then our contemporary activities are producing sequentially larger parts of what we seek, in more and more accurate renderings. As such, given our ultimate goals, these activities have clear value: for they are *already producing* what we want.

To sum up. In science – certainly, in physics – we arguably find the retention through change that is necessary to speak of ‘progress’, for there is a clear sense in which the claims made by former physicists may be said to be ‘approximately true’. What facilitates this, at least in this case, is the mathematical nature of the language involved.

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one: ‘The Holy Grail of physics is to find what is jocularly referred to as a “Theory of Everything”, or TOE, from which all else can be derived’ (Tegmark and Wheeler 2001).

<sup>35</sup>Here my analogy echoes one of Einstein’s: ‘To use a comparison, we could say that creating a new theory is not like destroying an old barn and erecting a skyscraper in its place. It is rather like climbing a mountain, gaining new and wider views, discovering unexpected connections between our starting point and its rich environment. But the point from which we started out still exists, and can be seen, although it appears smaller and forms a tiny part of our broad view gained by the mastery of the obstacles on our adventurous way up.’ (Einstein and Infeld (1938), pp. 1589; quoted in van Fraassen 2006, p. 300.)

<sup>36</sup>Popper op cit, 276; italics in original.

<sup>37</sup>Post op cit. p. 238; italics added.

### 3 Progress in Metaphysics

So that was the good news. Now for the bad news. My big claim here is going to be that metaphysics – even naturalized metaphysics, that informed by science – does not work like this. That is, there is no comparable story about progress that we can tell for our actual paradigmatic metaphysical claims – indeed, perhaps no similar story that could be told in principle. The reason, of course, is that metaphysical claims are paradigmatically not of a sort to which the language of approximation can meaningfully apply. But to see why, we need to get a better grip on what sort of thing I have in mind when I talk of our ‘paradigmatic claims of metaphysics’.

Our starting point here will be something already noted – namely, that metaphysicians take their principal role in life to be that of articulating what’s fundamental. One can find plenty of examples of metaphysicians in general saying as much, but also of those who are unambiguously naturalistic. A recent compendium of the metaphysics of physics, for example, states in the introduction that ‘In a nutshell, metaphysics is the study of the fundamental structure of reality’, and this general claim is borne out by many of the specific debates in the metaphysics of science, in that volume and elsewhere.<sup>38</sup> We can take it, then, that many of the paradigmatic questions of naturalistic metaphysics concern what is fundamental. Given the constraints of a single paper we obviously cannot discuss all such claims. So what I propose to do is take the claim that the world is (or is not) correctly described in terms of a Humean metaphysics as one representative, and the claim that the world is (or is not) correctly described in terms of an ontic structuralist metaphysics as the other representative. Such a selection has at least some motivation. First, each of these claims has been engaged with by our two defenders of naturalistic approaches to metaphysics cited above – namely, James Ladyman and Tim Maudlin – and as such they must be among the representatives of what naturalistic metaphysics is supposed to be concerned with. (Indeed, structuralism likes to present itself as the naturalistic metaphysics par excellence.) Secondly, the former question is standardly understood as a question about *fundamental ideology*, and the second about *fundamental ontology*.<sup>39</sup> The question of Humeanism is, at least in its contemporary guise, primarily understood to concern the need for a primitive modal operator, making the question one about what formal machinery must be taken as fundamental to a theory. Ontic structuralism, by contrast, is primarily a question about the world’s fundamental category, and hence primarily a question about fundamental ontology. And since the questions of fundamental metaphysics are often dichotomized into those of fundamental ontology and fundamental ideology, with these representatives we cover them both. Finally, it should be clear that both of these are *important* questions. Questions of the world’s fundamental categories are surely among the most important in ontology. And the question of whether there are necessary connections in nature is probably the most consequential fault line in the metaphysics of science.<sup>40</sup> So while these questions are of course not the only questions of naturalistic metaphysics, they

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<sup>38</sup>Bigaj and Wüthrich 2017, p. 8. In addition to the debates discussed below, consider the debate in the philosophy of time over whether ‘the passage of time [is] a fundamental, irreducible fact’ (Maudlin 2007, p. 107), or the substantialism - relationalism debate over spacetime, as one over whether ‘spacetime points... are the fundamental particulars’ (Armstrong 1997, p. 6).

<sup>39</sup>Cf. Quine 1951, p. 14.

<sup>40</sup>Cf. Mumford and Tugby 2013.

are highly significant questions, and moreover questions that we can expect to at least analogize many others in relevant respects. As such, showing that there are problems regarding progress for the claims made in these areas will likely pose a major, and likely broader, challenge to the advocates of naturalism.

This challenge is going to be mounted in each case with a two-part argument. First, it will be underlined that the truth-value of these claims is sensitive to changes in physical theory. (This is of course what we should expect – such sensitivity is a motivation for naturalism after all. But it is a feature that gives rise to the normative worry. ) It will then be argued that these paradigmatically metaphysical claims cannot in any meaningful sense be ‘approximated’. It follows that metaphysicians, including naturalistic metaphysicians, cannot be said to be developing theories that at least become ‘better approximations’ of the truth – giving rise to the worry about what the value of developing these theories is so long as we anticipate future change. I will go through this in any detail only in the case of structuralism; once that is behind us the Humeanism case can be made short work of.

Consider, then, the thesis of ontic structural realism (OSR), and a principal contention of *Every Thing Must Go*. Putting things in bluntest terms, this is the view that ‘relational structure is more ontologically fundamental than objects’.<sup>41</sup> In the words of Steven French, ‘as far as the ontic structural realist is concerned, [objecthood] is to be understood as derivative at best, with structure as the fundamental ontological category’.<sup>42</sup> Thus (as already noted) OSR consists of a claim about categories and their relative priority. Moreover, it is a claim that only one of the categories of structure and objects may be attributed truly fundamental status. So while some metaphysicians (for example, John Heil) think that objects and monadic properties appear in our inventory of fundamental ontology, most contemporary metaphysicians think objects and at least some relations have fundamental status (most saliently, spatiotemporal relations).<sup>43</sup> It follows that OSR is a distinctive position in metaphysics only if there are no objects at all in our fundamental ontology. To unpack the conditions in which this would be the case, clearly we need some sense of how it is that structuralists conceive of ‘objects’ and ‘structures’. While structuralists are rarely as explicit about this as one might have expected considering its defining role for them – ‘structure’ is not once, to my knowledge, unambiguously defined in *Every Thing Must Go* for example – the literature offers several grounds for regarding objects as entities that have at least some essential and irreducible *intrinsic properties*. Certainly this interpretation makes sense in the context of the history of structuralism, for in the very paper that coined the term ‘structural realism’ it is stated that ‘structural characteristics’ are ‘just those that are not intrinsic’.<sup>44</sup> Understood this way, ‘structure’ then consists of relations and extrinsic properties; the claim that there is *only* structure at the fundamental level therefore prohibits the presence of

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<sup>41</sup>Ladyman and Ross op cit, p. 145. To be more precise, this is radical ontic structural realism; but since I am unsure how anything less than radical OSR represents a metaphysics alternative to currently mainstream views I will understand it in this way. The same morals will apply, mutatis mutandis, to other theories of categories.

<sup>42</sup>French [2012], p. 122.

<sup>43</sup>Heil is plausibly right when he suggests that he is in the minority among contemporary metaphysicians on this score (Heil 2012, p. 136).

<sup>44</sup>Maxwell 1970, p. 188; cf. Ladyman and Ross, p. 126.

any intrinsic properties.<sup>45</sup>

Putting everything together, then, will take ourselves to have vindicated structuralism if we can show that fundamentally there are no intrinsic properties.<sup>46</sup> It should be immediately apparent, however, that it is not at all obvious that this can be done. For it is a standard view among metaphysicians that all the fundamental kind properties are intrinsic: indeed this is a point of wide agreement even between leading Humeans (most notably, Lewis) and anti-Humeans, with Alexander Bird having gone as far to state that ‘no-one has suggested that charge, rest mass, and spin are not intrinsic’.<sup>47</sup> This is unsurprising, as this is a natural view in classical mechanics and even quantum mechanics, in which all of these kind properties are state-independent properties apparently possessible independently of any contingencies.<sup>48</sup> But arguably this all changes when we move to the most fundamental framework for physical theories that we have at our disposal at present – namely, QFT.<sup>49</sup> For in this context, fundamental fields – and hence the fundamental kind properties – by definition occur in theories describing the most fundamental domains of QFT: namely, the domain of arbitrarily small spatiotemporal distances. (That they can get arbitrarily small is a consequence of the continuity of Minkowski spacetime upon which the theory is defined.) Since energy and space (better, momentum-energy and spacetime) are inversely related in quantum mechanics – large amounts of energy being needed, for example to probe distances that are very small – the most fundamental theories described in QFT are those that correctly describe physical goings-on in the  $E \rightarrow \infty$  limit. However, it is well known that exceedingly few mathematical functions have the property of being well-defined in infinite limits. As such, we do not expect an arbitrary function describing interactions between quantum fields to be well-behaved, let alone empirically adequate, as we let its variables diverge to infinity. What features, then, do the laws of quantum field theory have to have in order to have this property? While no general answer is known here, it does seem that only theories containing *very special combinations* of fields stay well-defined in this limit. As such, arbitrarily adding and subtracting fundamental fields from worlds is more apt to produce mathematical nonsense than it is a coherent description. But then it seems that, according to QFT, the fundamental properties essential to a quantum field cannot be possessed ‘solely in virtue of how it is, independently of its surroundings’, as is required of an intrinsic property.<sup>50</sup> For on the contrary, serious fine-tuning of field content emerges as necessary for there to be a world containing fundamental fields at

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<sup>45</sup>And I would argue – without wanting to get too into the weeds – any intrinsic relations either.

<sup>46</sup>One might reasonably object that this is too abstract an understanding of objects, and that’s probably right – and probably also a route into a criticism for what I’ll have to say. For the more criteria we add – cardinality, identity over time, etc. – the more complex the resulting description, and hence more the sort of thing that could be said to be approximated. But we need to work with something and let’s work with this for now; hopefully it will at least be agreed that the more fundamental the metaphysics, the less complexity we should expect – mitigating the force of this potential objection.

<sup>47</sup>Bird, 2007, p. 125.

<sup>48</sup>Cf. Ladyman and Ross op cit., p. 134, fn 11. (Of course this interpretation of kind properties in classical and quantum physics may be disputed, but let us grant it here: again, if metaphysics is not sensitive to changes in physical theories then a major motivation for naturalism is lost.)

<sup>49</sup>See McKenzie 2016 for more detail on the following.

<sup>50</sup>(Cameron 2009, p. 265; McKittrick, 2003 p. 158. For other close renderings see e.g. Dunn 1990 p. 178; see also Lewis 1986, p. 197.

all.<sup>51</sup>

While that was clearly a very rough-and ready argument – one whose subtleties could be expanded ad nauseam – suppose for argument’s sake that it is true and the claim ‘there are no fundamental intrinsic properties’ is true in QFT. If we do this, it might seem structuralism is vindicated, for by the lights of our most fundamental theory there are not fundamental intrinsic properties. But that of course is too hasty a claim unless QFT is fundamental *simpliciter* – something that, as already noted, is simply not the case. And so long as there is some danger (from another perspective, hope) of QFT being supplanted by a more fundamental framework there is reason to think that this metaphysical claim will likewise be overturned. Now of course, to take this to be a live possibility is just part and parcel of the naturalistic *modus operandi*. Here, however, there is already positive reason to suspect that the argument given is wrong, as it rests essentially on the continuity of spacetime – an assumption which we have strong suspicions will not survive into a quantum theory of gravity.<sup>52</sup> Thus the structuralist finds herself in the quandry that was mooted at the outset: why should anyone who wants to know what’s fundamental even bother with her claim of ‘naturalized metaphysics’, if the scientific grounds on which she offers it are by her own lights not up to the job?

It is of course at this point that the naturalist will reach for their ‘continuity gambit’. What they will do – indeed, what Ladyman and Ross *do* do with their own justifications of structuralism – is concede that while this claim no doubt gets things wrong in some way, it is nevertheless ‘better’ than the claims we made on the basis of the old theories. Based as it is on science that is making progress, the metaphysics we are developing on the back of it may be regarded as making progress too. And since the science is making progress, we have argued, by creating *better approximations* to the truth, the natural – indeed analogically the only – interpretation of metaphysical progress to invoke here is in terms of better approximations to the truth as well. This then is our question: *can* metaphysical claims be ‘approximately true’, or at least better approximations to the truth? At the root of the present scepticism about value of contemporary naturalistic metaphysics is my conviction that they cannot.

To see why, let us start with the claim about the world that *there are no fundamental intrinsic properties*. Since ‘extrinsic’ properties are standardly understood simply as “those that are not intrinsic”, this may equivalently be expressed as *all fundamental properties are extrinsic*.<sup>53</sup> Now it seems to me that there are just two ways to understand an approximation of this claim, as a claim about fundamental reality: we can say that *approximately all* of the properties are extrinsic, or that most or all of the properties are *approximately extrinsic*.<sup>54</sup> Let us focus initially on the

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<sup>51</sup>The situation here is thus more extreme than in the cases Ellis 2001 discusses, in which the presence or absence of entities distinct from the bearer causes the determinate value of a property possessed by an entity to deviate from the value it would have intrinsically. For here there is no coherent ascription of any determinate properties at all except in carefully-curated contexts.

<sup>52</sup>In general relativity, spacetime becomes a “*bona fide* dynamical player” (Brown 2005, 9) affecting and being affected by matter. While we do not yet have a theory, it is at least plausible that a quantum dynamics of space and time will result in the quantization, and discretization, of both.

<sup>53</sup>Cf. Cameron *op cit.*; McKittrick *op cit.*; also Ladyman and Ross *op cit.*, 136.

<sup>54</sup>Could we attach the approximation to ‘fundamental’ itself, and so contemplate that structuralism is (exactly) true of approximately fundamental reality? Unfortunately I don’t think so, for I don’t know what it would mean to be



first rendering, and so the claim that (let's say) only one or two fundamental properties turn out to be intrinsic; and let me begin with a purely descriptive claim. This is that, as it stands, both friends and critics of structuralism take *just one* intrinsic property to be fatal to the thesis. Chakravartty, for example, is unambiguous that “to offer any support to noneliminative OSR”, it must be that “not just some, but all properties of the particles described by quantum theory are extrinsic”.<sup>55</sup> Similarly, after arguing that spin and the vacuum expectation value of the Higgs field are not extrinsic properties, Berghofer states that “to refute [OSR] it, of course, suffices to identify one intrinsic property at the most fundamental level, i.e. to show that there is one intrinsic property exhibited by quantum fields”.<sup>56</sup> As a matter of descriptive fact, then, critics of structuralism are not going to take just one or two intrinsic properties to result in structuralism's being ‘approximately true’: rather, they are going to take it as definitively refuted. And it is moreover clear on principled grounds why this is so. For structuralism is just one of many attempts in metaphysics to make a claim about what *categories* there are: it is the claim that ultimately there is *only the category of structure*. And we've noted that structure, for structuralists, includes only that which is ‘not intrinsic’. It follows immediately that if we have even *one* intrinsic property at the fundamental level then we have something that is not in that category, and so the resulting picture is not the one-category ontology the structuralist is looking for after all. Thus it seems that what we have here is an instance of metaphysicians adhering to the principle, most associated with Lewis, that what is of metaphysical significance is not how many of a given kind there are in an ontology, but rather whether there is any member of the kind at all.<sup>57</sup> And while that status of that principle as a general maxim may be questioned, when it comes to the matter of what categories there are the motivation is perfectly clear.

The failure of the first strategy demands we consider the second possible rendering of ‘approximately true’ in the context of structuralist metaphysics – namely, that of regarding most or all of the properties the fundamental properties as ‘approximately extrinsic’. The tack taken here is to take the basic concepts of metaphysics and in some sense ‘relax’ them, and so emulate what very often happens in science – where we have moved from exact to approximate localization, or exact to approximate simultaneity, and so on. However, it seems clear that we can't do this in this context – or at least, not as things stand with our current repertoire of metaphysical concepts. For consider that when we say something is ‘approximately  $\Psi$ ’, we normally mean that it's *at best* approximately  $\Psi$ , and hence not  $\Psi$  strictly speaking. (Certainly that would be the case here, where we positively expect to not be exactly right.) So to say that some property is ‘approximately  $\Psi$ ’ is to say that, in reality, it is something else: something close, of course, but something else nonetheless. So here, to say something is ‘approximately extrinsic’ is in part to say it is not *strictly speaking* extrinsic, but rather something else. But what do we contrast extrinsic properties with? In other words, what properties are ‘not extrinsic’? It is at this point that the problem becomes obvious: for the standard answer here is simply *intrinsic* properties! For as noted above, the standard characterization of extrinsic properties is just as “those that

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for something to be ‘approximately fundamental’ without it approximating that which is fundamental *simpliciter*.

<sup>55</sup>Chakravartty 2012, 204.

<sup>56</sup>Berghofer 2017, 7.

<sup>57</sup>As Lewis (1973, 87) put it, “I subscribe to the general view that qualitative parsimony is good in a philosophical or empirical hypothesis; but I recognize no presumption whatever in favour of quantitative parsimony”.

are not intrinsic”. Thus as these properties are standardly defined they are simply logical contraries, mutually exclusive and jointly complete. So in saying that the property is ‘approximately extrinsic’, we transpose it into exactly that which the structuralist needs to avoid.

Just as with the last case, this it seems is but an instance of a more general phenomenon of metaphysics. For the paradigmatic properties of metaphysics, which are typically second-order properties, tend to be defined in mutually exclusive and jointly complete pairs, so that we tend to contrast them with nothing but their logical contrary. We’ll see another example in a moment when we think about Humeanism, but think of objective / subjective as mind independent *or not*, or fundamental / non-fundamental as dependent *or not*, abstract / concrete as causal-spatiotemporal *or not*, universal / particular as multiply instantiated *or not*, normative / natural as prescriptive *or not*. Indeed, the fact philosophers typically argue over whether the world is either one way or its opposite is presumably part of why Kant was able to surmise the history of metaphysics as a hopeless quest to resolve antinomies. Without wanting to diagnose yet again why the resolution of these questions has so often seemed hopeless, the very fact that metaphysical questions are so frequently posed as dualities in the first place presumably has much to do with metaphysics’ pretensions to being a theoretical discipline of the very highest generality.<sup>58</sup> For plausibly, for my predications to have *content*, the concepts I employ in them must have some contrast class.<sup>59</sup> And if this is so, then it seems we make the claims of highest generality when what we say partitions conceptual space into two.<sup>60</sup> Arguably this feature gives another reason for why metaphysicians typically don’t care about how many members of a given metaphysical kind there are, as already noted above: for it seems we could usually abstract away such specific differences and still be left with something to say. So the picture we seem to be converging on, then, and from both of these failed attempts, is that it is in part metaphysics’ aspiration to be the most general description of reality that is getting in the way of us being able to talk meaningfully of approximation and hence of approximate truth.

My case is by now largely made, but for completeness let us turn now to the debate over Humeanism – a forum, I will argue, in which the very same issues emerge. The contemporary Humean will not generally deny there are laws, or that smoking causes cancer, or that “I could have been a contender” is true: that is, they are not someone denying that modal discourse lacks a truth-value or can ever be true. Rather, the Humean is someone who holds that “modal-

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<sup>58</sup>The Maudlin quote above expresses this view; for more, see again Schrenk *op cit*. Note that there need be no conflict in viewing metaphysics as about the fundamental *and* the most general aspects of reality: the fundamental after all has implications for everything, and in any case what metaphysicians are typically interested in are the most general aspects of the fundamental.)

<sup>59</sup>I take this grand claim as intuitive. But if pressed, the most concise justification I can offer for it is that the inverse relationship between information and probability is well-established in information theory; and even if the only probabilities meaningful in the context of metaphysics are subjective there is nothing in this result that the subjectivist cannot help herself to.

<sup>60</sup>One might reasonably argue that conceptual space can always be carved into two by simply negating any given concept. Of course that is true, but as Lewis (1983) pressed in his highly influential discussion of ‘naturalness’, what results will generally be too gerrymandered and disunified to render it an eligible property. Only at sufficiently high levels of generality will differences between its members be abstracted away, and hence we can expect that it is only in highly general disciplines – such as metaphysics – that both a concept and its negation will be equally eligible.

ity is to be analyzed, or at least accounted for, in non-modal terms”.<sup>61</sup> Hence, as we have noted above, the debate over Humeanism in its contemporary guise is most naturally regarded as the dispute over whether modal ideology is fundamental. Now, as with other metaphysical doctrines, naturalists hold that the viability of Humeanism can change as our theories do. Indeed, Maudlin and others have argued that Humeanism is no longer tenable after quantum mechanics and its attendant metaphysics of entanglement.<sup>62</sup> While the Humeans have of course fought back against this accusation, let us here take it that the viability of our modal metaphysics can change as our physical theories do.<sup>63</sup> The next question is then whether we can regard Humeanism, or any rival view on the metaphysics of modality, as ‘approximately true’.

Our starting point here will be a description of the Humean worldview by Loewer, a leading architect of contemporary Humeanism. Here is what he has to say on what this view consists of and what its rivals are:

Contemporary Humeans about laws hold that the totality of the world consists of a mosaic of fundamental categorical properties/quantities and relations instantiated by fundamental entities (particles, fields etc.) throughout all of space-time. This distribution is called the ‘Humean mosaic’. A property is categorical if its instantiation in a region of space time don’t [sic] metaphysically necessitate anything about property instantiations in wholly distinct regions. Humeans claim that there is no fundamental necessity in nature connecting spatio-temporally non-overlapping events in non-overlapping portions of space-time...

In contrast, non-Humeans think that there is fundamental necessity in nature. Some non-Humeans hold that nomological necessity resides in fundamental properties/quantities themselves. They thus deny that all fundamental properties are categorical. At least some fundamental properties are claimed to be such that it follows from their natures that if one is instantiated in a region some other properties are instantiated in distinct regions... Other non-Humeans hold that laws are themselves fundamental features of reality. On this view laws are (or are associated with) fundamental entities that are over and above the Humean mosaic that ‘governs’ and constrains the mosaic. (Loewer 2012, p. 116).

The Humean position on fundamental reality outlined here corresponds to the ‘best system’ account chiefly associated with Lewis. Crucial to this view is that idea that all the fundamental properties whatsoever are categorical in nature – that is, such that they “don’t necessitate anything about property instantiations in wholly distinct regions”. The first anti-Humean position, according to which “at least some” of the fundamental properties are “such that it follows

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<sup>61</sup>Wilson 2015, 147.

<sup>62</sup>Maudlin *op cit*, Chapter 2. The reason is that when we have entangled systems we find that fundamental properties defined on spatio-temporally separated regions are not independent but rather highly coordinated with each other. And since the absence of such remote coordination is arguably “the most natural way for the Humean to guarantee that the world be fundamentally non-modal and lacking in necessary connections” (Bhogal and Perry 2017, 91), the prospects for some other reductive analysis succeeding would at least appear to be greatly compromised.

<sup>63</sup>Again, if we can reasonably cling onto our favourite metaphysical claims regardless of changes in physical theory then it is unclear what motivation there would be for naturalistic metaphysics in the first place.

from their natures that if one is instantiated in a region some other properties are instantiated in distinct regions”, corresponds to ‘dispositional essentialism’. For the very definition of an essentially dispositional property is a statement of what it necessity *would* do (i.e., how it would subsequently behave) *were* it to be embedded in particular circumstances – a statement replete with modal ideology. The second anti-Humean position corresponds to the ‘governing’ view chiefly associated with Dretske, Armstrong, and Tooley. According to this view all the fundamental natural properties are categorical, but these are supplemented by a primitive second-order relation of ‘nomic necessitation’, *N*, that relates them in natural laws. This relation is intended to capture a notion of physical necessity that is irreducible to first-order goings on, and as such represents primitive modal ideology.

Within this carving of the conceptual space, is it possible to say that a worldview is ‘approximately Humean’? It is very hard to see how so. For we have already noted that contemporary Humeanism is most naturally viewed the claim that modal predicates and operators do not feature as unanalyzed elements of our most fundamental theory. And clearly, if there is *even one* property that requires modal operators in its definition then modal ideology will not be analyzable away, rendering Humeanism straightforwardly false. So in a situation similar to the case of ontic structuralism and the presence of intrinsic properties, here the presence of even a single essentially dispositional property, or the single primitive relation of nomic necessitation, is sufficient to sink a Humean metaphysics. What then of the prospects of ‘relaxing’ the basic concepts of the Humean theory so as to make them more akin to those of changing scientific theories? Could the Humean say, for example, that the world is exhausted by a mosaic of ‘approximately categorical’ properties? But just as was the case with ‘approximate extrinsicity’ it seems that nothing of the sort is available. For just as with intrinsic and extrinsic properties, categorical and essentially dispositional properties are standardly defined dichotomously as mutually exclusive and jointly complete pairs. Bird, for example – surely one of the most subtle expositors of dispositional essentialism – takes it that “to say that a property is categorical is to deny that it is essentially dispositional”; similarly Mumford uses ‘categorical’ and ‘non-dispositional’ interchangeably.<sup>64</sup> One might be wondering how the relation of natural necessitation *N* fits into this picture. There are complications here, in part caused by the fact *N* paradigmatically relations co-instantiations while the definition of categorical properties given by Loewer above has them free of implications for spatiotemporally remote instantiations. Suffice to say that Handfield (2005) argues that *N* should be regarded as an ‘*über*-disposition’, since it, just like essentially dispositional properties, by its very nature implies counterfactuals. For these purposes, then, we will take *N* as relevantly akin to a dispositional essence, and postpone the full resolution of this issue to another occasion. Thus on standard renderings, to say that a property is ‘approximately’ categorical, and hence not categorical strictly speaking, commits us to viewing it as essentially dispositional. But this again requires the introduction of primitive modal ideology – precisely that which the Humean by definition must avoid.

While modal metaphysics and categorical metaphysics by no means exhaust naturalistic metaphysics of science they are surely cornerstones of it. And what we have seen is that there is no obvious sense in which either may be regarded as ‘approximately true’. But since science, we

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<sup>64</sup>Bird (2007, 66-67; Mumford 2006, 477.

believe, is making progress by generating theories that *are* more and more approximately true, the naturalistic metaphysics that is based on this science cannot be making progress in that same sense. Why think, then, that naturalistic metaphysics is making any progress at all? And the absence of any reason to think that it is, and every reason to think our current metaphysics is false, does any value reside in our contemporary activities in metaphysics? Neither question, to my mind, has a remotely obvious answer.

## 4 Conclusion

The picture I have been drawing here is one in which some of the core concepts of naturalistic metaphysics, and the claims that we make in terms of them, have a rather dichotomous, crude, and ‘all-or-nothing’ character which obstructs the concept of approximation being meaningfully predicated of them. This relative crudeness undermines the ability of our metaphysical claims to participate in the progress of science, which in turn makes it unclear what value there is in engaging in scientific metaphysics today.

This is of course a rather bleak conclusion. Needless to say, there are however many places in the argument that one could push. The first objection one might raise is that there are sources of value that we can ascribe to metaphysics of any stripe other than it describing the world with any degree of correctness. One might for example argue the activity is intrinsically valuable; that it sharpens our critical faculties that may then be put to use elsewhere; or that it confers a deeper understanding of scientific theories that cannot but help make us better scientists. All of these are ideas that have been discussed elsewhere.<sup>65</sup> My personal view, however, is that these are positions of last resort when it comes to naturalistic metaphysics. In metaphysics quite generally we do not conduct ourselves in a fashion that suggests we don’t believe there’s something for us to be right about. Partly on the basis of this observation Bryant (2017) has made a good case for analytic metaphysicians’ being in a state of ‘false consciousness’ with regard to their discipline; and if this is the way we choose to respond to the argument made here then that judgement ought to be expanded to naturalistic metaphysicians as well.

I expect most, then, to contest the fundamental premise here that paradigmatic metaphysical claims cannot in any clear sense be approximated. In my defence, the basic point undergirding my argument has been articulated, in one form or another, many times before. For example, at the fulcrum of Rescher’s metaphilosophical reflection *The Strife of Systems* is the idea that philosophical positions are fundamentally “based on deliberately conflicting visions of things, and there just is no way to ‘have it both ways’. To deprive them of their contriety is to deprive them of their substance – *omnis affirmatio est negatio*”.<sup>66</sup> But ‘having it both ways’ is a good way to put what approximation is all about. (Classical mechanics was wrong, we want to say; but also in a very important way right.) But one might still accuse my argument for the ‘crudeness’ of metaphysical concepts of being rather crude in itself. For even if I am right

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<sup>65</sup>French and McKenzie (2012, 2015), and in a different way Dorr (2010), both defend the heuristic value of *a priori* metaphysics.

<sup>66</sup>Rescher 1985, 14-15.

that ‘paradigmatically’ the core concepts of metaphysics, such as ‘intrinsic’ and ‘categorical’, are understood in dichotomous terms, can they not be modified in a way that will permit them to admit of degrees? If so then perhaps we may talk about greater and lesser degrees of these properties after all. And either way, since we can expect whole metaphysical *worldviews* to have a certain degree of complexity, may not one of those meaningfully be said to be closer or further from another? Bird, for example, regards the nomic necessitation view of Armstrong to be an intermediate ‘semi-Humean’ view, in that it (unlike Lewis’) posits necessitation relations but (unlike dispositional essentialism) holds that this necessitation is not *metaphysically* necessary (Bird *op cit.*, 2). Might not this situation be expected to generalize, and thus there be some scope of speaking of one metaphysical position as being ‘closer’ to another, and hence also, one might hope, as being *closer to the truth* about the fundamental metaphysics of the world?

All of these are ideas that I think merit much further reflection. But note that we cannot answer the question of whether one view counts as an ‘approximation’ of another until we have specified the purpose to which the view is being put. For ‘approximation’ is elliptical for ‘good approximation,’ and just as 4mm may count as a good approximation to 5mm for the purposes of home decoration it may not in the context of surgery, or gemology, or particle physics. Thus before we can take a stance on whether Armstrong’s position on modality is to count as an ‘approximation’ to that of Bird, we are going to have to specify whether we are interested in the ideological inventory of the actual world (in which they might seem similar) or in issues of trans-world identity (in which they seem very distinct), or in issues of the categorial inventory of the world (in which they seem very distinct again) – issues which we can expect to serve other purposes in turn.<sup>67</sup> Thus in considering whether we can develop a more approximate metaphysics – a metaphysics with sufficient tolerance to allow for progress through theory change – we must place front and centre why it is that we are interested in judging similarity in the first place.

The idea that similarity is always relative to a purpose is by now a familiar one in metaphysics, again largely thanks to Lewis (this time through his theory of counterparts). But the last thing I want to urge – urge in order that we make progress with this question of progress – is that we ask ourselves why it is that we do metaphysics of science at all. For it seems to me that some motivations for engaging in the metaphysics of science will permit approximations and others will not. Thus if one’s reason for doing metaphysics is to interpret the world described by science in a way compatible with the supreme rationality of God, as (crudely speaking) was the case for the Scholastics, then it seems that approximation is not in general an option. (A world in which there are *just a couple of things* that are perfectly alike, for example, requires God to make choices without reason, in stark contradiction with his nature.) By contrast, if one’s reason for doing metaphysics is to uncover the conditions of possibility of science itself, then plausibly a lot of approximation will be permitted – indeed likely mandated. For while merely approximate determinism may be an affront to the principle of sufficient reason, it will do science just as well as the unqualified version (cf. Peirce 1892). What our purpose is in engaging in metaphysics at all, then, will determine to what extent we may hope to render it approximate. Insignificant assertions that our aim is to “describe the world” are not enough for naturalistic metaphysics, then: our prior agenda for doing so must be specified. The fact that so much hangs on ambitions held

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<sup>67</sup> Armstrong’s theory, unlike dispositional essentialism, takes laws to be a fundamental category of the world.

prior to interpreting the science perhaps gestures at another reason why naturalistic and *a priori* metaphysics are not so far apart. But this is an issue that must be left for another occasion.

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