



An Empiricist Conception of the Relation Between Metaphysics and Science

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Received: 6 August 2018 / Revised: 14 October 2018 / Accepted: 23 October 2018 /
Published online: 5 November 2018
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Abstract

It is widely acknowledged that metaphysical assumptions, commitments and presuppositions play an important role in science. Yet according to the empiricist there is no place for metaphysics as traditionally understood in the scientific enterprise. In this paper I aim to take a first step towards reconciling these seemingly irreconcilable claims. In the first part of the paper I outline a conception of metaphysics and its relation to science that should be congenial to empiricists, motivated by van Fraassen's work on 'stances'. There has been a considerable amount of recent work devoted to van Fraassen's 'stance' view, but it has not on the whole been noticed that the view has the potential to motivate a general empiricist conception of the relation between science and metaphysics. In the second and third sections I discuss two examples from biology to illustrate this conception: metaphysical punctuated equilibrium, and its relation to and influence on the thesis of punctuated equilibrium; and dialectical biology as defended by Levins and Lewontin.

Keywords Metaphysics · Empiricism · Stances · van Fraassen · Punctuated equilibrium · Dialectics

1 Introduction

In this paper I outline a conception of the relation of metaphysics to science, motivated by van Fraassen's work on philosophical stances, that does justice to the role played by metaphysical assumptions and presuppositions in scientific inquiry, while honouring the anti-metaphysical attitude that has always characterised the empiricist tradition.

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It is widely acknowledged that metaphysical assumptions, commitments and presuppositions play an important role in science. Yet according to the empiricist tradition there is no place for metaphysics as traditionally understood in the scientific enterprise (Chakravartty 2010). In this paper I aim to take a first step towards reconciling these seemingly irreconcilable claims. In the first part of the paper I outline a conception of metaphysics and its relation to science that should be congenial to empiricists, motivated by van Fraassen's work on 'stances'. There has been a considerable amount of recent work devoted to van Fraassen's 'stance' view, but it has not on the whole been noticed that the view has the potential to motivate a general empiricist conception of the relation between science and metaphysics. In the second and third sections I discuss two examples from biology to illustrate this conception: metaphysical punctuated equilibrium, and its relation to and influence on the thesis of punctuated equilibrium; and dialectical biology as defended by Levins and Lewontin. These examples are only intended to be illustrative: my discussion is largely programmatic, and does not aim to prove conclusively that the model I am outlining and applying is correct. My claim is rather (a) that *if* empiricists are to do justice to the role played by metaphysics in science, they must adopt the approach I am outlining, or something very similar; and (b) that this approach is not obviously untenable, and may have something to recommend it.¹

There are a number of questions about the relation between science and metaphysics. I am focusing on the role played by metaphysics in science. I will not be discussing metaphysics as practiced by analytic metaphysicians², and thus I will not be entering into the debate about the extent to which such metaphysics can and ought to be naturalised (see e.g. Ladyman et al. 2007, 2013). My focus³ is rather on questions such as: to what extent is science imbued with and constrained by metaphysics? To what extent *should* science be imbued with metaphysics? What is the influence of metaphysics on the practice of science, and on scientific theories? What inferential relations, if any, hold between scientific theories and the type of metaphysical assumptions that guide and motivate scientific theorising? What is the *nature* of these metaphysical assumptions (are they beliefs, theories, attitudes, etc.), such that they play the role in science that they do? I do not regard these questions as pertaining to the theoretical posits that form part of scientific theories (electrons, protons and the like). As Chakravartty notes (2013, 27; see also van Fraassen 2004b, 171), although in the past commitment to such entities was considered a type of metaphysical commitment, this is no longer the case. It would be odd, today, to call belief in the mind-independent existence of electrons a 'metaphysical' belief. But there are other, more obviously metaphysical, types of commitments and assumptions that do seem to play an important role in science, and about which the above questions can be raised.

¹ It will be seen that the position I am exploring has some affinities with the view defended by Kant, on the positive role of reason, in the Appendix to the Transcendental Dialectic, from his *Critique of Pure Reason* (1965, 532-549).

² Or indeed philosophers of science practicing what has been called the metaphysics of science.

³ Chakravartty has had a similar focus in his recent work (2004, 2010).

2 van Fraassen on Science and Metaphysics: The Positive Program

Bas van Fraassen has been one of the most prominent empiricist critics of the revival of metaphysics in analytic philosophy in the last few decades. This critique, which we may call his ‘negative program’ (see e.g. 2002), has been the subject of considerable discussion in recent years. But what has been largely overlooked is that van Fraassen also defends (or at least hints at) a *positive* empiricist program with respect to metaphysics and its relationship to science, according to which metaphysical positions, reconceptualised as stances (rather than factual beliefs) may play a positive role in scientific inquiry, albeit a different role from the one they have typically been thought to play.⁴

He writes, ‘I ... lack sympathy for metaphysics, though not in general: only for pre-Kantian metaphysics – and then only if practised after Kant’ (van Fraassen 1989, viii). He is willing to allow a role for metaphysical exploration of the way scientific theories represent reality, and speculation about how the world might be if what a theory says about it is correct (2004b, 180; 2007, 379–81). He accepts this could be called a form of metaphysics (Ladyman (2011, 94) calls it ‘quasi-metaphysics’), but sharply distinguishes the question of the *interpretation* of a scientific theory from the practice of speculating about metaphysical matters of fact on which science is silent.

The above point has to do with philosophical reflections on science, characteristically pursued by philosophers. But van Fraassen also allows that metaphysical positions and orientations, properly understood and constrained, may play a positive role in science, and it is this that I am interested in here. For instance, in his unjustly neglected (1996), while he denies that metaphysical positions (such as materialism, realism and naturalism) as factual theses influence science in virtue of their *content*, he suggests that, understood as *stances* or *attitudes*, they may have an inspirational, motivational effect on scientists and their work, and thus be pragmatically useful. ‘There is... a way in which materialism can play a role in shaping science... not through the content of its theses, entering as assumptions, but through attitudes for which these theses are mere codes’ (1996, 151). Elsewhere he writes that if metaphysical speculation ‘has great heuristic and inspirational value, let’s encourage scientists to so far forget themselves as to constantly engage in it’ (2004b, 181).

We may say that van Fraassen’s view on science and metaphysics is intermediate between the traditional empiricist position that sees no role for metaphysics in science

⁴ van Fraassen is of course best known for defending the anti-realist position in the philosophy of science known as constructive empiricism (CE). This is the view that the aim of science is empirical adequacy rather than truth, and that the acceptance of a theory amounts to the belief that it is empirically adequate (van Fraassen 1980, 12).

Chakravartty (2010, 63) mentions CE, along with logical empiricism, as a perspective from which one may reject a role for metaphysics in science, given the epistemic attitude it promotes towards unobservables. According to CE, the positing of unobservable entities plays an important role in science only inasmuch as it assists scientists to develop empirically adequate theories, and CE recommends an attitude of agnosticism towards the question of the existence of these entities. But we have seen that the question of the reality of unobservable scientific posits is no longer widely considered a *metaphysical* question. CE’s suggestion that we should limit our epistemic commitments to the observable, and that unobservable posits play at most a pragmatic role in scientific theorising, do not speak to the question we are addressing here, that of the role, if any, played in science by general metaphysical systems, worldviews, presuppositions, perspectives and so on. The empiricist needs van Fraassen’s stance conception, in addition to CE, to deal with this latter question, and in particular, to provide a means of reconciling the empiricist tradition with an acknowledgement of the central role played by metaphysics in science.

at all (that is, has a completely negative view of metaphysics), and the popular contemporary view (that we can think of as a version of naturalism) that sees science as permeated by metaphysical assumptions understood as factual theses.

More specifically, I will distinguish three broad positions on the role of metaphysics in science:

1. The naturalist view: metaphysical positions are (or can be) foundational principles in science grounding and constraining scientific theorising. Metaphysical positions are high-level, possibly empirical, beliefs.
2. The view that metaphysical positions are not part of science, and typically are not empirical. They are nonempirical beliefs.
3. van Fraassen's position: metaphysical positions are not part of science, and are not empirical. They are pragmatic, values-driven stances (not beliefs).

Two main post-positivist traditions have contributed to the first (naturalist) view becoming standard (or at least popular) in contemporary philosophy – that originating with Kuhn, and that originating with Quine. Kuhn's questioning of the distinction between the context of discovery and the context of justification (see below), and his wish to import into our account of the scientific process elements, such as value judgements and metaphysical commitments, that had been thought to be extraneous to science – for instance in his idea that a paradigm includes among its components a metaphysical worldview (1996) - was significant in undermining the positivist separation of science and metaphysics (Chakravarty 2010, 6); while Quine's famous suggestion (1953) that science is continuous with ('on a par with') metaphysics, and his influential holist idea that metaphysics and science form part of our total world picture (web of belief), confronting experience as a whole, also contributed to undermining the positivist conception. Those who have been influenced by Kuhn and Quine have tended to inherit these views and arguments.

I will also distinguish three views about the inferential relations that hold between scientific beliefs and metaphysical positions:

1. Relationship between metaphysical positions and scientific theories/beliefs is deductive (relationship of entailment) and inductive.
2. Relationship is inductive/explanatory, not deductive.
3. There is no inferential relationship, either deductive or inductive.

van Fraassen appears to be committed to (3).

Although he doesn't explicitly mention it (as far as I am aware) van Fraassen's views on the relation of metaphysics to science appear to make use of the familiar distinction in the philosophy of science between the context of discovery and the context of justification.⁵ The context of discovery is the context in which scientists come up with theories and hypotheses, while the context of justification is the context in which those theories and hypotheses are tested, and come to be accepted or rejected. For van

⁵ For classic statements and defenses of the distinction, see Hempel (1966, 3-18), Popper (1963, 42-59), and Reichenbach (1938). One of the most famous statements of it is Popper's: '[T]he act of conceiving or inventing a theory seems to me neither to call for logical analysis nor to be susceptible to it... the question of how it happens that a new idea occurs... may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge.' Popper, quoted in Ladyman (2002, 75).

Fraassen, metaphysical commitments may influence scientists in the context of discovery, may assist, that is, in the formulation of specific scientific hypotheses. But they play no role in the context of justification – when scientists are testing a theory, and trying to decide whether or not it's acceptable, all that matters is whether it's empirically adequate; the question of its origins is irrelevant. '[A]n empirical hypothesis introduced into science for reasons, and perhaps with putative credentials, coming from outside that science, will so to speak *forget its origins* ... so that its fortunes within science will soon have little or nothing to do with those origins' (1996, 157).⁶

Putting all this together, van Fraassen seems to hold the following views on metaphysics and science⁷:

- Metaphysical positions are not part of science, and are not empirical.
- Metaphysical positions are, or should be, pragmatic, values-driven stances (not beliefs).
- There are no inferential relationships, either deductive or inductive, between metaphysical positions and scientific beliefs/theories.⁸
- Metaphysical positions may influence empirical scientific inquiry, but only in the context of discovery, never in the context of justification.⁹

2.1 Stances

Two elements of this picture call for further comment. Firstly, I need to say a word about what van Fraassen means by 'stances'. For van Fraassen a stance is a cluster of attitudes, commitments, goals, values and epistemic policies:

...a philosophical position can consist in something other than a belief in what the world is like. The alternative is a stance (attitude, commitment, approach) which can be expressed, and which may involve or presuppose some beliefs as well, but not ones that are unpalatable to someone taking that stance...What empiricists

⁶ One other empiricist philosopher of science who seems to have used the distinction in a similar way is Karl Popper (e.g. 1963, 37–8. See Ladyman 2002, 72). Popper accepts the importance of metaphysical theories in inspiring and helping to generate scientific theories, which is in line with van Fraassen's view that metaphysical commitments in science may play a potentially valuable role 'inspiring' scientists in the context of discovery.

⁷ As an interpretation of van Fraassen's views, this may well be controversial. But what I am mostly concerned with is not whether it perfectly captures van Fraassen's actual views on science and metaphysics, but how plausible it is. If it is thought to depart significantly from van Fraassen's actual position, we can rather call it a view 'inspired by' his comments on science and metaphysics. I will continue to refer to it as van Fraassen's position for convenience sake.

⁸ Of course, once we construe metaphysical positions as stances rather than factual beliefs, this point follows trivially, since stances are nonpropositional, so are not the kinds of things that may stand in relations of entailment or support. But, setting aside the issue of stances vs. beliefs, it seems to capture van Fraassen's views about science and metaphysics, e.g. 'Duhem ... saw science as neutral on all issues of metaphysics ... Duhem is right, in the main...' (van Fraassen 1996, 149). '[T]here is no nonempirical claim which matters at all to the process of science' (*ibid*, 175).

⁹ Is this claim descriptive or normative? It is at least normative, that is, a claim about how science ought to proceed. But it is likely that van Fraassen means it to be descriptive as well, that is, a claim about how science does in fact proceed.

have shared over the centuries...has not most obviously been a set of beliefs... [empiricism is] an attitude, or rather a cluster of attitudes, a philosophical stance. (1995, 86, 83)

The key features of stances in van Fraassen's sense are:

- They are not reducible to beliefs; they are *adopted* rather than believed, like an approach or policy.
- They are in large part *non-propositional*; so they are not to be thought of as true or false.
- They are largely *values-driven*. One adopts a stance which coheres well with ones values, both epistemic and nonepistemic.
- They are pragmatically justified in part in terms of their fruits; one adopts a stance at least partly on the basis of the *consequences* of doing so.

There has been much discussion in the literature about the nature and function of stances (see Baumann 2011; Chakravartty 2004, 2011; Cruse 2007; Finch 2003; Ho 2007; Horsten 2004; Jauernig 2007; Ladyman 2004, 2011; McMullin 2007; Mohler 2007; Rowbottom 2005, 2011; Rowbottom and Bueno 2011; Teller 2004; van Fraassen 1994, 1995, 1996, 2002, 2004a, b, c, 2007, 2011), but for our purposes the above characterisation will suffice.

Van Fraassen's paradigm examples of philosophical stances are empiricism, materialism (physicalism), naturalism and secularism (2002). But one example van Fraassen gives of a philosophical stance that is particularly pertinent to my analysis is Arthur Fine's 'Natural Ontological Attitude (NOA)' (van Fraassen 2004b, 173; Fine 1984). According to this view, science may be accepted at face-value as providing us with truths about the world, including the unobservable world. But so long as the notion of truth is not given a realist interpretation (e.g. as correspondence to the facts), this falls short of being a realist conception of science, in Fine's view. Neither is it an anti-realist view; it is 'non-realist'. As the name suggests, NOA is a distinctive *attitude* one may take towards science, not primarily a theory or factual claim.¹⁰

In his (1986), Fine suggests that Einstein accepted something close to NOA, and that it influenced his science in much the way that van Fraassen, as I am interpreting him, suggests metaphysical assumptions may have an effect on science: as a prescientific stance or attitude exerting a motivational (rather than inferential) influence on the practice of science, and that may be pragmatically justified in terms of this effect. While we may hesitate to label NOA a metaphysical view – indeed Fine's motivations appear strikingly anti-metaphysical – still, understood as a characteristic attitude one may take towards science (as opposed to a factual claim), and one that may influence and shape scientific work in accordance with the principles outlined above, it is a clear example of the sort of stance van Fraassen, and I, have in mind.¹¹

¹⁰ See also Wright (1986), who suggests that constitutive of realism are the *attitudes* of modesty (the world exists independently of us) and presumption (we can know the world).

¹¹ Thank you to an anonymous referee who urged on me the relevance of NOA to this discussion.

2.2 The Two Contexts

Secondly, I need to offer a comment on the context of discovery and the context of justification. In early 20th century philosophy of science the distinction between the two contexts was, for its defenders such as Popper and Reichenbach, a means by which both to recognise, and neutralise, the non-rational and subjective elements that it was understood play a role in scientific theorising, but that seemed to escape analysis in terms of logic and inference. (Scientists may be inspired by dreams or religious beliefs, may be suddenly struck by inspiration, may pay excessive heed to unsupported hunches and guesses, may be subject to biases, and so forth). It was conceded that the nonrational elements play a role, but it was claimed that this role (in the context of discovery) was logically distinct from the rational part (in the context of justification). Thus the nonrational part could in effect be bracketed, and, for the purpose of analysing the logic of scientific inference, ignored. There was no reason to think it in any way infected the rational part.¹²

This approach was thrown into question by Kuhn's analysis in the early 1960s. Far from being safely sealed off from the properly rational process of scientific inference, Kuhn suggested that non-rational and subjective elements intervened at every level, ruling out the possibility of giving a general account of scientific methodology that showed it to be a logical, purely rational process (Kuhn 1996). Thus the distinction between the two contexts fell into disrepute.

A version of the distinction can perhaps be defended however. Firstly, Kuhn's arguments may still presuppose a distinction between rational and nonrational components of scientific method, which may be all that defenders of the distinction require. Even if nonrational and subjective elements do in fact intervene at every level of scientific methodology, we can still point out that they shouldn't, and still attempt to bracket them *normatively* when characterising the scientific method normatively.¹³ Secondly however, we can seemingly disassociate the distinction from the logical empiricist and falsificationist philosophies of science with which it is usually associated. We can accept the general consensus in the philosophy of science that the project of characterising *the* scientific method is hopeless, while still insisting that it makes sense to distinguish between the two contexts. Arguably the insight informing the distinction between the two contexts - that the origin of a hypothesis is irrelevant to the question of its truth-value, or whether it's

¹² As Longino (1990, 172) puts it: 'This distinction enables positivists to acknowledge the play of subjective factors in the initial development of hypotheses and theories while guaranteeing that their acceptance remains untainted, determined not by subjective preferences but by observed reality. The subjective elements that taint its origins are purged from scientific inquiry by the methods characteristic of the context of justification: controlled experiments, rigorous deductions, etc.'

¹³ Kuhn responds to this sort of defence of the distinction in his (1977), in which he argues that the contamination of the context of justification by subjective, individual, and value-based elements from the context of discovery, is not a contingent matter from which we can abstract to give an admittedly idealised account of the scientific method, but follows necessarily from the very nature of the context of justification itself.

justified - is a valid insight, and continues to be so even once we have abandoned the approaches with which it is typically identified¹⁴ (Ladyman 2002, 75-6).

In the following two sections I apply the above analysis of the role of metaphysics in science to two cases from biology: punctuatedism as defended by Stephen Jay Gould, and dialectics as defended by Levins and Lewontin. It is important to be clear about what these examples do and do not establish. Firstly, while I aim to show that the stance interpretation of these positions is coherent and worth taking seriously, I accept I have not established conclusively that it is correct; that would require more detailed argumentation. Secondly, I am not even arguing that Gould and Levins and Lewontin would agree with this interpretation. I suspect that Gould would be sympathetic to it, but that Levins and Lewontin would not be. But I just hope to show that this interpretation is *suggested by* and *consistent with* a number of things the views' proponents say about them. Furthermore, even if we had established that the stance interpretation of these particular views was correct, this clearly does not show that a similar interpretation must be true of all cases of metaphysical influences on science – we cannot hope so to generalise from only two cases.¹⁵

Instead, in these sections I aim simply to illustrate how the empiricist must conceive of the role of metaphysics in science, and show that such a conception is *prima facie* defensible in at least some cases. These sections are thus more illustrative than argumentative. I am addressing the question: is there a coherent and defensible alternative to (a) the view that metaphysical positions such as these play no role in science, and (b) the view that they (at least often¹⁶) play a role as factual beliefs grounding, and bearing evidential relations to scientific beliefs. In order to answer this question in the affirmative, we require some illustrative examples of metaphysical perspectives that arguably play an important role in science, but not as factual beliefs. If it is plausible, or at least not obviously false, that they do, that is sufficient for my purposes, vis. to *illustrate* the stance alternative to (a) and (b). I wish to show that, despite appearances, the empiricist *has* a promising strategy, via the stance approach, for avoiding (a) and (b), and that this strategy is worth pursuing.

My aim, then, is to outline what I take to be the only promising strategy for reconciling empiricist commitments with the acknowledged role of metaphysics in science, and indicate that it has something to recommend it, i.e. it's not obviously hopeless. But this is clearly just a first step. Whether the stance theorist can successfully show that these perspectives *actually are* stances in van Fraassen's sense, not factual beliefs, or should be construed as such - i.e. whether their strategy is successful - is not a question one I can hope to conclusively resolve here.

¹⁴ Although see Okruhlik (1994) for a powerful critique of the distinction. Her argument draws on Kuhn, but also on recent feminist philosophy of science. For other discussions of the two contexts, see Kordig (1978), Gutting (1980), Zahar (1983), Leplin (1987), Hoyningen-Huene (1987), and Schickore and Steinle (2006).

¹⁵ As it happens I do think the stance interpretation is plausible in a range of other cases. It's just that I am not arguing for that here. See conclusion below.

¹⁶ One could hold of course that metaphysical positions sometimes play this role, and sometimes play more of a stance role in van Fraassen's sense. Thus we should think of the view to which an alternative is being sought as the view that metaphysical positions typically, or characteristically, or at least much of the time, play this sort of role, not that they necessarily always do.

3 Punctuationalism and Gradualism

In this section I will discuss the general philosophies of change known as ‘punctuationalism’ and ‘gradualism’, and their relationship to the empirical, scientific positions that also bear those names. I will focus on Stephen Jay Gould, the most prominent evolutionary theorist in this debate. The way he describes the relationship between the metaphysical and empirical positions at issue is strongly suggestive of van Fraassen’s positive program. For convenience I will be talking primarily about punctuationalism, but most of what I say applies also to gradualism.

3.1 Punctuationalism and Gradualism: Empirical Theories and Metaphysical Stances

Famously, Gould and Eldredge in the 1970s proposed the thesis of *punctuated equilibrium*, according to which the picture of evolutionary change that the fossil record appears to present – that most species change very little through the course of their existence – is not, as traditional Darwinians tended to argue, an illusion, but is in fact veridical: the majority of species are in ‘stasis’ for the great majority of their life-spans, rather than gradually and continually evolving, as the standard Darwinian ‘phyletic gradualist’ view has it (Gould and Eldredge 1972; Gould 2002). Evolutionary change, on this view, is largely a result of the processes associated with *speciation*. Thus speciation itself emerges as the crucial process responsible for the great bulk of genetic and phenotypic evolutionary change; species are seen to be discrete ontological *individuals*, rather than classes; and macroevolution (evolution above the species level), rather than being merely the summation of microevolutionary processes, emerges as a distinct and irreducible causal process, subject to its own laws.

As stated, punctuated equilibrium is a scientific theory that makes testable predictions concerning macroevolutionary patterns. It asserts that the punctuationalist pattern is the *predominant* pattern for the life history of a species, not that it holds universally:

[P]roponents of punctuated equilibrium have always recognised that the theory cannot be proven ... from documentations, however rigorous and complete, of individual cases. As its primary claim, therefore, punctuated equilibrium must assert a dominant role for stasis within species and rapid cladogenesis between species in the construction of macroevolutionary patterns at the appropriate scale of speciation and trends across species within clades. This assertion requires that punctuated equilibrium maintain a *dominant relative frequency* in the origin of new paleospecies. Tests of the theory must therefore focus upon percentages of occurrence in exhaustive, or at least statistically definitive, surveys of particular taxa, faunas and times. (Gould 2002, 854)

The fact that punctuated equilibrium is a claim about relative frequency makes it more difficult and complicated to empirically test than all-or-nothing positions. For instance, the validation of gradualist hypotheses regarding particular evolutionary histories will not undermine it, since it accepts that these hypotheses will sometimes be correct. Thus no ‘crucial experiments’ will be possible

to test, once and for all, whether punctuated equilibrium or phyletic gradualism is true (*ibid*, 823). But this is, most theorists now accept, how things stand with most of the interesting debates in biology (*ibid*; see also Beatty 1997). Few positions make all-or-nothing claims, and therefore crucial experiments of the classical kind are unlikely to be forthcoming. But it is recognised that this needn't be cause for despair, and some recent work in the philosophy of biology has been devoted to showing how hypotheses about relative frequency and relative importance may be subjected to empirical test, and also how hypotheses that cannot be directly tested in any straightforward way may be indirectly empirically tested in the long run through an assessment of the longer term success of the research programs of which they form a part.

There are some more specific methodological issues surrounding the empirical testing of punctuated equilibrium (*ibid*, 784–874) but for present purposes we can accept that it is a respectable empirical, scientific hypothesis. As such, it should be distinguished from 'punctuationalism' understood as a broader, more metaphysical, and higher-level view, applicable to change over time in any natural or social system. Gould and Eldredge have wanted to distinguish sharply between the metaphysical thesis of punctuationalism and the empirical thesis of punctuated equilibrium, while acknowledging that they are inclined to accept both.¹⁷ (*ibid*, 1011). Punctuated equilibrium is, they argue, a specific, empirically testable scientific claim, while metaphysical punctuationalism is more like a philosophical attitude or general perspective or worldview, and thus should not be thought of as a part of science strictly speaking.¹⁸

For instance, in his final book, Gould (2002, 1018), responded to those who had suggested that the fact that he and Eldredge had, in their (1977), admitted to the possible influence on the theory of punctuated equilibrium of metaphysical punctuationalism, implied that punctuated equilibrium must represent little more than bad metaphysics (or Marxist politics) imposed on nature:

We needed to say something about why we, rather than other paleontologists at other times, had developed the concept of punctuated equilibrium. We raised this point [about our interest in Marxist and punctuationalist conceptions of change] as sociological commentary about the *origin* of ideas, not as a scientific argument for the *validity* of the same ideas. An identification of cultural or ontogenetic sources says nothing about truth value, an issue that can only be settled by standard scientific procedures of observation, experiment and empirical test.

¹⁷ In a television interview Gould (1984) contrasted the punctuationalist with the gradualist conception of change: 'The issue at stake is the very nature of change itself. There is I think a pervasive bias in Western thought to see change as slow, steady, accumulative, gradual, to see change as the essence of nature. There's another view however, that stability and system and structure is more the essence, and the change, when it occurs, is difficult, that systems absorb stress, and try to maintain themselves, and that every once in a while the stress accumulates to a point where the system breaks and quickly reconstitutes in a new way so that change is not always continuously accumulating, but is rare and episodic, and that systems tend to sit at stable points as much as they can. It's a different way of viewing the world.'

¹⁸ Gould has not however always clearly drawn this distinction. In the quote from the television interview above for instance, he suggests that 'the issue at stake' in the debate over punctuated equilibrium is precisely the nature of change in general.

Put in the terms of this paper, Gould is saying that the influence of metaphysical punctuated equilibrium on the development of punctuated equilibrium took place in the context of discovery, not the context of justification. Being predisposed to seeing the world in terms of a metaphysics of punctuated equilibrium made the hypothesis of punctuated equilibrium both more ‘visible’ as a potential theoretical option, and more initially attractive, than its gradualist rivals. But once developed, these metaphysical influences on the theory became irrelevant, and all that mattered was its empirical predictions and whether they were confirmed. The metaphysical origins of the hypothesis were strictly irrelevant to the question of its acceptability as a scientific hypothesis. ‘As with all scientific theories, punctuated equilibrium will live or die by concrete and quantifiable evidence’ (*ibid*, 774).

They make a similar point (1977) about the influence that the Victorian ideology of gradual progress (which can be seen as a form of metaphysical gradualism) had on Darwin’s gradualist theory of evolution. This influence also belongs to the context of discovery:

‘The general preference that so many of us hold for gradualism is a metaphysical stance embedded in the modern history of Western cultures; it is not a high-order empirical observation, induced from the objective study of nature ... We mention this not to discredit Darwin in any way, but merely to point out that even the greatest scientific achievements are rooted in their cultural contexts...’ (Quoted in Gould 2002, 1017)

So, at least according to Gould, punctuated equilibrium as an empirical hypothesis is distinct from, and independent of, punctuated equilibrium as a metaphysical position. The same is true of gradualism as an empirical hypothesis and as a metaphysical position. The metaphysical positions may have influenced the development of the empirical hypotheses, but this influence took place in the context of discovery, not the context of justification. Thus reference to the metaphysical positions is pertinent when considering the historical (or ‘sociological’) question of the origins of the empirical hypotheses, but is not relevant when considering the empirical, scientific question of the rational acceptability of those same hypotheses. This accords with van Fraassen’s claim, quoted above (1996, 157) that

...an empirical hypothesis introduced into science for reasons, and perhaps with putative credentials, coming from outside that science, will so to speak *forget its origins* ... so that its fortunes within science will soon have little or nothing to do with those origins.

3.2 The Relation Between Science and Metaphysics: van Fraassen, Dupre, and Gould

The naturalist conception of the relation between metaphysics and science includes the view that metaphysical positions can enter into science as fundamental or foundational principles, underpinning and grounding the science. They are ‘in the same boat’ as more obviously empirical hypotheses, differing from the latter only in being more abstract, general and conceptual – lying closer to the core of our web of belief, as Quine puts it. As van Fraassen (*ibid*, 176) notes, this is ‘the picture of science deeply imbued with metaphysics...’ The case of punctuated equilibrium and gradualism appears to controvert

this picture however. If Gould is right, metaphysical punctuationism and metaphysical gradualism are not foundational with respect to punctuated equilibrium and empirical gradualism. The metaphysical positions do not underpin or ground the empirical hypotheses; from a scientific perspective, they are irrelevant to them. It follows that acceptance of punctuated equilibrium is consistent with the rejection of metaphysical punctuationism, and acceptance of empirical gradualism is consistent with the rejection of metaphysical gradualism.¹⁹ Whether one's acceptance or rejection of the empirical hypotheses could or should have *any* bearing on one's attitude towards the metaphysical positions is another matter. It might be suggested that even if the empirical and the metaphysical positions are logically independent, the former may still inductively *support* the latter. So while strictly it may not be inconsistent to, say, accept punctuated equilibrium while also accepting metaphysical gradualism, if one is persuaded that empirical gradualism is false, this may have the effect of shaking one's confidence in metaphysical gradualism, and may indeed lead one to consider abandoning it.

This conception of how metaphysical positions may be amenable to justification or refutation on the basis of empirical scientific evidence has been defended by Dupre (1993, 2) among others: 'I ... claim that empirical inquiry (which I do not limit to scientific inquiry) provides the evidence on which such [metaphysical] assumptions must ultimately rest. Thus I claim that founding metaphysical assumptions of modern Western science ... have been shown, in large part by the results of that very science, to be untenable.'

As I suggested above, van Fraassen appears to reject these kinds of inferences from empirical science back to metaphysics.²⁰ According to van Fraassen's view empirical hypotheses neither entail metaphysical positions, nor so much as *support* them. This is so partly because metaphysical stances are not beliefs, and so not the kind of things that may be *inferred* at all, but also because, even if we do think of them as belief-like, it seems there will always be more than one metaphysical stance that is consistent with, and *supported by*, the scientific evidence.

Is Gould closer to the van Fraassen conception or the Dupre conception? Gould does not elaborate much on the nature of the metaphysical positions he alludes to, but what he says is compatible with, and suggestive of, the interpretation of them as pragmatic stances in van Fraassen's sense. Firstly, we have seen that he denies that they are 'high-order empirical observation[s], induced from the objective study of nature'. This clearly puts him at odds with the naturalist position; whether it puts him at odds with the Dupre position is less certain.

¹⁹ This is not to deny that there may be some pragmatic incoherence involved in certain combinations of beliefs and metaphysical stances here. van Fraassen (2004b, 173, 176) notes that there can be pragmatic incoherence involved in adopting a stance while denying certain characteristic beliefs naturally or typically associated with it.

It is plausible that there may be at least some pragmatic incoherence involved in, for instance, accepting metaphysical punctuationism while at the same time accepting empirical gradualism, or accepting metaphysical gradualism while accepting punctuated equilibrium.

²⁰ There may of course be *pragmatic* inferences in this direction. If metaphysical punctuationism inspired the development of punctuated equilibrium, and the latter is true, this may give us a reason to endorse metaphysical punctuationism as useful, but it doesn't give us a reason to believe it is true.

Secondly however, Gould is keen to stress the *values-driven* character of the metaphysical positions²¹, and their *nonrational* dimension (where ‘rational’ is to be understood as ‘epistemically rational’). Thus he indicates that the basis of metaphysical gradualism, at least in Darwin’s day, was his society’s deep ideological commitment to gradual progress and improvement, in the natural, and especially the social, realm. Thus metaphysical gradualism is ‘embedded in the modern history of Western cultures’, and the influence on Darwin’s science of this metaphysical position shows that ‘even the greatest scientific achievements are rooted in their cultural contexts...’ (*ibid*, 1017). He also stresses the ‘cultural embeddedness of preferences for punctuational change’ (*ibid*). (The term ‘preference’ itself suggests a nonrational psychological inclination.) Of course proponents of the naturalist view (or the Dupre view) can accept that metaphysical positions and worldviews possess this nonrational, ideological, socially and culturally embedded dimension. But they will tend to de-emphasise this aspect of the positions, and emphasise instead their epistemically rational, empirically justifiable character. Gould on the other hand wishes to place primary emphasis on the nonrational, ideological and value-driven aspect. In this he is in agreement with van Fraassen.²²

Thirdly, Gould defends *pluralism* about metaphysical positions, at least with respect to their influence on biology (Gould and Eldredge 1977, quoted in Gould 2002, 1018; Gould 1980, 185). We should, he argues, draw on more than one general philosophy of change in trying to understand the natural world; only having gradualism to draw on in the past has been limiting. He doesn’t argue for the correctness of punctuationalism (‘We emphatically do not assert the ‘truth’ of this alternative metaphysic of punctuational change’ (Gould and Eldredge 1977, *ibid*)); he just thinks it should be added to gradualism to enrich the philosophical influences on empirical biology.²³ So he admits gradualist hypotheses are sometimes true, and that gradualism as a philosophy has often been useful and encouraged good work. Pluralism is, *prima facie*, inconsistent with the interpretation of the metaphysical positions as factual beliefs that may be supported by empirical evidence from science. Dupre, for instance, is not a pluralist in this sense (although he is in other senses). He regards the positions he is arguing against, such as essentialism, reductionism, and determinism, as *wrong*, and the opposing positions as *right*. Gould on the other hand is not interested in questions of ‘right’ and ‘wrong’, ‘true’ and ‘false’; his focus is on the *usefulness* the different positions may have for empirical work.²⁴

This pluralist/pragmatist orientation is reminiscent of pluralism about the units of selection, as defended by Dawkins (1982) among others. According to Dawkins’ pluralism,

²¹ The focus here is on social, political and ideological values, but clearly the positions fit with certain epistemic values as well. Metaphysical punctuationalism will appeal to those who value non-gradualist forms of explanation, for instance.

²² Whether Gould holds that metaphysical positions have an epistemically rational dimension is not clear.

²³ This is reminiscent of Feyerabend’s plea for pluralism with respect to metaphysical influences on science. See van Fraassen (1996).

²⁴ So we do not, for the most part, find him arguing that the truth of punctuated equilibrium gives us a reason to think that metaphysical punctuationalism is true and metaphysical gradualism is false (although see interview quote above). But he would presumably endorse the pragmatic inference that the truth of punctuated equilibrium gives us a reason to accept metaphysical punctuationalism as useful. I leave aside for now the plausibility of the further, abductive, inference that the best explanation of the usefulness of metaphysical punctuationalism is that it’s true.

the gene's eye view and the orthodox individual-level view are equally correct perspectives on the same reality, but the gene's eye view is pragmatically or heuristically superior:

‘What I am advocating is not a ... hypothesis which ... can be judged by its predictions. What I am advocating is a point of view, a way of looking at familiar facts and ideas, and a way of asking new questions about them’ (*ibid.*). This viewpoint ‘has made me see animals and their behaviour differently, and I think I understand them better for it. [The stance] does not constitute a testable hypothesis in itself, but it so far changes the way we see animals and plants that it may cause us to think of testable hypotheses that we would otherwise never have dreamed of’ (*ibid.*, 1–2). ‘[I]t is not a factual position I am advocating, but a way of seeing facts...’ (*ibid.*, vi).²⁵ He accepts that for others, the orthodox view may be pragmatically preferable.²⁶

The analogy with Dawkins' view can help to dissolve the apparent conflict involved in Gould, on the one hand, defending the punctuationalist stance as superior to others, while on the other endorsing pluralism about metaphysical positions. According to Dawkins, there is no fact of the matter about whether the gene's eye view or the individual-level perspective is true, yet he favours the former for pragmatic (non-factual) reasons. It is the pragmatic (nonempirical) character of these reasons that licenses a pluralistic and tolerant attitude towards the individualist perspective. If biologists find the latter pragmatically or heuristically preferable, he argues, they should feel free to adopt it. Similarly, so long as Gould's preference for metaphysical punctuationalism is understood in pragmatic terms, there will be nothing inconsistent in his adopting a pluralistic and tolerant attitude towards other positions (such as metaphysical gradualism). And, like Dawkins, Gould argues for a minimal claim and a stronger claim. The minimal claim is that punctuationalism should be included with gradualism among the philosophical positions biologists may draw on. This is the pluralist claim. The stronger claim is that, in the context of this pluralism, punctuationalism will be found to be generally superior to gradualism, not in the sense of more objectively correct, but in the sense of more useful, fruitful and so on. It is the minimal, pluralist claim that he is keen to establish; the stronger claim is, he accepts, more uncertain and conjectural (Gould and Eldredge 1977, quoted in Gould 2002, 1018). Dawkins, in the same vein, notes that his ‘*minimum*’ claim, of which he is ‘pretty confident’, is that the gene's eye view is ‘at least as satisfactory’ as the orthodox individualist view, while his ‘wildest daydream’ is that the gene's eye view will prove more illuminating than the orthodox view throughout ‘whole areas of biology’ (Dawkins 1982, 7). This is not to deny, of course, that Gould and Dawkins' attachment to their respective perspectives involves, at least in certain contexts, deep and abiding *commitment*, such as van Fraassen suggests is essentially involved in the adoption of a stance. No-one could be more ideologically committed to a particular way of seeing the world than Dawkins is to his, or Gould to his. It is the apparently paradoxical combination of this undoubted commitment and strong partisanship, with the more tolerant, pluralistic attitudes expressed in the passages quoted above, that the construal of these worldviews in terms of pragmatically justified van Fraassian stances or perspectives is intended to account for. Gould and Dawkins would, I am suggesting, accept that rival perspectives to their own, which they strongly reject given their values, preferences, inclinations, other

²⁵ Boucher (2014) argues that the gene's eye view, construed in this nonfactual perspective-like way, is a paradigm example of a philosophical stance in van Fraassen's sense.

²⁶ ‘[T]he biologist should try both ways of thinking, and choose the one he or she prefers’ (*ibid.*, 7).

commitments etc., may nonetheless be valuable for other theorists in other contexts who have different values, preferences, inclinations, and commitments.

Finally, in a passage from a 1982 paper (quoted in Gould 2002, 1012), Gould makes three points that are very much in keeping with van Fraassen's stance approach. Firstly, he suggests that punctuationalism is a 'style of thinking', characterised by a focus 'upon the stability of structure, the difficulty of its transformation, and the idea of change between stable states' (see also quote from television interview above). In other words, it is not a particular factual belief about how the world is; it is rather an orientation, or perspective: a tendency or inclination to focus on and emphasise certain aspects of reality. It is a style of thinking, not a particular thought.²⁷

It is likely that Gould opts for this stance-like characterisation of punctuationalism because he does not want proponents to be saddled with strong and unjustified factual beliefs about nature. One may, for instance, seemingly adopt the punctuationalist stance in Gould's sense without believing that, say, all (or even most) natural and social systems are in fact characterised by the punctuational mode of change.

Secondly, he notes that this style of thinking has several manifestations within biology. But these manifestations are independent of one another. 'Any manifestation may be true or false, or of high or low relative frequency, without affecting the prospects of any other.' (The different manifestations of metaphysical gradualism, such as Darwin's theory in biology and Lyell's in geology, are also independent of one another.) The particular manifestations neither entail nor inductively support one another; yet they are united by their shared connection with the overarching metaphysical stance/orientation. Without the concept of a stance/orientation, it is difficult to do justice to the intuition that theories and hypotheses that neither entail nor support one another may nevertheless possess something important in common. On the stance approach, this intuition can be justified. Thirdly, Gould suggests that the punctuationalist style of thought is valuable as 'a fruitful source for hypotheses.' This is in line with van Fraassen's conception of how metaphysical positions may be (pragmatically) justified.

Thus, if Gould is right, van Fraassen's theses on the relation of metaphysics to science appear to be satisfied with respect to punctuationalism and gradualism.

4 Dialectics

4.1 Dialectics and Dialectical Biology

'Dialectics of nature' is the attempt to apply the Marxist doctrine of dialectical materialism, with its emphasis on totality, change, conflict and contradiction, to the natural world. Dialectical materialism has been seen as a paradigm example of the kind of a prioristic metaphysical speculation that empiricists have traditionally shunned.²⁸ But I will argue that, as with metaphysical punctuationalism and gradualism, if

²⁷ Compare Rowbottom and Bueno (2011) on stances as 'styles of reasoning'.

²⁸ Melnyk (2013, 80) suggests, in response to Shaffer's metaphysical thesis that the whole is prior to the parts, that there is no scientific reason to suppose there is such a thing as 'priority' in this sense. Shaffer is defending monism, not dialectics, but dialectics is similarly committed to the priority of the whole in relation to the parts. Thus this supports the idea that dialectics is lacking in empirical, scientific content.

interpreted as a van Fraassian stance, it can in fact be considered potentially legitimate, even by empiricist lights.

Levins and Lewontin (1985) defend a dialectical approach to biology, based on the idea of a dialectic of nature.²⁹ Dialectics is, they argue, opposed to ‘Cartesian reductionism’, which has dominated western thought for centuries. On this view the parts of a system are ‘ontologically prior to the whole; that is, the parts exist in isolation and come together to make wholes’ (*ibid*, 269). The world of Cartesian reductionism is ‘the *alienated* world, the world in which parts are separated from wholes ... causes separated from effects, subjects separated from objects’ (*ibid*, 270). They oppose to this their dialectical outlook, which involves the following ideas:³⁰:

- A whole is composed of heterogeneous parts that do not exist independently of the whole (*ibid*, 273).
- The parts have the properties they do in virtue of being parts of the whole (*ibid*).
- Subjects and objects, and causes and effects, are ‘interchangeable’. Nothing is purely passive object or purely active subject; one and the same entity (such as the organism in evolution) is frequently both subject and object, mover and moved (*ibid*, 274).
- Change is a pervasive feature of every aspect of reality (*ibid*, 275). The world described by dialectics ‘is constantly in motion...’ (*ibid*, 279).
- Change results from contradiction (ontological, not just epistemic), which has a number of aspects: ‘self-negation’, which is similar to logical contradiction (*ibid*, 282); the ‘interpenetration of seemingly mutually exclusive categories’ (such as ‘deterministic’ and ‘random’), which refers to the tendency for opposing properties to involve and give rise to one another (*ibid*, 283-4); and ‘the coexistence of opposing principles’, which refers to the tendency for conflicting standards (such as ‘use value’ and ‘exchange value’) to produce different effects when combined from those they would produce when taken separately (*ibid*, 285).

4.2 Dialectics as Stance

Lewontin and Levins are less likely than Gould to agree with stance interpretation of their metaphysical commitments. Indeed they seem to hold that dialectics is both a method and a worldview (i.e. factual belief).³¹ But as I noted above, the stance view is consistent with and suggested by a number of remarks they make about dialectics.

For example, Levins and Lewontin talk of the value of dialectical ‘habits of thought’, ‘forms of questioning’ and ‘ways of thinking’ (1985, 267), just as Gould talks of metaphysical punctuatedism as a ‘style of thinking’. These are, of course, quite

²⁹ See Godfrey-Smith (2001), for one of the few discussions of dialectics in mainstream analytic philosophy of biology.

³⁰ The following have the appearance of being factual beliefs about what the world is like. But we will see that on the stance interpretation, they should rather be understood as expressing a certain mode or style of thinking – what Levins and Lewontin call ‘habits of thought’ and ‘forms of questioning’.

³¹ They argue (*ibid*, 2) explicitly that Cartesian reductionism is both a worldview (factual claim) and a method, and that endorsement of the method is not the same thing as endorsement of the worldview. One assumes they hold the same view about dialectics.

different from factual beliefs with propositional content. Levins and Lewontin (*ibid*, 277) point out that the dialectician need not hold that change characterises all systems at all times. But, unlike the reductionist, she *expects* change to characterise the systems under study. And it seems clear that an *expectation*, being non-propositional, cannot stand in an inductive or deductive relation to particular scientific hypotheses or beliefs. This notion of dialectics as *perspective*, and *expectation*, rather than as factual belief, chimes with the stance view.

Furthermore, it is arguable that accepting dialectics of nature, like metaphysical punctuationalism, is neither necessary nor sufficient for accepting the scientific claims and theories with which it is associated. In particular, I suggest that the empirical science inspired by dialectics, is not *itself* dialectical; in van Fraassen's terms, it 'forgets' its dialectical origins, and all that matters as far as its scientific acceptability goes is its *empirical* adequacy.³² In other words the influence of dialectics on empirical biology takes place in the context of discovery, not the context of justification. If that is correct, the relationship between dialectical materialism and the science done under its influence mirrors the relationship between metaphysical punctuationalism and PE (as Gould understands the latter).

A couple of examples should help to make the point. Firstly, as Maynard-Smith notes (1993), the content of much of Lewontin's own scientific work would be hard to describe as 'dialectical' in any meaningful sense. His dialectical stance may have motivated and influenced his science, but it seems that the science ultimately leaves the stance behind, and is not at all infected with it (*ibid*, 33). Lewontin's key contributions to theoretical biology have probably been in the field of population genetics. This work has been thoroughly incorporated into mainstream (non-dialectical) biology.

Secondly, some of the best candidates for scientific theories or models that are related to dialectics in the way suggested by the naturalist conception of metaphysics and science, can be seen, on closer inspection, to fit rather with the stance analysis. Royle (2014) and Sullivan (2015) have argued recently, for instance, that the theory of niche construction³³, is an example of genuinely *dialectical biology*. Lewontin (Levins and Lewontin *ibid*), and more recently, in much greater detail, Odling-Smee et al. (2003), argue that organisms *construct* their environment, rather than merely becoming adapted to independently existing environments.³⁴ Thus niches do not, as orthodox Darwinism would have it, exist independently of organisms, but rather are created (and indeed defined) by, the species that inhabit them. In rejecting the idea of the organism as the passive object of external evolutionary forces, Royle, Sullivan and Lewontin affirm what they regard as a dialectical relationship holding between the organism and its environment. Thus on this view, the organism becomes, in Lewontin's famous

³² Kitcher (2001, 408, 413) has argued that dialectics fails to offer anything concrete that scientists can use in their day-to-day work. See also Daly, who suggests that Lewontin (and his ally Gould) have failed to effect the paradigm-shift in biology they have desired because they have 'no alternative research program to offer.' This is why '[s]ufficient research to fill a first issue of *Dialectical Biology* has yet to materialise' (Daly, quoted in Dennett 1995, 249). On the stance view I am considering, Kitcher and Daly are right to be sceptical about the prospects for dialectical *science*, but wrong to thereby dismiss dialectics altogether. They do not recognise that it may play a valuable role as a metaphysical stance in the context of discovery.

³³ Sullivan also suggests that the relationship of predator and prey exemplifies dialectics.

³⁴ For discussion see Sterelny (2001, 2005), Okasha (2005), and Griffiths (2005).

phrase, the ‘subject and object’ of evolution (exemplifying point three in the above general characterization I offered of dialectical principles).

If Royle and Sullivan are right, this is a case of scientific theories that are themselves dialectical, in that they embody the principles of dialectics of nature, and indicate that, insofar as the theories are correct, dialectical materialism is *true of the world* (or certain parts of it): ‘...the reciprocal influence of organism and environment seems to be an example of the pattern of causation that dialectical biology contends is present in biology.’ (Sullivan *ibid*³⁵). This clearly fits with the naturalist view of metaphysical positions as being factual beliefs about the world that may be true or false; as underlying or grounding scientific theories in the context of justification; and as standing in inferential relations to those scientific theories and beliefs.

The problem is that these theories (niche construction and so forth) are part of mainstream (or, at least, non-dialectical) evolutionary biology and philosophy of biology. Kim Sterelny, for instance, makes major use of the notion of niche construction in his book on the evolution of human cognition (2003). Yet he would certainly not see himself as thereby accepting dialectics. Odling-Smee *et al* also do not apparently regard their defence of niche construction as amounting to an embrace of dialectics.

Now one could of course argue that the idea of niche construction is a dialectical idea whether or not it is understood as such by its proponents. But the apparent ease with which the idea can be endorsed by non-dialecticians strongly suggests that it is not intrinsically dialectical³⁶. I would suggest that rather the following analysis is more plausible: *If one has a dialectical outlook – adopts the dialectical perspective – one may be more likely to produce certain sorts of science, i.e. to access certain facts (about, say, niche construction). To that extent dialectics may be a useful heuristic with epistemic benefits.* It makes it more likely that one will hit on certain truths about nature. But those truths, on this view, are independent of any metaphysical perspective, so *perfectly acceptable to people who don't accept the metaphysics of dialectics*. More precisely, there are no inferential relations, either deductive or inductive, connecting dialectics as a metaphysical view with the scientific claims (such as niche construction) with which they have been associated. Such, at least, is the position of the stance theorist.³⁷

Consider again, as an analogy, selfish gene theory. Defenders of the selfish gene perspective argue that it forces on one's notice certain problems that are hard to see from other perspectives, e.g. ‘the problem of the organism’ (Dawkins 1982; Sterelny and Griffiths 1999, 75). Why should organisms exist at all, from the perspective of

³⁵ Sullivan's suggestion (*ibid*) that dialectics is a ‘heuristic’ that can assist scientists in the process of scientific discovery is quite congenial to the stance position; however he also clearly regards it as a factual belief that correctly describes the biological world (or certain aspects of it), and is borne out by empirical investigation.

³⁶ Similarly, we saw that, according to Gould, PE may be accepted by those who do not endorse metaphysical punctuatedism.

³⁷ I have been focusing on niche construction theory, but similar things could be said regarding the broader research program of which it is a part, which has been termed the Extended Evolution Synthesis (ESS) (Laland *et al.* 2015; Pigliucci 2007). The ideas within the ESS are clearly in the spirit of, and belong to the same tradition as, Lewontin and Levins' dialectical approach. But again, the existence and importance of the facts, processes and phenomena that adherents of the ESS focus on – niche construction, developmental constraints, developmental plasticity, extended inheritance, evolvability, etc. – can be recognised and appreciated independently of dialectical metaphysics, and one need not adhere to dialectics in order to adhere to the ESS. This doesn't however change the fact that having a dialectical attitude or perspective may make one particularly open or receptive to the ideas of the ESS, and to the extent that the latter are borne out within evolutionary biology, they can help to vindicate the pragmatic utility of the dialectical metaphysical perspective/stance.

replicators? Why did replicators build organisms? This question can be asked by non-selfish-geners, but it is not as obvious or ‘in your face’ from perspectives that treat the existence of the organism as a given (Sterelny et al. 1996, 395). This supports the conception I have outlined of metaphysical perspectives as justified in terms of their ability to draw attention to and highlight certain features of the empirical world that are accessible, but harder to see, from other viewpoints. The empirical facts are, then, independent of and separable from the metaphysics, but the metaphysics can make certain empirical facts easier to locate.³⁸ (See Boucher 2014.) Similarly, as I suggested, metaphysical punctuationism may make it easier to hit on the truth of punctuated equilibrium, and dialectics may make it easier to hit on the truth of niche construction and so on. Levins and Lewontin recognise this point when they suggest that a commitment to a metaphysical perspective ‘strongly predisposes us to see some things in the world and not others’ (*ibid*, 268). The facts are there for all to see; but some metaphysical perspectives make it easier to pick out certain classes of facts, while others have the effect of obscuring them.

Those, such as Royle and Sullivan, who appeal to phenomena such as niche construction as evidence that dialectics as a factual belief is true of the world must explain the fact that such phenomena are clearly exceptions rather than the rule. It would appear that at most a small number of phenomena in nature exemplify dialectical processes and relations.³⁹

Firstly, it’s not at all clear how the world can be slightly dialectical. Metaphysical claims are generally meant to apply to reality as a whole, not just small bits of it, and this is certainly true of dialectics of nature. Surely either all of nature is dialectical or none of it is. Secondly, in what sense is dialectics as a metaphysical view ‘true’ if hardly anything in nature is dialectical? If Royle or Sullivan was to apply the naturalist view, or the Dupre view, of the relation between science and metaphysics, according to which metaphysical beliefs may be empirically supported by appeal to evidence, and the truth of scientific theories, to the justification of dialectics, they would be attempting to infer from a very small number of biological phenomena to the truth of dialectical materialism. Such an inference would be very weak. Dialectics surely could not be epistemically justified on such grounds. If on the other hand we adopt the stance view, according to which dialectics may be pragmatically justified on the grounds that it makes it easier to notice, and leads us to expect to find, phenomena in nature that appear to instantiate the kind of relations dialectics describes, dialectics is eminently justifiable. Thus this approach ought to *appeal to* defenders of dialectics. In general, it is a major virtue of the stance approach – at least for those with empiricist sympathies – that it enables us to see how metaphysical perspectives may be justified. The prospects for direct epistemic verification (or falsification) of general metaphysical perspectives such as dialectical materialism, or metaphysical punctuationism, appear dim. But if the

³⁸ Similarly Sober and Wilson argue that the multilevel selection theory they favour enables us to ‘see the whole [evolutionary] stage’ rather than being narrowly focused on a small part of it (1998, 332). It is, they argue, a powerful ‘way of seeing’ with which to view and make sense of facts that are nonetheless accessible (in perhaps less vivid and more obscure and confusing form) from other standpoints. So it is distinctive and valuable not only in virtue of its uncovering of new facts, but also in virtue of the orientation it provides on facts that can be represented from alternative points of view.

³⁹ ‘Whilst some of the world is constituted by dialectical relations, some of it is not. In fact, I would say that the vast majority of the world is not...’ (Sullivan personal communication)

stance view is right, they may be indirectly pragmatically justified in terms of their effects on empirical inquiry. That is the best we can do, but it may be enough.

As we've seen, the justification of the dialectics-of-nature perspective by way of a consideration of its epistemic fruits is something Levins and Lewontin lay stress on (see Maynard-Smith 1993). Adopting a dialectical attitude to understanding the natural world, they suggest, brings to light certain (otherwise hidden) features of natural phenomena, suggests new and fruitful avenues of research, makes manifest new problems in need of solution, allows one to avoid certain characteristic errors typical of the reductionist attitude, and so on. It thus has significant epistemic benefits (in just the way that, for Gould, as we've seen, metaphysical punctuatedism does).

Hence the dialectical approach may be justified in terms of its epistemic fruits. Can it also be justified in terms of its coherence with a set of values? The approach arguably coheres with certain holist, non-reductionist epistemic values, and undoubtedly it was partly Levins and Lewontin's possession of such values that made dialectics attractive for them. What about nonepistemic values? Lewontin and Levins are happy to allow that nonepistemic factors, such as social and political ideologies, may be highly relevant to the choice of a metaphysical stance or perspective. Reductionism, they argue, is a product of modern western culture and industrial society, and has its rationale in the way it reflects the ideological world-picture of the bourgeoisie under capitalism. If, as I argued, Gould's emphasising of the social and ideological basis of metaphysical gradualism brings him close to the stance view, Levins' and Lewontin's emphasising of the social and ideological basis of reductionism seems to bring them close to the stance view as well. It is notable that they do not claim that reductionism's relationship to a social/political ideology, and the fact that it reflects the worldview of a certain type of society or ruling class is something peculiarly wrong with reductionism. This is the case, they argue, with metaphysical worldviews generally - dialectics itself reflects a revolutionary anti-capitalist ideology, for instance (*ibid*, 286-7). (This is similar to the way Gould accepts that not just gradualism, but punctuatedism as well, has connections to values and political ideologies.) So all metaphysical worldviews are closely related to social and ethical values, and political ideologies, for Lewontin and Levins.

We have seen that an implication of the stance view is *pluralism* with respect to rival metaphysical stances, and that Gould defends pluralism with respect to metaphysical gradualism and punctuatedism, arguing that metaphysical gradualism is not *false*, and has been useful in influencing and inspiring good science. Similarly Levins and Lewontin accept that Cartesian reductionism has also been extremely useful, as the metaphysical inspiration for major scientific theories and discoveries that count as successful on any measure. '...Cartesian reduction as a method has had enormous success in physics, in chemistry, and in biology, especially molecular biology...' (*ibid*). Levins and Lewontin (unlike Gould), are not however pluralists in any more than the weak sense of conceding the usefulness of different metaphysical perspectives: they do in fact regard Cartesian reductionism, however fruitful it has been as a metaphysic and as a method, to be, or involve, a factual belief about what the world is like, and is moreover a *false* factual belief. But the stance theorist, as we have seen, defends the stronger pluralist position that there is no question of truth or falsity with respect to such perspectives. On the stance view, asking whether the world is dialectical is asking the wrong question: since dialectics is not a factual claim, the question of whether it is true

of the world simply doesn't arise. Adopting a dialectical perspective may help one to notice and understand certain features of reality (e.g. niche-construction), but that's all there is to it. Dialectics may be a useful heuristic, in emphasizing otherwise neglected features of reality, making certain facts and phenomena easier to see, and so on, but we shouldn't ask whether the stance is 'true', or whether the world 'really is' dialectical.

5 Conclusion

I have discussed two examples of metaphysical perspectives that plausibly have been related to scientific theorising in precisely the way suggested by van Fraassen's stance conception, which I outlined in section 1. They provide a model for a role for metaphysics in science that may be acceptable to empiricists, in being compatible with empiricism's traditional hostility towards metaphysics, and its dismissal of the idea that the sciences incorporate metaphysics. On this model, the influence of metaphysics on science is acknowledged to be heuristically important, even indispensable, but as the metaphysical assumptions and commitments in question are interpreted as stances rather than factual beliefs, as their influence on empirical inquiry takes place in the context of discovery rather than the context of justification, and as the existence of inferential relations, both deductive and inductive, connecting them to particular scientific hypotheses is ruled out (their justification being understood in pragmatic and values-based terms), the traditional empiricist doctrine that the content of science is, and should be, largely or entirely innocent of metaphysics, can be, in the main, retained.

As a general picture of the relation between science and metaphysics, this conception would be questioned by many; as we've seen, it conflicts with the dominant view in the philosophy of science about the role of metaphysics in science.⁴⁰ Hence the importance of my illustrative examples. They show, I suggest, that this picture cannot be immediately dismissed as clearly wrong-headed, or as manifestly not fitting the facts. It is at least plausible that metaphysical punctuatedism, metaphysical gradualism, and dialectics, have stood in precisely the relation to empirical science, and played precisely the sort of role, that the model describes.

Though I have focused on these two examples, the model in question arguably applies to a number of other cases of metaphysical influences on science. Boucher (2014) shows, for example, that the gene's eye view, understood as a broad metaphysical perspective, is fruitfully construed as a stance in van Fraassen's sense, while his (2015) make the case for understanding the influence on biology of the broad metaphysical perspectives known as functionalism and structuralism in much the same way. Elsewhere (Boucher 2012) he has suggested that the way that Einstein conceived of the influence of metaphysical realism on his science (at least as interpreted by Fine (1986)) also conforms closely to the model; while we have seen that van Fraassen (1995) interprets the relationship between materialism and empirical science in the same way.

⁴⁰ Chakravartty notes that empiricist interpretations of metaphysics and its relation to science are often dismissed as 'rather severe and ideologically driven rational reconstructions' (2010, 66). He wasn't talking specifically about the conception I'm discussing here, but the latter would no doubt be subject to just this sort of criticism.

My analysis in this paper, along with these complementary analyses, does not establish definitively that the van Fraassen stance model is the correct way to construe the nature of metaphysical positions, and their influence on science. A good deal more work is clearly required to establish this. But it does indicate, I think, that the model is promising and worth taking seriously, as an alternative to the currently dominant paradigm with respect to science and its metaphysical presuppositions. At the very least, the model shows, as I noted above, that despite appearances the empiricist does have available a strategy for reconciling empiricist commitments with a recognition of the role of metaphysics in science.

Acknowledgements Thank you to Terry Sullivan, Greg Restall and Adrian Walsh for helpful comments and criticism.

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