

LAWS OF NATURE: NECESSARY AND CONTINGENT

BY SAMUEL KIMPTON-NYE

This paper shows how a niche account of the metaphysics of laws of nature and physical properties—the Powers-BSA—can underpin both a sense in which the laws are metaphysically necessary and a sense in which it is true that the laws could have been different. The ability to reconcile entrenched disagreement should count in favour of a philosophical theory, so this paper constitutes a novel argument for the Powers-BSA by showing how it can reconcile disagreement about the laws' modal status. This paper also constitutes a defence of modal necessitarianism, the interesting and controversial view according to which all worlds are nomologically identical, because it shows how the modal necessitarian can appease the orthodox contingentist about laws.

Keywords: contingency, laws of nature, modality, necessity, pragmatism, real patterns.

I. INTRODUCTION AND BACKGROUND

Some philosophers think that laws of nature are contingent, others think that laws are metaphysically necessary. The contingentist line probably deserves the status of orthodoxy because, traditionally, empirical propositions, such as those expressing laws, have been thought to be contingently true or false. But at least since the arguments of Putnam (1975) and Kripke (1980), this orthodoxy has come under serious scrutiny and a great many philosophers now subscribe to the idea that the laws are metaphysically necessary.

As popular as necessitarianism about laws has become, many find it difficult to shake the idea that the laws must be contingent because it is so easy to imagine worlds in which they are different. One might then think that the necessitarians at least owe the contingentists some story about how their intuitions have led them astray or, better still, some way of capturing a sense in which the laws really are contingent.

As it happens, one type of necessitarianism about laws that has proved particularly popular in recent years, *dispositional essentialism* (see e.g. Shoemaker 1980; Ellis 2001; Chakravartty 2003a,b; Bird 2007), can appease the

contingentist to a large extent. According to dispositional essentialism, laws of nature hold in virtue of the essences of properties and this is the source of their necessity. Coulomb's law, for example, holds in virtue of the essence of *charge*, from which it follows that it is necessary that instances of *charge* are governed by Coulomb's law. The contingentist may object that they can imagine charges being governed by an inverse *cube* law (Coulomb's law is inverse square), or behaving in no systematic way at all, from which they will infer that Coulomb's law is contingent. The dispositional essentialist can respond that the contingentist has simply misdescribed the possibility in question. Granted, there are possible worlds in which instances of *some* property interact in accordance with an inverse cube law, but they are not instances of *charge* and they are not governed by Coulomb's law. The imagined possibility is one in which some other property, call it *schmarge*, is governed by some other law, call it *Schmoulomb's law* (see e.g. Shoemaker (1980), Sidelle (2002) and Fine (2002) for discussion of this strategy).¹

The above move mirrors a Kripkean response to the contingentist who claims, for example, that water is not necessarily H₂O because they can imagine water being some other substance, XYZ, say. According to the Kripkean line, what is imagined in this situation is not the impossibility that water is XYZ but the genuine possibility that some other substance with all of the sensible qualities of water, call it *schwater*, is XYZ (see e.g. Kripke 1980: 128–9). In both cases, it is conceded that the contingentist imagines *some* real possibility, so the conceivability–possibility link is retained, but that they are wrong about the proper description of the possibility in question.

Those of a more necessitarian persuasion might be concerned that dispositional essentialism, as articulated above, concedes too much to the contingentist, or, indeed, that dispositional essentialism is not really about the modal status of laws at all but is instead about the metaphysical individuation of properties (Wilson 2013: 654). One might then be motivated to defend a stronger type of necessitarianism about laws. According to *modal necessitarianism*, all possible worlds are *identical* with respect to the laws that prevail. In other words, physical and metaphysical modalities collapse. Proponents of this view argue that it demystifies metaphysical modality and yields certain explanatory and epistemological benefits (see, in particular, Edgington (2004) and Wilson (2013); Ladyman *et al* (2007) and Maudlin (2007) may also be read as expressing scepticism about the idea that there exists a variety of modality, metaphysical modality, that is different from physical modality, and thus as collapsing this distinction). However, if all worlds are identical with respect to the laws of nature, it seems that contingentist intuitions cannot be placated via the kind of

¹ Tahko (2015) proposes a view in the dispositional essentialist spirit but according to which some of the laws that prevail in the actual world are metaphysically necessary while others are contingent. This concedes even more to the contingentist.

re-description strategy outlined above. The modal necessitarian will typically deny that there are any worlds with different laws or properties to those found at the actual world. There is then nothing to which the above re-description strategy may be applied because it cannot even be claimed that the contingentist's '*conceivings*' describe a world with alien properties and laws because according to modal necessitarianism there are no such worlds.²

In this paper, I provide a way of reconciling modal necessitarianism and contingentism about laws. To this end, I argue that a niche view about the metaphysics of laws and properties, the *Powers-BSA* (Demarest 2017; Kimpton-Nye 2017; Williams 2019), with a pragmatic twist, is able to both underpin modal necessitarianism *and* yield a sense in which it is true that the laws could have been different. The details of this conciliatory move then open up the possibility of a novel re-description strategy which allows the modal necessitarian to at least partially uphold the conceivability–possibility link. This paper thus constitutes a novel argument in favour of the Powers-BSA because it shows how the Powers-BSA can reconcile entrenched disagreement about the modal status of laws of nature; it also constitutes a defence of modal necessitarianism because it shows how the modal necessitarian can appease the steadfast contingentist.

Perhaps some will deny that reconciliation of contingentism and necessitarianism is worth achieving, or will suspect that the reconciliation may be achieved independently of the Powers-BSA. Unfortunately, it would be beyond my scope to defend the premise that reconciling contingentism and necessitarianism is worthwhile and it would be beyond my scope to survey all possible alternative reconciliatory strategies. So, while I think that the more modest claim of this paper—the defence of modal necessitarianism according to which it is *possible* for the latter to appease contingentism—is on relatively firm ground, the further novel argument for the Powers-BSA is more defeasible. Nevertheless, I think this novel line of argument for the Powers-BSA is worth pursuing because it shows how to motivate the Powers-BSA in a completely different way from how it was originally motivated (e.g. by Demarest 2017); thus, the argument has the potential to give the Powers-BSA broader appeal. Furthermore, the argument shows what can be achieved if the Powers-BSA is modified with a pragmatic twist à la the recent trend towards *pragmatic Humeanism* (Hall 2015; Dorst 2017; Hicks 2017; Jaag and Loew 2018). Incorporation of a pragmatic element into the Powers-BSA is not something that the

² See Bird (2007: ch. 8) for discussion of applying a modified Kripkean strategy to account for the *illusion* that laws are contingent, even in the absence of any worlds with alien properties and laws. My aim in this paper is different from Bird's; I'm not interested in explaining why some truths appear contingent when they are in fact necessary. Rather, I am interested in articulating a sense in which it is *true* that laws are contingent and in developing a strategy for upholding the conceivability possibility link while simultaneously maintaining, with the modal necessitarians, a strong sense in which the laws are metaphysically necessary and hence a sense in which the distinction between physical and metaphysical modality collapses.

originators of the view considered; Demarest, for example, sticks as closely as possible to the Lewisian BSA in articulating her view and it is the Lewisian BSA that the pragmatic Humeans criticise for understanding strength and simplicity from a ‘God’s eye view’, and hence as being insufficiently pragmatic to be continuous with science.³

The rest of this paper will proceed as follows. In the next section, I will outline the metaphysics of properties and laws constitutive of the Powers-BSA. It will help my argument to leverage the fact that Powers-BSA laws may be identified with *Real Patterns*, in Dennett’s (1991) sense, so I will discuss the details of, and motivation for, this move in Section III. In Section IV, I’ll show how all of the pieces come together to affect the reconciliation of contingentism and necessitarianism about laws. In Section V, I’ll present some objections and replies before concluding in Section VI.

II. THE POWERS-BSA

The Powers-BSA results from combining an unHumean account of fundamental physical properties with a Humean account of the laws of nature. The idea is discussed in detail by Demarest (2017) and by Kimpton-Nye (2017). In this section, I will provide an overview of the most salient features of the Powers-BSA.

First, let’s consider the unHumean account of fundamental physical properties (just *properties*, from now on) and, for illustrative purposes, how it contrasts with the *Humean* view of properties. According to the unHumean account of properties, properties are *powers*—they are necessarily connected with the dispositions that they confer upon their bearers. Powers thus induce necessary connections between their individual instances. An instance of positive charge is necessarily disposed to exert a repulsive force on other instances of positive charge, conditional upon its continuing to instantiate positive charge. This stands in contrast with the Humean view according to which properties are *quiddities*—quiddities neither stand in nor induce any necessary connections. Quiddities are just essentially self-identical and distinct from other quiddities and there are no restrictions on how quiddities can be recombined. It is possible, on the quidditist understanding of properties, that an instance of positive charge failed to be disposed to exert a repulsive force on other positive charges, or that it was disposed to exert an attractive force, or anything else one can imagine. One can understand the Humean motivation for quidditism as stemming from a commitment to abjure necessary connections. Those of an unHumean persuasion are less squeamish about necessary connections and find the powers metaphysic attractive because of the work that it is able to do in

³ Demarest has also explicitly argued against pragmatic Humeanism in a recent talk.

accounting for such phenomena as laws of nature (e.g. Ellis 2001; Chakravartty 2003a; Bird 2007) and modality (e.g. Borghini and Williams 2008; Jacobs 2010; Vetter 2015). Furthermore, it is not clear why we should think of the Humean view, according to which contingency reigns supreme and necessity is rare, as the default; once this Humean *bias* in favour of contingency is given up, the view according to which there are constraints on how properties are possibly recombined looks more plausible (cf. Heil 2015).

There is a further substantive question about the nature of powers: What are powers like which means that they stand in these necessary connections? I will not address this question here. For present purposes, it will suffice to note just that all parties agree that powers should at least be understood as necessarily connected with dispositions and, hence, as inducing necessary connections between their instances, from which it follows that there are restrictions on the possible recombination of powers; powers metaphysically constrain their own spatiotemporal distributions. Recombination of Humean quiddities, by contrast, is completely unconstrained.

The BSA (best system analysis) is an account of laws developed by Lewis (1973, 1983, 1994) in the context of his Humeanism. According to Lewis's *Humean Supervenience* everything, including the laws of nature, supervenes on the spatiotemporal arrangement of properties, either of, or instantiated at, point-sized regions of spacetime. And those properties, according to Lewis, are quiddities (see e.g. Lewis 2009). Laws supervene on the distribution of properties by *describing* that distribution. One way of describing the spatiotemporal distribution of properties would be to simply list the spatiotemporal location of each individual property instance. But such a description would be incredibly complicated and unwieldy and thus wouldn't yield anything close to the concept of laws of nature that is familiar to science; the scientist's laws help her to navigate the world, make predictions and design experiments, among many other things. A better option, then, would be to describe the distribution of properties by providing far fewer statements about it, but statements from which additional information about the distribution may be deduced. That is to say, the spatiotemporal distribution of property instances may be described via a deductive systematisation of the information. The strongest such systematisation will capture all the relevant information—there will be no truths about the distribution of property instances not capturable by the strongest systematisation. But this will likely require a great many basic statements—*axioms* of the system. A simpler system will contain far fewer axioms, but this will come at the cost of informative strength. These virtues, strength and simplicity, compete. According to Lewis's BSA, the laws of nature are the axioms of the system that strikes the optimal trade-off between strength and simplicity.⁴

⁴ The criterion of *fit* is omitted for brevity but see, e.g. Lewis (1994) for more on chance laws and fit, see also Kimpton-Nye (2017: sec. 5) for discussion of fit in the context of the Powers-BSA.

According to the Powers-BSA, properties are powers, in the minimal sense discussed above according to which they metaphysically constrain their spatiotemporal distribution. The laws then describe not just the actual distribution of properties, but *all possible* distributions of properties. More precisely, the laws are the axioms of the deductive systematisation of all possible property distributions that maximise the virtues of strength and simplicity. I further discuss this idea that laws systematise all possible distributions of properties in the next section.⁵

The powers metaphysic is largely motivated by a desire to explain other phenomena, including the laws of nature, in terms of fundamental physical properties. Powers, in virtue of inducing necessary connections between their instances and placing restrictions on their recombination, metaphysically determine how they are *possibly* distributed throughout spacetime. Since, according to the Powers-BSA, laws are features of a description of all possible distributions of powers, laws are metaphysically explained in terms of powers, in keeping with the motivation for positing powers in the first place. (Barker and Smart (2012), Barker (2013) and Jaag (2014) have argued forcefully that more orthodox accounts of the powers/laws relationship, e.g. Bird's (2007) dispositional essentialism, fail to satisfy this explanatory demand.)

Furthermore, the Powers-BSA, in virtue of the BSA-component, retains, or at least has the option to retain, a high degree of continuity with actual scientific practice (see Kimpton-Nye 2021: sec. 5). Plausibly, scientists are in the business of articulating generalisations about the world that are strong and simple and have other features that make them particularly useful for us given our practical and scientific interests. The version of the Powers-BSA that I favour follows the recent *pragmatic* Humeanism movement in that it takes the features that scientists aim for in their theorising, including features that make them useful *for us*, and makes them constitutive of what it is to be a law of nature (cf. Hall 2015; Dorst 2017; Hicks 2017; Jaag and Loew 2018). In the next section, I will show that Powers-BSA laws may be identified with Dennettian *real patterns*. This will help me to further spell out the pragmatic twist on the Powers-BSA that I advocate and will facilitate the reconciliation of contingentism and necessitarianism about laws.

III. POWERS-BSA LAWS AS REAL PATTERNS

It will help my argument to understand Powers-BSA laws as *real patterns* in Dennett's sense. In this section, I'll say a bit about what real patterns are

⁵ See also Wilson (2020: ch. 4) who defends a *modalized* regularity view of laws according to which laws are transworld regularities. The reconciliation of modal necessitarianism and contingentism about laws discussed in this paper may also work in the context of Wilson's *quantum modal realism*. This would benefit the latter view because it too is modal necessitarian and so liable to face strong opposition from contingentists about laws.

before discussing how Powers-BSA laws might be understood as real patterns and why it is relevant to my argument to understand Powers-BSA laws thusly.

According to Dennett: 'A pattern exists in some data—is real—if *there is* a description of the data that is more efficient than the bit map, whether or not anyone can concoct it' (Dennett 1991).

Imagine a square of 1000 pixels by 1000 pixels. Some of the pixels of the square are black and others are white, and no pixel is any other shade. If we can transmit this data, the colour of each pixel in the square, in some way that is more efficient than just listing the colour of each individual pixel (that is, giving the bit map), then, according to Dennett, there exists a real pattern in the data. An efficient transmission would be possible if, for example, the square had the appearance of a chessboard, in which case there would be a relatively simple formula, call it *F*, that could tell us, for any given pixel, *p*, whether *p* was black or white, and transmitting *F* would be more efficient than transmitting the bit map of the square. The chessboard pattern needn't be completely noise-free in order to be *real*. If noise were present, we could transmit data about the square in the following way: *the pixels of the square are coloured according to F with the following exceptions: 22,567,1294. . . , etc., which are the opposite colour to that predicted by F*. This transmission would be more complex than if the pattern were completely noise-free, but it is still far more efficient than the bit map. If we were interested just in the pattern and not in where, exactly, the noise happened to be, we could efficiently transmit the data in our example in the following way: *the pixels in the square are coloured according to formula F with n% noise*.

While a chessboard pattern in the set-up just described might be readily *perceptible* to creatures like us, the same data could be presented in a very different way such that any pattern is rendered utterly imperceptible to us. Imagine, for example, translating the data in the square into hexadecimal notation (by breaking it up into 4-bit chunks, each of which is then assigned a symbol from 0-F depending on which of the 16 possible arrangements of black and white pixels it exhibits). Our visual apparatus and, in general, our '*cognitive wiring*' (more on this later) makes *edge-detection* relatively natural and easy for us, hence the ready perceptibility of a chessboard pattern in an array of black and white pixels, but the same data in hexadecimal notation would appear as just a random array of letters and numbers (to the vast majority of people, at least, though perhaps one could train to perceive patterns in hexadecimal) (Dennett 1991: 33). That is not to say, however, that the pattern would be destroyed by translating it into hexadecimal notation, it would still be there because it would be possible to describe the data in a way that is more efficient than the bit map.

Different individuals with different interests and perspectives may perceive different patterns when confronted with the *same data* presented in the *same way*. For example, when presented with an array of black and white pixels,

Jones may see pattern α with $n\%$ noise whereas Brown sees pattern β with $m\%$ noise. Must it be that at most one of Jones and Brown is correct about the pattern that exists? No. If Jones and Brown could both make money by betting on the next data point in the set according to their pattern and budgeting their odds according to the noise ratio, then both patterns are equally real (Dennett 1991: 35–6). The betting example is just another way of getting at the notion of a real pattern; if there is a way to make money betting on the next data point in a set, then there is some formula that can be used to describe the data in that set that is more efficient than just giving the bit map, namely, there is some *pattern* in the data.

My suggestion, then, is that Powers-BSA laws *are* real patterns, in Dennett's sense. As we saw in Section II, Powers-BSA laws serve as efficient means of conveying the data about possible property distributions and they allow creatures like us to make predictions with a better-than-chance success rate, so the suggestion is plausible on the face of it. I'll now make this idea more precise.

Properties are spatiotemporally distributed at worlds. We can think of each spacetime point at a world as a pixel that either does or does not instantiate one or more of the properties: X, Y, Z. . . etc. that exist. So, the spatiotemporal distribution of properties at a world is analogous to the grid of pixels, some black some white, in the example above. It is thus possible that there exist Dennettian real patterns in the spatiotemporal distribution of properties at a world. A real pattern exists in the data that is the spatiotemporal distribution of properties at a world, w_1 , if, and only if, there is some way of conveying information about the distribution of properties at w_1 that is more efficient than listing the spatiotemporal location of each property instance, namely, giving the bit map.

Powers-BSA laws systematise all possible property distributions. In other words, they systematise the *transworld* distribution of properties. So, we can think of spacetime points *at worlds* as 'pixels' that either do or do not instantiate one or more of the properties: X, Y, Z. . . , etc. This time, the *transworld* spatiotemporal distribution of properties is analogous to the grid of pixels, some black some white, in the example above. Powers-BSA laws are thus real patterns in this transworld property distribution.

I am not the first to suggest that BSA laws are real patterns, this suggestion has also been made by Wheeler (2016) and Torza (ms); in a similar vein, Andersen (2017) understands *causation* in terms of real patterns. So, the general idea enjoys some plausibility independently of my specific interests in this paper. But I will now outline two broad respects in which my argument will leverage that fact that Powers-BSA laws *are* real patterns.

First, I want to capture the idea that there is a pragmatic dimension to what it is to be a law of nature. I want to capture the idea that laws help us to make sense of the 'blooming, buzzing confusion that bombards us with sense data'

(Dennett 1991; see also James 1890), since this is precisely what real patterns are good for, emphasising the fact that Powers-BSA laws are real patterns helps me to more precisely articulate a sense in which there is a pragmatic dimension to being a law of nature. What's more, the best way of making sense of the blooming, buzzing confusion may sacrifice something in the way of *truth*; given a degree of pragmatism about laws, the option is open for laws, like some real patterns, to be lossy (cf. Braddon-Mitchell 2001), which further speaks in favour of the identification. The idea that there is a pragmatic dimension to the laws of nature, that they ought to be useful tools for *creatures like us* as opposed to some idealised being outside space and time, has recently gained a lot of interest and support (Hall 2015; Dorst 2017; Hicks 2017; Jaag and Loew 2018). I am sympathetic to this move, which, as we will see, facilitates the reconciliation of contingentism and necessitarianism about laws that I discuss in the next section. Understanding laws as real patterns, then, is a natural way of articulating and precisifying the pragmatic constraint on what it is to be a law of nature—laws/real patterns are useful for us insofar as we want to make sense of the 'blooming, buzzing confusion', and there is nothing to rule out the possibility that the most useful pattern-making perspective for us will be a lossy one.

The second reason in favour of identifying laws with real patterns (and hinting at what is to come) is that I want it to be the case that there are lots of law candidates all of which exist necessarily and which are on an ontological par, but whose law status varies from world to world. Real patterns in the transworld distribution of properties are perfect for the role of necessarily existing law *candidates*. So, it helps to leverage the fact that laws *are* these real patterns, by which I mean there are no laws that are not real patterns in the transworld distribution of properties, even if not all such real patterns are laws. I hope to make this clearer in the next section.

IV. LAWS OF NATURE: NECESSARY AND CONTINGENT

All of the pieces are now in place for me to show how the Powers-BSA can reconcile modal necessitarianism and contingentism. There is a sense in which all possible worlds are identical with respect to the laws that prevail, as per modal necessitarianism. There is also a sense in which it is true that the laws could have been different *and* the conceivability–possibility link is at least partially upheld, as per contingentism. I'll elaborate on the necessity claim and the contingency claim in turn.

IV.1 *Necessity*

The necessity of laws is as follows. The real patterns that we identify with laws are really there in the data, whether anyone perceives them or not, this is part

of what it means to be a real pattern after all. Furthermore, it is metaphysically necessary that the data—metaphysically possible property distributions—is exactly how it is because it spans all of modal space, and facts about modal space are themselves metaphysically necessary. So, the real patterns that we identify with laws (because they best balance strength, simplicity, and other pragmatic desiderata as per the pragmatic twist on BSA laws that I endorse) themselves exist as a matter of metaphysical necessity, because the data that they are patterns *in* could not possibly have been different (the same goes for other real patterns in this data that we do not call laws, more on this in a moment). Alternatively, the *propositions* according to which there are such and such real patterns in the transworld distribution of properties, some of which qualify as laws of nature, are *necessarily true*.

Another way of putting the point is this: facts about modal space do not themselves vary from *world to world*—all worlds agree with respect to these facts (on the plausible assumption that S_5 is the correct logic for metaphysical modality). The laws/real patterns encode facts about modal space and so the laws/real patterns *hold in all possible worlds*, which is what modal necessitarians wish to maintain. This sense in which the laws are necessary is stronger than that in which they are necessary according to dispositional essentialism because the latter allows for truly different laws at other possible worlds with alien properties (I return to the issue of alien properties in the objections and replies; in short: the possibility of alien properties does not compromise the necessity of Powers-BSA laws). The Powers-BSA, by making laws features of a description of all of modal space, provides a metaphysical underpinning for modal necessitarianism. This is an interesting result in itself because although modal necessitarianism has its advocates, relatively little has been said about what a metaphysical underpinning of modal necessitarianism might look like (though see Bird (2004) and Wilson (2020)).

At this point, one might question the relevance of the *powers* component of the Powers-BSA. If laws are patterns in the actual and possible distributions of properties, i.e. patterns spanning all of modal space, and *this* is what ensures their necessity, why does it matter that the properties be powers?

I agree with Demarest (2017: 49) that if properties could freely recombine, as is the case with the Humean's quiddities, worlds would differ from one another *radically*. There would be no non-trivial patterns across such disparate worlds and, so, no BSA laws. The fact that powers constrain how they are possibly distributed suggests a greater degree of similarity even between the most disparate worlds and, hence, that there *will* be non-trivial patterns in the transworld distribution of powers. These patterns can then be identified with laws and will hold of necessity. In short, the fact that properties are powers as opposed to Humean quiddities is what justifies the claim that non-trivial laws systematise other possible worlds besides the actual world which, in turn, yields a strong sense in which the laws are necessary. Furthermore, the fact

that powers constrain how they are possibly distributed gives us hope that we can have epistemic access not just to the actual distribution of powers but other possible distributions too. Scientific investigation into the possible behaviours associated with properties is our route to knowledge of the possible spatiotemporal distributions of those properties and, hence, to knowledge of the laws.

IV.2 *Contingency*

I will now show that there is also a sense in which it is true that the laws of nature could have been different. This, in turn, opens up a novel redescription strategy via which the conceivability–possibility link can be at least partially (more on this qualification at the end of the subsection) upheld.

The patterns in possible property distributions that we perceive and find predictively and explanatorily useful will depend on what I'll call our *cognitive wiring*—features of sentient beings including, but not limited to, visual apparatus, intelligence, practical and scientific interests, etc. Plausibly, then, our cognitive wiring is a highly contingent matter.

As discussed, I think that laws are best understood as maximising strength, simplicity and other desiderata in order to yield generalisations that are useful *for us*, not some idealised agent with a 'God's eye view of the universe'. This is largely motivated by a desire to achieve continuity with science; scientists are interested in generalisations, or *patterns*, that they can readily use to manipulate, navigate and make predictions about the world. It would be frivolous to propose an account of laws according to which laws did not serve scientists' interests in this way.

Some real patterns in the transworld distribution of properties serve our interests in such a way as to warrant elevation to the status of laws of nature and so *are* laws of nature. But given the contingency of our cognitive wiring, it is possible that some other real patterns served our interests in the way required for them to be laws. In other words, it is possible that some other real patterns struck the optimal strength, simplicity, etc. balance *for us* and hence that these patterns counted as laws. Put in terms of propositions: the propositions that express laws only *contingently* express laws because there are worlds in which those same propositions do not express laws because the real patterns that give them their content do not qualify as laws. This is the sense in which it is true that Powers-BSA laws are contingent. Whereas it was the *powers* that were doing the work of yielding a sense in which the laws are necessary, it is the *pragmatism* that does the work of yielding a sense in which the laws are contingent; the *uber* realist who denies that utility to sentient creatures has anything to do with what it is to be a law of nature could capture no such sense in which the laws are contingent.

What's more, a world in which different real patterns counted as laws, because our cognitive wiring was different, would also be a world that *appeared* very different to us—a difference in our cognitive wiring would lead to a difference in how the world appears to us. Different laws would thus be reliably accompanied by different *appearances*, which, I will now argue, goes a long way to capturing contingentist intuitions.

Consider, for example, the possibility that humans, on average, had significantly higher general intelligence than they have in the actual world. If this were the case, then the benefit of recognising additional real patterns as laws would outweigh the cost associated with the additional complexity of a scientific systematisation of the world that included additional laws; some real patterns that we do not actually call laws would achieve law status. The additional patterns that achieve law status in this situation would be salient to us in a way that they are not in the actual world, given our comparatively limited cognitive capacities in the actual world. So, the possibility under consideration, in which there are additional laws because human general intelligence is higher, would be one that *appeared* different to us too. This is analogous to Dennett's chess player example: the arrangement of pieces on a chess board 12 moves into a game *appears* very different to a grandmaster than it does to a layperson because the former is receptive to all sorts of patterns and possibilities to which the layperson is oblivious (Dennett 1991: 34).

Humans might also have varied along dimensions other than intelligence. We might have had very different perceptual apparatus, in which case, some quite different way of systematising the world would have better served our interests—perhaps we greatly struggled to perceive edges but subtly different surface textures shone out. What also seems likely is that if we were wired so differently (perhaps we navigated by *echolocation* among other differences), the world would *appear* very different to us (presumably the world *seems* very different to bats, even if we cannot possibly know how exactly it seems to them). Consider the following from McCulloch, which is evocative of the central idea here:

Sightless Martians would not have our concept red, and it can be presumed that their sonar apparatus would equip them with analogous concepts similarly inaccessible to us (for instance, they might be able to classify surfaces on a sonar basis in ways which *cut across our colour and other visual classifications*, and which *exploit an aural phenomenology in ways we can barely, if at all, imagine*). (McCulloch 1988, 14, my emphasis)

The point, then, is that cognitive wiring, understood very broadly, is a contingent feature of sentient beings and the way creatures perceive and interact with the world is intimately tied up with their cognitive wiring. Different cognitive wiring will lead to radically different appearances and, hence, different conceptual schemes, interests, abilities, etc. The way a world appears to the beings that inhabit it and the real patterns in possible property distributions

that count as laws will thus covary because they will have as a common cause the cognitive wiring of those beings.

So, to reiterate, the Powers-BSA allows for a sense in which it is true that the laws could have been different: which real patterns in the transworld distribution of properties qualify as laws varies from world to world, in other words, the *propositions* that express these real patterns count as expressing laws in some worlds but not in others (though they are *true* in all worlds). The Powers-BSA also allows for the possibility that the world *appeared* very different to us and that this difference in appearances was reliably accompanied by different laws of nature and vice versa.

Furthermore, the conceivability–possibility link is at least partially upheld. It can be conceded that we are able to conceive of worlds that appear very different to the actual world and in which the laws are different and that such *conceivings* correspond to real possibilities. However, it can be maintained that the real possibilities conceived are *not* accurately described as: worlds in which things seem different and in which the laws are different because the real patterns in the transworld distribution of properties is different. Rather, the correct description of what is conceived is: worlds which seem different because our cognitive wiring is different, and in which different real patterns count as laws than those that count as laws in the actual world. On the present view, a novel re-description strategy is available that allows the modal necessitarian to respect the contingentist’s conceivability–possibility link. This strategy may manifest in conversation as follows:

Contingentist: I can conceive of a world in which the laws are different. Conceivability entails possibility. Therefore, the laws are contingent because they could have been different.

Me: I grant the conceivability–possibility link. However, to be clear, what you really conceive is a world in which things seem very different to you *and* in which the necessary real patterns in the transworld distribution of properties that qualify as laws is different from those that qualify as laws at the actual world.

I say that the conceivability–possibility link is *at least partially* upheld because one may still wish to maintain that it is conceivable that I retain my cognitive wiring *and* the laws are different; however, this does not seem to be a real possibility, on the present view. It could be responded that to conceive of something is to picture it in one’s mind’s eye. And the picture in one’s mind’s eye of a world in which I retain my cognitive wiring and the laws are different is indistinguishable from one in which my cognitive wiring changes and so it *appears* as if the laws are different. Hence, it is underdetermined what I am conceiving and there is no clear-cut violation of the conceivability–possibility link. Or, more simply, one could maintain that conceivability is mere *defeasible* justification for possibility (cf. Yablo 1993). In short, the issue turns how we

understand ‘conceivability’ and it would be beyond my scope to go into this in more detail. Hence for now I am happy to settle for the claim that the conceivability–possibility link is at least partially upheld. (See also objection 3 in the Objections and Replies section.)

IV.3 *Summing up*

The Powers-BSA (with a pragmatic twist) and the understanding of its laws as real patterns respects Dennett’s contention that ontology has a pragmatic source.⁶ Our ontology (in this case *laws of nature*) arises from various ‘pattern-making perspectives we have on the buzzing blooming confusion that bombards us with data’ (Dennett 1991: 36), and our actual pattern-making perspective is as contingent as our cognitive wiring. This *pragmatism* about laws allows for a reconciliation of modal necessitarianism and contingentism because while the real patterns identified with laws exist necessarily, it implies that *what it is* for a real pattern to qualify as a law is for it to be useful to creatures like us, where what is useful in this sense is as contingent as our *cognitive wiring*. Put in terms of *propositions*: the propositions expressing laws-cum-real patterns are necessarily true but they do not necessarily express laws of nature.

One may worry that the contingentist will not be placated because they think that the propositions that express laws *could be false*. I am inclined to respond that this objection fails to properly enter into the reconciliatory spirit of compromise that this paper assumes: I’ve given the contingentist *something*, they shouldn’t be so greedy! However, it turns out that the sense in which laws are necessary on the present view is not diminished by allowing worlds to vary with respect to the properties instantiated, i.e. by allowing possible *alien* properties. And this allows more ground to be conceded to the contingentist, which may go some way to satisfying the present demand. I discuss this in more detail in objections 2 and 3 in the next section.

This all constitutes an admittedly defeasible, novel argument for the Powers-BSA. I am assuming that a reconciliation of necessitarianism and contingentism about the laws is something that is desirable. I show how to achieve this reconciliation, but my argument makes essential appeal to the Powers-BSA. So, to the extent that we would like to achieve this reconciliation we have reason to adopt or believe in the Powers-BSA. For this reason, this paper is not a mere argument for necessitarianism which says that necessitarianism can appease the contingentist; there is an argument to this effect but there is a further argument for the Powers-BSA because the latter is the account of laws

⁶ Previous articulations of the Powers-BSA (e.g. Demarest 2017) do not incorporate pragmatism into their account of what it is to be a law; they stick as close as possible to the Lewisian BSA, which the pragmatic Humeans criticise precisely on the grounds that it is not pragmatic enough. So, pragmatism in the context of the Powers-BSA is, as far as I can tell, an innovation here.

that enables the desirable reconciliation. Of course, this argument is defeasible because one could deny the premise that the reconciliation is desirable or one could propose an alternative reconciliatory strategy that does not invoke the Powers-BSA. Unfortunately, it would be beyond my current scope to say more in defence of my premise or to evaluate all possible alternative reconciliatory strategies.

V. OBJECTIONS AND REPLIES

I'll now discuss some objections and replies.

Objection 1: Perception and perhaps even intellect and other aspects of our 'cognitive wiring' are modified over time by technology at the actual world. But the laws do not change at the actual world. So, why think that creatures with different cognitive wiring at other possible worlds will identify different real patterns with laws than the ones that we identify with laws?

Reply 1: Cognitive wiring is intended to be a broad church and the objection is right insofar as there are certainly *some* aspects of our cognitive wiring which, if altered, would not lead us to identify different real patterns with laws. But if our cognitive wiring were *sufficiently* different, then things would seem very different and, I maintain, we would choose to elevate different real patterns to law status. Of course, microscopes, telescopes and particle accelerators allow us to 'perceive' and manipulate all sorts of things with which we would never have dreamt of being acquainted in decades past. But there is a difference between this sense of modifying our perceptual capacities and, say, being born with sonar rather than visual perceptual capacities, or failing to perceive edges but perceiving subtle variations in surface texture instead. And cognitive wiring is not limited to perception; our interests could be radically different too. If we were only ever interested in objects the size of golf balls or larger, we'd never be privy to the weird and wonderful *appearances* of the quantum domain and we'd have no inclination to elevate patterns corresponding to quantum phenomena to the status of laws. Radical differences such as these are the sort that I imagine being sufficient to alter the appearances of a world to such an extent that we would choose different patterns to call laws.

On the other hand, perhaps what we call laws will/does change over time at the actual world. Technological advances and, ultimately, evolutionary changes over time may lead to a world of radically different appearances and hence to different or additional laws, but this is no objection to the present proposal.

Objection 2: The Powers-BSA doesn't ensure the necessity of laws in any sense because there may be different properties at different worlds.

Reply 2: Alien properties are properties that are not instantiated anywhere at the actual world but are possibly instantiated, i.e. are instantiated at other possible worlds. One may then worry that the possibility of alien properties

compromises the necessity of the laws because alien properties will have alien possible distributions. However, alien properties do not, strictly speaking, compromise the sense in which laws are necessary. Laws, on the present view, get their necessity by describing modal space, which is itself necessary, and this is not compromised by possible alien properties. No matter how things vary from world to world, the necessity of modal space itself is unaffected. In the introduction, I suggested that the modal necessitarian maintains that all possible worlds are nomologically identical *and* or perhaps *because* there are no possible alien properties. But what I have shown is that the Powers-BSA is capable of rendering all worlds nomologically identical while allowing possible worlds to vary with respect to which properties exist or are instantiated. The Powers-BSA is thus able to retain the *letter* of modal necessitarianism—*all possible worlds are nomologically identical*—while also admitting possible alien properties.

The more pressing problem posed by alien properties is epistemological: real patterns in the possible distributions of alien properties will be epistemically inaccessible to us at the actual world; one might think it odd that some law candidate real patterns would be forever beyond our ken and thus worry about possible alien properties.

There are at least three things that could be said here to assuage concern about alien properties.

One could just stipulate that all law-candidate real patterns span only those worlds at which all and only the properties instantiated at the actual world are instantiated; patterns that span worlds with alien properties will not even be candidates for laws (see Kimpton-Nye (2017) for more on this strategy).

Alternatively, one could simply deny the possibility of alien properties, something that is arguably more in keeping with the *spirit* of modal necessitarianism anyway, and so perhaps safe to assume in the context of an attempt to reconcile *modal necessitarianism* with contingentism.

However, if one does not share the epistemological concern (after all, at least we can know real patterns in the possible distributions of *terrestrial* properties, so the most important laws remain within our epistemic reach), one could allow for alien properties and law-candidate real patterns that span worlds at which alien properties are instantiated, safe in the knowledge that the law-candidate real patterns nonetheless hold of necessity, because they are features of a description of all of modal space. To take this strategy would perhaps be to concede more to the contingentist and less to the necessitarian. But the flexibility of the present proposal on issues such as this should count in its favour because if one thinks that too much is conceded to the necessitarian/contingentist, simple tweaks can be implemented to move it in the other direction.

Objection 3: The contingentist can conceive of mass obeying an inverse cube law and thus infer the possibility that mass obeyed an inverse cube law. The Powers-BSA cannot account for *this* possibility and others of similar specificity.

Reply 3: I have only explicitly shown how to reconcile modal necessitarianism with the *general* possibility that the laws were different and shown how to retain the link between the ability to conceive of the laws being different *in general* and the *general* possibility that the laws were different. But that should count as a significant achievement so I am inclined to say that this objection demands too much, though more can be said.

Defenders of modal necessitarianism tend to be motivated, at least in part, by a belief that conceivability has nothing to do with what's really possible (see e.g. Edgington 2004; Wilson 2013). So, given that my aim here is to reconcile modal necessitarianism and contingentism about the laws, one might think that it would be to swing too far in favour of the latter if absolutely all instances of the conceivability–possibility link were upheld. I have shown how modal necessitarianism and *some* though perhaps not *all* contingentist intuitions about the laws can be reconciled, which is perhaps what we should expect given that a large part of the motivation for modal necessitarianism is the denial of the conceivability–possibility link. Reconciliation is going to require compromise.

Having said this, one could invoke possible alien properties and, as discussed in the previous reply, this would not compromise the laws' necessity on the current view. Call one such alien property *schmass*. The transworld distribution of *schmass* may then be most efficiently described by an inverse cube law of universal attraction; this inverse cube law will be a real pattern in the transworld distribution of properties. For the sorts of reasons discussed, sentient creatures at worlds where *schmass* is instantiated will then elevate this real pattern to the status of a law. So, the response to the contingentist at the actual world who claims to be able to conceive of mass obeying an inverse cube law is that they imagine themselves inhabiting a *schmass* world where the inverse cube-real pattern that describes the possible distribution of *schmass* is elevated to the status of a *law*. Something similar could be said in response to the ability to conceive of other laws being different in very *specific* respects. Furthermore, this could then account for the possibility that our cognitive wiring was *the same* and the laws *different* (see end of Section IV.2); plausibly the creatures in a world with alien properties would elevate different real patterns to the status of laws (patterns involving those properties) even if their cognitive wiring were the same as ours, say.

Alternatively, maybe there is a way of making, e.g. 'mass obeys an inverse cube law' count as true at some worlds even if alien properties are deemed impossible. Compare the mereological nihilist's task of allowing for the truth of sentences such as 'the cat is on the mat' even in the absence of cats, mats, or anything other than simples. The nihilist achieves this with the help of additional ideological machinery, namely, the idea that there may be *simples arranged X-wise*, that permits the systematic translation of sentences seemingly about everyday objects into sentences that are about simples which can count as true by the nihilist's lights. Similarly, then, perhaps with some additional

ideology it could be the case that ‘mass obeys an inverse cube law’ comes out true at worlds inhabited by creatures wired differently from us and at which the real patterns that count as laws are different too, even in the absence of alien properties. Filling out the details here would be an interesting task for future work.

Objection 4: Physical possibility is consistency with the laws of nature. On the present proposal, the laws vary from world to world. So, consistency with the laws varies from world to world; hence, the physical possibilities vary from world to world. *Metaphysical* possibility, on the other hand, is absolute and does not vary from world to world. The present proposal thus fails to collapse physical and metaphysical modality and so fails to properly underpin modal necessitarianism.

Reply 4: The Powers-BSA maintains that properties are *powers*. Powers are irreducibly modal in the sense that they impose metaphysical constraints on their own possible distributions (see Section II). Another key motivation, besides accounting for laws of nature, for positing the existence of powers is to account for metaphysical modality (see e.g. Borghini and Williams 2008; Jacobs 2010; Vetter 2015; Williams 2019); metaphysical modality isn’t reduced to anything non-modal, on this account, but it is grounded in irreducibly modal, physical properties. Vetter (2015: 281–90) argues that the question of whether physical and metaphysical modality collapse is left wide open by a powers-based account of modality.⁷ The natural response, then, is to twin the Powers-BSA with a powers-based account of modality. It can then be maintained that there is an important sense in which the physical/metaphysical modality distinction collapses. In a nutshell, there is just one type of objective modality, which ultimately concerns the restrictions imposed by powers on their own possible distributions, and which does not vary from world to world.

Nevertheless, the objection is correct that there is room for a sense in which physical and metaphysical modalities come apart. But again, this just speaks to the flexibility and reconciliatory power of the present proposal. It can capture a sense in which physical and metaphysical modalities collapse: there is only one type of objective modality and this concerns how properties are possibly distributed. But there is also a sense in which physical and metaphysical modalities are separable because consistency with the laws will vary from world to world.

In general, I expect a slew of objections to the effect that the view presented in this paper is not sufficiently necessitarian/contingentist. But these objections are likely to be as unfair as they are expected because reconciliation is of course going to require compromise. Indeed, I’d be surprised if an uncompromising

⁷ Vetter talks about ‘potentialities’ as opposed to powers, but the underlying idea that modality in general is rooted in irreducibly modal physical properties is essentially the same.

necessitarian/contingentist to whom such objections came forcefully to mind had read this far, so I'll keep my remaining comments on this matter brief.

The objections and replies illustrate that there is scope for tweaks that move the view more towards the contingentist or necessitarian side as desired. Nevertheless, this will do little to convince anyone who is absolutely adamant that the laws are necessary/contingent and that there is nothing to appreciate of the side with which they disagree. I think that objections from *this* perspective are unfair. On the face of it, I am defending the contradictory claim that the laws are metaphysically necessary and metaphysically contingent. Of course, a contradiction cannot hold so something will have to give. I have shown how to give a little on both sides and thereby *reconcile* contingentism and necessitarianism about the laws. On the necessitarian side, the real patterns identified with laws exist necessarily and it can be maintained that there is a single source of objective modality. On the contingentist side, there remains a sense in which the laws vary from world to world and this variation is reliably accompanied by a variation in appearances, which, in turn, allows for the conceivability–possibility link to be upheld. I suggest that this is as much as could be hoped for in bringing these two radically opposed positions into harmony.

VI. CONCLUSION

The Powers-BSA provides a metaphysical underpinning for modal necessitarianism but in so doing, the option remains to capture something of the idea that laws are contingent. The real patterns that we identify with laws exist necessarily. But it is possible that some different necessarily existing real patterns qualified as laws. Given the pragmatic constraints on what it is to be a law of nature, laws and appearances will systematically covary: a world in which different real patterns counted as laws would be one that appeared very different. What's more, it can be maintained that these worlds that appear different and in which different real patterns count as laws are the real possibilities of which we conceive when we imagine worlds with different laws. So, a novel re-description strategy is available to the modal necessitarian who wishes appease the contingentist by upholding the conceivability–possibility link.

Reconciliation of entrenched disagreement should count as progress in philosophy because it is one way of settling disputes and thus allowing us to move on to other concerns. Of course, one may hope instead to settle disputes with a knockdown argument in favour of one side or the other. But knockdown arguments are incredibly rare; hence, I think we should be more receptive to the option of making progress via reconciliation. This paper thus counts as a novel argument in favour of the Powers-BSA by showing how it can affect

the reconciliation of an entrenched dispute. This paper also counts in favour of the new and controversial view that is modal necessitarianism because it shows how it can harmonise with contingentist orthodoxy.⁸

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University of Bristol, UK