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Non-Humean theories of natural necessity

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Abstract

Non-Humean theories of natural necessity invoke modally-laden primitives to explain why nature exhibits lawlike regularities. However, they vary in the primitives they posit and in their subsequent accounts of laws of nature and related phenomena (including natural properties, natural kinds, causation, counterfactuals, and the like). This article provides a taxonomy of non-Humean theories, discusses influential arguments for and against them, and describes some ways in which differences in goals and methods can motivate different versions of non-Humeanism (and, for that matter, Humeanism). In short, this article provides an introduction to non-Humeanism concerning the metaphysics of laws of nature and natural necessity.

1 | INTRODUCTION

A deck of cards has three noteworthy features. First, its individual cards have *properties*. For example, the seven of hearts and the king of hearts are similar in color and suit but different in number. Second, the cards are arranged in a sequence. Third, among the possible sequences of cards, some exhibit obvious patterns. For example, consider a deck in which all cards are arranged by suit.

The natural world is analogous. First, worldly objects have properties. Second, they are arranged in a sequence: namely, they are distributed in the multi-dimensional spacetime manifold. Third, some possible sequences exhibit obvious patterns or, as they are usually called, *regularities*. For example, bread nourishes, massive objects attract, similarly charged particles repel, and so on.

The laws of our best scientific theories describe especially stable and resilient regularities. We regard such regularities as having modal force: the fact that stones fall when unsuspended is no accident; they *must* fall under normal conditions. This necessity—call it *natural* or *nomic* necessity—differs from necessities in logic, mathematics, and perhaps metaphysics. Natural necessity seems weaker, because we can imagine worlds with different laws. By comparison, we cannot imagine that 2 + 2 = 5. Moreover, natural necessities are plausibly a posteriori. We accept them because they stand in some sort of intimate connection to regularities observed in nature. However, the connection between regularities and natural necessities leads to a great division in metaphysics.

According to *Humeanism*, natural necessities reduce to something that lacks modal character—namely, to the *Humean mosaic*. There are different ways of characterizing the Humean mosaic, but the basic idea is this: it consists of fundamental property instances distributed throughout spacetime, and there are no primitive modal connections among them. (Note that a primitive such as *essence*—one that is not explicitly modal, but has modal implications concerning property distributions—is a "modal primitive" in my sense.) Thus, the Humean mosaic is a basic feature of our world; it has no deeper metaphysical explanation. How, then, do Humeans analyze natural necessity? According to the most popular version of Humeanism, the *Humean Best Systems Account*, laws are theorems of the best systematization of particular matters of fact, where the quality of a system is determined by its simplicity, informativeness, and/or its ability to satisfy other criteria.[1] To simplify somewhat, Humeans treat laws of nature as convenient summaries of the most significant regularities that happen to occur. Thus, Humeanism takes regularities to be prior to nomic necessities. The laws are what they are because of the regularities; the modal facts—namely, the natural necessities—are what they are because of the non-modal facts.

In contrast, *non-Humeanism* posits a metaphysical explanation of regularities in terms of modal primitives; modal facts of some sort are prior to regularities.[2] If presented with an orderly deck of cards, you'd suspect that someone had imposed order on it. Similarly, non-Humeans think that regularities are imposed on nature. However, whereas explanations of sequences of cards are familiar to everyone, the modal primitives distinctive of non-Humean theories are not. What are they, and how do they perform their explanatory task? Let us take a look. In the next section, I'll provide a taxonomy of non-Humean theories of natural necessity. In the following section, I'll examine how well these theories satisfy various desiderata for a theory of laws and consider some objections to non-Humean theories. I'll conclude by discussing some arguments for non-Humeanism.

Before diving in, I'll make an important clarification.[3] Humeans and non-Humeans tend to agree about *which* regularities and *which* laws there are. For example, they can agree that Schrödinger's equation is a law and that the equation describes a regularity. After all, such determinations are the business of the sciences. However, they disagree about what it means to say that the equation is a law. Humeans say that the feature of our world that makes the equation a law is ultimately just a significant regularity (or the Humean mosaic as a whole), whereas non-Humeans say that the regularity is lawlike because it is imposed on the world by some sort of modal primitive. This is not a dispute about which regularities there are. It is a dispute about the nature of laws and the order of metaphysical explanation.

2 | VARIETIES OF NON-HUMEANISM

I'll sketch some specific versions of non-Humeanism in Sections 2.1 through 2.5. That will pave the way for a general taxonomy in Section 2.6.

2.1 | Divine voluntarism

Suppose we take the analogy between our deck of cards and nature at face value. The best explanation for an orderly sequence of cards is that someone has intentionally arranged the deck. Perhaps natural regularities have been intentionally arranged by a powerful person who stands apart from and directs the course of nature.

> *Divine Voluntarism*: There exists a personal being, God, such that it is necessary that its will concerning nature be done.

This picture of laws is presented in Newton's General Scholium (1713) to his *Principia Mathematica* (Newton, 2004, pp. 109–114), and it was popular during the early modern period (see Ott, 2009; Ott & Patton, 2018; Psillos, 2018). Contemporary proponents include Foster (2004), Swinburne (2006), and Collins (2009).

Divine Voluntarism is not as popular as it once was, but it's useful to start with this theory. Its primitives are probably somewhat familiar to those who aren't well-versed in metaphysics. It vividly illustrates how non-Humean theories reverse Humeanism's order of metaphysical explanation. Moreover, because it was popular during the rise of modern science, it may have been influential in shaping our modern conception of law (see Beebee, 2000; Ott & Patton, 2018).

Clarification for readers familiar with recent debates about metaphysically explanatory relations: I've characterized Divine Voluntarism using plain old metaphysical necessity, but we could substitute another modally-rich primitive. For example, we could frame Divine Voluntarism in terms of God's *essence*, in terms of nature's *dependence* on God, and so forth. We could even make the connection *chancy*, positing a God that is merely powerful enough to direct the course of nature with a non-negligible probability of success. To keep things simple, I'll characterize (most) non-Humean theories in terms of metaphysical necessity. Variants are generated by substituting other primitives, including but not limited to: chance, essence, ontological dependence, ground, diachronic production, and so on.[4]

2.2 | Primitivism

Divine Voluntarism posits a powerful person that governs nature. But why invoke a *person* instead of simply treating *laws themselves* as primitives?

> *Primitivism*: Laws are primitives that govern—that impose structure on nature "from the outside."[5]

Indeed, Maudlin (2007, 15) suggests that the concept of law is more familiar than the primitive concepts employed by competing non-Humean theories (as we'll see, these include *God*, *universals*, and *natural kinds*, among others). Nonetheless, one might wonder what it means for something non-personal to govern. One way to make sense of this is to treat ⌜it is a law that⌝ as a sentential operator axiomatized as follows: necessarily, for all statements *p*, it is a law that *p* entails *p*. Roughly, the idea is that these primitives make nature conform to the content of the sentences to which the operator is attached. Notice that the primitive modal truths/entities posited by Primitivism do not have, and are not supported by, any sort of deeper underlying metaphysical structure. (If we could break them down and analyze them in terms of internal or underlying structure, they would not be primitives!) Primitivists simply posit primitive truths, or primitive entities responsible for such truths, and end their account of lawhood there.

2.3 | Relations between universals: The DTA theory

However, we might want nomic necessities to have an underlying structure. Consider Newton's second law, *F = ma*. "*F*", "*m*", and "*a*" refer to properties of objects, so it's natural to think that laws might involve some kind of modal relation between properties. According to Dretske (1977), Tooley (1977), and Armstrong (1983), laws are higher-order states of affairs. They consist of a nomic relation holding between first-order universals. For those unfamiliar, universals are fundamental elements of an ontology that are posited to metaphysically explain relations of similarity and difference among objects. Whenever two things are genuinely similar, that is because there is a universal—an entity that is wholly present in each of its instances—that the two things share (see Armstrong, 1989, especially chap. 1).

Nomic relations have four crucial features. They are *second-order*: their relata are universals, not particulars. They are *external*: they do not hold solely in virtue of their relata. They are *irreducible*: nomic relations are fundamental universals themselves, so whether a nomic relation binds two universals cannot be reduced to other features of the world, including facts about which natural regularities occur.[6] Finally, they are *modally laden*: for example, we can define *nomic necessitation N* to be the unique irreducible relation such that, *necessarily*, if two universals F and G stand in the relation N(F,G) then all Fs are Gs. As is common, let us call this theory *DTA* after Dretske, Tooley, and

Armstrong. Note that DTA laws play the same governing role as primitive laws, but the governing entities posited by DTA have an internal metaphysical structure. They are relations between universals.

2.4 | Dispositionalism

We come now to what is perhaps the most popular version of non-Humeanism: *Dispositionalism*.[7] Here is Alexander Bird's sketch of the view:

> laws are not thrust upon properties, irrespective, as it were, of what those properties are. Rather the laws spring from within the properties themselves. The essential nature of a property is given by its relations with other properties. (Bird, 2007, 2)

Like DTA, Dispositionalism analyzes laws in terms of properties. Unlike DTA, it builds modality into first-order properties themselves, so that properties instantiated in nature are individuated by their modal relations to other properties. For example, the behavior of massive objects is not imposed on them from the outside by a god or an external relation like nomic necessitation; rather, the behavior flows from the very nature of mass itself. I'll use the label "disposition" for these modally-laden properties; other common labels include "powers," "propensities," "capacities," and "potencies."

Before moving on, let me mention some important issues concerning dispositions and laws of nature. First, there is a spectrum of interpretations of properties, from treating them as transcendent universals (Tugby, 2013b) to worldly tropes (Heil, 2003). Second, there are different methods of individuating dispositions. For example, Bird (2007) and Tugby (2013a) endorse very rigid constraints on fundamental dispositions—in Bird's case each property has exactly one stimulus condition and one manifestation—whereas Cartwright (1999) and Williams (2019) endorse almost no constraints on individuation at all. Third, Dispositionalism appears to have the (perhaps unintuitive) consequence that laws of nature are metaphysically necessary (for discussion, see Bird, 2007, chap. 8; Kistler, 2002; Cartwright & Merlussi, 2018). Fourth, on some theories—such as Primitivism and DTA—the account of natural necessity just is an account of lawhood. This is *not* so for Dispositionalism. Accordingly, we need an account of how laws are derived from dispositions.

According to the orthodox version of Dispositionalism, laws are derived directly from the modal relations that individuate dispositional properties (Bird, 2007). Others hold that laws are generalizations in the best systematization of particular matters of fact, just as the Humean BSA would have it, except that particular matters of fact involve the instantiation of dispositions rather than Humean categorical properties (Demarest, 2017; Kimpton-Nye, 2017; Williams, 2019). Finally, some dispositionalists hold that we can dispense with talk about laws entirely. Instead, we should, or at least can, reframe scientific discourse in terms of properties (Mumford, 2004). There need be no difference in ontology among these three approaches. However, clarifying the relationship between dispositions and lawhood is important for understanding the relationship between scientific practice and the epistemology of dispositions, and it is potentially important for the way in which we interpret laws in the special sciences (see, for example, Schrenk, 2006).

2.5 | Natural kind essentialism

Intuitively, a *natural kind* is, or may be associated with, a cluster of properties. *Natural Kind Essentialists* posit essences that bind properties together so that they characterize a kind. Consider the kind *electron*: it is characterized by a specific set of properties specifying the *mass*, *charge*, *spin*, and other properties of electrons. The essence binds these properties together in such a way that it's no accident that they are clustered together in nature. This cluster-

forming sort of modality is not dispositional, even if Natural Kind Essentialists understand properties in the cluster (like *mass*) to be essentially dispositional, as is common. Indeed, many proponents of Natural Kind Essentialism treat kinds as being more fundamental than the properties that characterize them.[8]

> *Fundamentalist Natural Kind Essentialism*: Natural kinds are prior to properties, and the latter are abstracted from natural kinds (Dumsday, 2019; Ellis, 2001; Lowe, 1989, 2006; Oderberg, 2007; Tahko, 2015).

On this view, a lot is built into the nature of natural kinds. (Theories of natural kind essences are frequently developed as part of a more general metaphysics of substance, often along the lines of Aristotelian hylomorphism.) Fundamental kinds are taken to ground both the modal connection among properties that characterize kinds and the modal essences of the dispositional properties themselves. Natural Kind Essentialists exploit these two different sorts of modality to explain different kinds of regularities. For example, Bigelow, Ellis, and Lierse (1992) suggest that the regularities associated with conservation laws might be best explained by the natural kind modality, whereas the regularities associated with dynamical laws might be best explained by dispositional modality. And Tahko (2015) suggests that Natural Kind Essentialism makes sense of the fact that different laws seem to have different modal force.

2.6 | Recap and taxonomy

If we are going to posit modal primitives, we have to put them somewhere. Non-Humeans have two general options. *Inflationary theories* add modal primitives that govern nature "from the outside", analogous to someone (or something) imposing structure on a deck of cards. Examples include Divine Voluntarism, Primitivism, and DTA. In contrast, *revisionary theories* reinterpret the fundamental facts in nature as being modally-laden, so that regularities arise "from within" nature. By way of analogy, this would be like holding that the sequence of cards in a deck arises because of something about the cards themselves. Dispositionalism and Natural Kind Essentialism are examples of revisionary theories. To put this another way, inflationary theories reject the reductionist component of Humeanism, whereas revisionary theories reject the Humean characterization of nature as a Humean mosaic involving only non-modal categorical properties (see Bhogal & Perry, 2017, sect. 3, for relevant discussion). Thus, the inflationary/revisionary distinction is exhaustive but *not* exclusive.[9]

As we have seen, we can make finer divisions as well. On the inflationary side, natural necessity can be primitive or analyzable. If analyzable, it can involve intentionality (e.g., a god) or not. If not, it's natural to analyze laws of nature in terms of properties/universals, given the way properties feature in statements of laws. Thus, while the inflationary theories discussed in Sections 2.1-2.3 aren't exhaustive, they do cover a lot of logical space.

Revisionary theories can be divided along similar lines. First, some versions of *Panpsychism* (Dolbeault, 2017) constitute a purely revisionary analogue of Divine Voluntarism, since both theories invoke a primitive sort of intentionality. Second, there are analogues of Primitivism. Lange (2009) posits an ontology of fundamental singular subjunctive facts, and Whittle (2009) posits an ontology of fundamental singular causal facts. The relevant subjunctive facts and causal facts are not determined by the properties of objects and the laws of nature. Rather, the order of explanation goes in the opposite direction. I consider these to be revisionist analogues of Primitivism because their singular facts do not flow from some deeper metaphysical structure (e.g., involving universals). Finally, many revisionary theories—including Dispositionalism and Natural Kind Essentialism—involve properties in their accounts of natural necessity. I've focused on property-based versions of revisionism simply because they are the most popular, but all of these accounts are interesting and warrant serious consideration. (Readers are encouraged to consider whether the pros and cons of Divine Voluntarism and Primitivism discussed in the next section transfer to their revisionary analogues.)

Finally, let us recall that the above options for "locating" modal primitives are compatible with different interpretations of the primitives themselves. Variants of these theories result from substituting chance, essence, ontological

dependence, ground, diachronic production, and so on, in place of the modal primitives I've used in the characterization of non-Humean theories.

3 | ASSESSING NON-HUMEAN THEORIES OF LAWS

In this section I'll introduce some criteria for assessing non-Humean theories and say something about how well the theories satisfy them. The following questions provide a rough sense of the criteria I have in mind:

1 Are non-Humean theories intelligible?
2 Do they do what they are supposed to do? In particular, can they explain regularities?
3 Are they compatible with our best scientific theorizing about nature?
4 Are they metaphysically extravagant?
5 Do they complement our broader metaphysical theories?

This list is by no means exhaustive, but it includes what I consider to be the most influential criteria relevant to choices *among* non-Humean theories. Additional criteria, chiefly used in arguments for non-Humeanism over Humeanism, include the following:

6 Do our theories align with common intuitions about lawhood? For example, do they support counterfactuals and do they allow for the possibility of uninstantiated laws?
7 Can our theories help to make sense of the rationality of inductive inferences?

I will not discuss questions (6) and (7) in this section, since many non-Humean theories appear similarly equipped to answer them. However, they do feature in Section 4.

Note: In order to explain criteria (1), (2), and (3), it will be helpful to select a single non-Humean theory and describe how its proponents might answer (or fail to answer) to the relevant questions. Any theory would do, but I've selected Divine Voluntarism for the reasons mentioned in Section 2.1.

3.1 | Intelligibility

Consider this question for Divine Voluntarism: Are we even capable of understanding the concept of God? If not, the theory is unintelligible. In general, we should like our theories to satisfy the

Intelligibility criterion: An adequate theory must not involve primitives we cannot understand.

One could object that *all* modal primitives, including the notion of God's power, are unintelligible to us. See, for example, Hume's (2000) famous argument that we do not possess the concept of irreducible necessity (*Enquiry*, Section VII). Hume's empiricism about the origin of concepts drives his objection. It has fallen out of favor, and so too have objections to non-Humeanism based on the intelligibility criterion.[10]

Nevertheless, a related worry about intelligibility continues to be very influential. Consider a similar question for Divine Voluntarism: Why *must* God's will be done? In other words, why does God's decree that L *entail* L? In general, we should like our theories to satisfy the

Inference criterion: A theory must include an account of the connection between the modal entities it posits and natural regularities.

Many critics of (certain versions of) non-Humeanism think that the inference criterion is difficult to satisfy *even if* we accept the general intelligibility of primitive modality. This is known as the *inference problem* (Van Fraassen, 1989).

A proponent of Divine Voluntarism might try to solve the inference problem as follows: "We *defined* God as the being such that necessarily its will is done. Provided that God's will and God's power are intelligible, the inference criterion is trivially satisfied." This is an *axiomatic solution* to the inference problem (Schaffer, 2016).[11] The basic idea is this. Whenever we introduce a new primitive, we can—indeed, we must—outfit the primitive with axioms specifying the theoretical role(s) of the primitive and its relation(s) to other primitives in our metaphysics. Provided that the roles and relations associated with God's power and God's will are intelligible, Divine Voluntarism as defined here automatically satisfies the inference criterion. Critics can reject the intelligibility of the modality involved or of the concept of an immaterial thinking thing, but that is to invoke the original intelligibility criterion. For this reason, the inference criterion for non-Humeanism may simply collapse into the intelligibility criterion.[12]

Axiomatic solutions to the inference problem appear to be available to proponents of *all* non-Humean theories. That said, problems of internal consistency can arise, depending on one's other philosophical commitments. For example, both Armstrong and Tooley express a commitment to *categoricalism*, the view that all fundamental properties (and thus genuine universals) have no essential non-trivial modal attributes. Categoricalism seems incompatible with my definition of nomic relation N (see above), since N is characterized by a modal axiom. If that's right, proponents of DTA must restrict their categoricalism so that it does not apply to nomic relations (Bird, 2005).

3.2 | Explanation

We want non-Humean laws to *explain* regularities. Indeed, David Armstrong once quipped,

> Perhaps the regularities need no explanation? If you believe that, I say, you can believe anything. (Armstrong, 1988, 229)

The sense of explanation here is epistemological. The literature on explanation is vast, and I cannot begin to do it justice here, so I'll settle for an illustration by example. Suppose you sit down to play poker, and the dealer immediately deals himself a royal flush (the best possible hand). Now consider this proposed explanation:

> It was not the *dealer* who manipulated the deck. It was a *demon* who wants to guarantee your loss, and she does not trust the dealer to beat you with anything less than a perfect hand.

Let us assume that the hypothesis is intelligible. It entails the observed sequence of hands, so it satisfies the inference criterion. Thus, we are granting that the primitives of the hypothesis do what its proponents say; we are granting that these primitives can *metaphysically* explain. Nevertheless, there is an important sense in which the hypothesis *does not* provide a good explanation.

The question "Why does the demon have *that* preference?" is (at least!) as puzzling as our initial question "Why did the dealer receive that hand?" We have simply pushed the problem back a level. Applied to laws, then, we have the

> *Explanatory criterion*: An explanation of regularities must not replace the question "Why are there regularities?" with a question just as difficult.

Suppose we ask: Why does God decree regularities as opposed to something else? Given how little we have said about God, that question may seem just as puzzling as the initial question about regularities. If that's right, Divine Voluntarism does not satisfy the explanatory criterion.

Primitivism appears to have difficulty with the explanatory criterion as well. We've built almost nothing into the nature of primitive laws. There is no restriction on the kind of sentence to which the "it is a law that" operator can attach, so it's not clear why we should expect primitive laws to give rise to regularities in the first place (Hildebrand, 2013). In other words, the question "Why do primitive laws give rise to regularities as opposed to apparently random property distributions?" seems just as difficult to answer as the question "Why does our world contain regularities?" Positing wholly primitive laws seems to push the explanatory question back a level.

An explanatory shortcoming of this sort may be costly if our epistemic access to non-Humean primitives is by way of their explanatory power.[13] If they cannot explain, we cannot infer them by way of an explanatory inference. However, there are different ways to provide an epistemology for non-Humean laws. Maudlin (2007, especially chaps. 1 and 6) accepts non-Humeanism for different reasons: ontological commitments are "read off" our best scientific theories à la Quine (1948) (see also North, 2013), and Maudlin argues that a non-Humean ontology provides the best interpretation of our theories and associated practices.

However, some non-Humean theories may provide a better explanation of regularities. For example, consider DTA and versions of Dispositionalism or Natural Kind Essentialism that invoke universals in their analyses of laws. No matter which laws they posit, regularities seem to be inevitable, because even enormously complex DTA laws, networks of dispositions, and natural kinds seem to be guaranteed to give rise to regularities in the long run (Bird, 2007; Fales, 1990, chap. 4; Hildebrand, 2013). Thus, these theories may have an easier time answering the follow-up question "Why do our laws give rise to regularities as opposed to irregularities?" Of course, like most of the argumentative moves discussed in this article, this claim is controversial. I'll say more about this—and about other claims concerning explanation—when I consider arguments for non-Humeanism in Section 4.

3.3 | Fit with science

Consider a narrow version of Divine Voluntarism, according to which God loathes non-Euclidian geometries.[14] This metaphysical account of laws does not fit with our best scientific theories of gravitation. Generalizing, we can ask of Divine Voluntarism: Could God will the specific regularities posited by our best scientific theories? To ask a question like this is to appeal to the

> Scientific criterion: A theory should be compatible with our best scientific account of which regularities occur.

In its general form, Divine Voluntarism seems to have no trouble here: any regularity scientists could discover seems to be a regularity that a supernatural being could will. The same is true for Primitivism and for Lange's (2009) and Whittle's (2009) versions of revisionism. They can accommodate any lawlike generalization by making suitable adjustments to their primitive laws, singular subjunctive facts, or singular causal facts.

However, it is at least an open question whether other non-Humean theories can satisfy the scientific criterion. For example, it has been argued that various forms of Dispositionalism and DTA struggle to account for conservation laws (Bigelow, Ellis, & Lierse, 1992; Bird, 2007, 213–214; French, 2014; Schurz, 2011), functional laws (Collins, 2009; Vetter, 2009), fundamental laws involving non-natural properties (Hicks & Schaffer, 2017), laws to the effect that objects are disposed to retain their dispositions over time (Tugby, 2017), and idealized laws (Tan, 2019). Similar problems might arise for Natural Kind Essentialism as well, though it may be less susceptible because it endorses more types of primitive modality (see, for example, Bigelow et al., 1992 account of conservation laws).

There is an important lesson here. As we saw in Section 3.2, some philosophers try to satisfy the explanatory criterion by positing modalities that have a deep metaphysical structure. They rule out irregularities as the sorts of things that can be governed by laws. However, building too much metaphysical structure into a theory may preclude explanations of certain kinds of regularities we might like to explain (Hildebrand, in press). A delicate balance is required to satisfy both the explanatory and scientific criteria.

3.4 | Extravagance

A theory might seem extravagant in one of two ways, corresponding to the following two criteria:

> *Parsimony criterion*: Other things being equal, more parsimonious theories are to be preferred.[15]
> *Naturalistic criterion*: Other things being equal, theories compatible with naturalism are to be preferred.

Before we can apply such criteria we need to know how to interpret them. What is parsimony? For example, does it concern types or tokens? What is naturalism? Is it a metaphysical thesis or an epistemological one? And of course we need to be mindful of the ceteris paribus clauses. It's obvious that Humean ontologies are sparser than non-Humean ontologies, at least in one major respect, but it's not obvious that Humean and non-Humean theories are on an explanatory par. After all, non-Humeans typically think that their ontological additions are worth the cost. Employing such criteria may be especially difficult when comparing non-Humean theories to one another.

Though the preceding questions are difficult, these criteria are very influential. In practice they usually operate metaphilosophically as unargued-for assumptions. For example, Armstrong develops DTA using immanent as opposed to transcendent universals. This is primarily motivated by his commitment to *naturalism*, defined as the view that the spacetime world is all there is (Armstrong, 1997, 5–6, 41). But although Armstrong is committed to this sort of naturalism, he says little in support of it. This is not to say that these aren't good criteria. After all, we have to start somewhere. However, it's important to recognize that in normal philosophical discourse some criteria have a different status than others. Appeals to metaphilosophical criteria are likely to be rhetorically effective within groups with shared metaphilosophical commitments, but rhetorically ineffective outside of them.

3.5 | Relation to other metaphysical issues

One way to motivate a theory is to argue that it fits nicely within a broader metaphysical worldview. For example, it has been argued that accounts of natural necessity are relevant to the metaphysics of

1. Causation,[16]
2. Counterfactuals,[17]
3. Modality,[18]
4. Chance,[19]
5. Grounding and metaphysical explanations,[20] and
6. Properties.[21]

Each of these issues could have its own article in *Philosophy Compass*. (Indeed, some do!) Discussing them with the care they deserve would require more space than I have, but these references should point readers in the right direction.

4 | CONCLUSION: WHY BE NON-HUMEAN?

So, should *you* be a non-Humean? Many of the criteria discussed in Section 3 suggest objections to non-Humeanism, but I've said little about arguments in *favor* of non-Humeanism in its general form. There are many, and I cannot discuss them all here. However, most arguments for non-Humeanism fit into one of two classes.

First, there are objections that attempt to show that Humean concepts of law do not align with either our normal concept of a law or with the concept of law required to make sense of scientific practice. For example, it has been argued that Humeans cannot make sense of the fact that scientists might want to consider a pair of models

that agree on all their particular matters of fact while disagreeing about their laws (Maudlin, 2007, 67–68). It has been argued that Humeans cannot make sense of uninstantiated laws (Carroll, 1994; Tooley, 1977).[22] And it has been argued that the most popular version of Humeanism, namely the Humean best systems account, involves a problematic element of subjectivism about lawhood (Armstrong, 1983, chap. 5). Theoretical criteria like simplicity or informativeness seem to be partially subjective, but we do not normally think that laws are subjective in any sense.[23] Finally, sometimes non-Humeans simply argue that it is part of the concept of a law that it governs.[24] These remain lively areas of dispute. However, at the end of the day, Humeans can treat their account of laws as an *explication* of a fruitful concept of laws rather than an *analysis* of the scientific or ordinary concept itself.[25] That makes it easier to bite the bullet. Thus, whether you find these objections compeling will be highly sensitive to the importance you place on various criteria for a theory of laws.

Second, there is a class of objections connected to the idea that the regularity of nature demands an explanation. When we encounter a well-ordered deck of cards, it's hard to believe that it could be the result of random shuffling. Similarly, it's hard to believe that the regularity of nature is simply a rock-bottom feature of the world with no deeper explanation. This insight features differently in different objections to Humeanism. For example, it is sometimes claimed that Humeanism leads to explanatory circularity. We all agree that in the sciences laws explain their instances (and thus explain regularities), but according to Humeanism the regularities metaphysically explain the laws. This looks like an explanatory circle.[26] Alternatively, some argue that some non-Humean theory provides the *best explanation* of observed regularities, and thus should be accepted.[27] Some non-Humeans build on this claim, arguing that their theory can help to explain why induction is a rational form of inference. In addition to the premise that some non-Humean theory of laws has genuine explanatory power over observed regularities, these arguments require the premise that natural necessities will not change: they are the sorts of things that *must* give rise to regularities.[28] As with the first class of objections, your assessment of these arguments will inevitably be sensitive to the importance you place on various criteria, as well as your background views in epistemology. For example, if you are committed to a version of empiricism according to which inference to the best explanation is not a rational form of inference, you probably will not find the second class of explanatory arguments compelling.

To sum up, your assessment of non-Humean theories will inevitably be sensitive to your preferences. How much do you value the various criteria discussed in Section 3? How important is it that your theory of nomic necessity align with your pre-theoretical intuitions about lawhood? How badly do you want to explain the regularity of nature? I cannot try to answer these questions here, but hopefully I've pointed you in the right direction.[29]

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ENDNOTES

[1] Proponents of Humeanism include Lewis (1973, 1983), Loewer (1996), and Beebee (2000).

[2] "Non-Humean" and "anti-Humean" are used interchangeably in the literature. I prefer "non-Humean", because to my ear 'anti' has a negative connotation. I'm no Humean, but I'm not *anti*-Humean!

[3] For a similar clarification, see Nina Emery (in press).

[4] For discussion of the modality in lawhood see Schrenk (2010) and Wilsch (2018; Manuscript).

[5] Proponents include Carroll (1994, 2018), Maudlin (2007), Kment (2014), Bhogal (2017), and perhaps Woodward (2018).

[6] Armstrong and Tooley disagree about how many nomic relations there are and whether universals are immanent or transcendent. See Hildebrand (2019b) for an argument that DTA requires transcendent universals.

[7] Proponents include Shoemaker (1980), Swoyer (1982), Cartwright (1999), Heil (2003), Molnar (2003), Mumford (2004), Bird (2007), Chakravartty (2007), Tugby (2013b), Vetter (2015), Demarest (2017), and Williams (2019).

[8] If properties are more fundamental than kinds, this view looks like Dispositionalism augmented with governing laws. For discussion, see Drewery (2005) and Keinänen and Tahko (2019). For a summary of different approaches to the metaphysics of kinds, see Bird and Hawley (2011) and Bird (2018).

[9] Versions of Dispositionalism and Natural Kind Essentialism that invoke either transcendent universals or God are examples of theories that are both inflationary and revisionary. For example, Aquinas held that God created a world full of natural kind essences (see Ott & Patton, chap. 1). For contemporary discussion of this sort of Divine Voluntarism, see Dumsday (2013, 145-146). Readers may wish to compare with Adams (2018), who argues that Divine Voluntarists should be dispositionalists.

[10] Wilson (2010) argues that the rejection of necessary connections is difficult to motivate without a Humean theory of the origin of concepts. See Van Cleve (2018) for a recent overview of literature on the acceptability of brute necessities.

[11] See also Tooley's (1987, 77-91, 123-129) discussion of the "stipulative account" of nomological relations.

[12] This is not to say that an axiomatic solution satisfies the inference criterion *without cost*. Presumably there is *some* cost in accepting a new primitive, and thus one might worry that axiomatic solutions trade a problem of intelligibility for a problem of extravagance.

[13] See Hildebrand (2019a) for a recent discussion of this epistemology for non-Humeanism.

[14] Descartes thought that he could derive conservation principles from God's immutability (see Psillos, 2018). This illustrates how the nature of one's non-Humean primitives—in this case, God—can be relevant to the kinds of regularities that a theory can explain.

[15] For recent discussion, see Huemer (2009), Sober (2009), Kriegel (2013), and Metcalf (2016).

[16] See Tooley (1987, 1990), Mumford and Anjum (2011), Bird (2016), and Williams (2019).

[17] See Maudlin (2007), Lange (2009), and Tan (2019).

[18] See Borghini and Williams (2008), Vetter (2015), and Wang (2015).

[19] See Lewis (1994), Hall (2004), Briggs (2009), and Emery (2017).

[20] See Kment (2014), Wilsch (2015), Schaffer (2017), and Emery (2019, in press).

[21] See Demarest (2016) for an overview of the relationship between laws and fundamental properties. See Wang (2016) for an overview of property individuation. These issues are especially important for settling disputes among proponents of DTA and dispositionalism. See, for example, Bird (2007) and Hildebrand (2016).

[22] See Bhogal (in press) for a unified response to the two preceding types of objections.

[23] A recent trend is for Humeans to *embrace* the subjectivism involved in selecting a best system (Dorst, 2019; Hall, 2012; Hicks, 2018; Jaag & Loew, in press). I'm not a fan of subjectivism in general, but these authors do an excellent job of arguing that this sort of subjectivism is not objectionable given a Humean ontology.

[24] See Beebee (2000) for a reply.

[25] See Carnap (1950/1962) on this distinction.

[26] This has been a hot topic in the recent literature. See, for example, Loewer (2012), Lange (2013), Hicks and van Elswyk (2015), Miller (2015), Lange (2018), Emery (2019), Shumener (2019), and Bhogal (in press).

[27] See Foster (1982), Fales (1990, chap. 4), Sankey (1997), Bird (2007), Tooley (2011), and Hildebrand (2013). This version requires solutions to difficult problems. For example, on probabilistic formulations, one needs to partition the space of possibilities to yield the relevant assignment of probabilities (e.g., by way of a principle of indifference), and all general methods of partitioning are very controversial. For discussion see Filomeno (2019).

[28] See Beebee (2011) for an objection to this premise, and Hildebrand (2018) for a defense.

[29] I am indebted to Harjit Bhogal, Tuomas Tahko, Neil Williams, and an audience at Dalhousie University for valuable feedback on earlier versions of this article.

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