and so on. So Bode's law, also known as the Titius–Bode law, is still so called, even though it is widely believed to be merely accidental.

These two conclusions may be combined to give an account of laws which is, in summary:

(L2) The laws of a domain are the fundamental, general explanatory relationships between kinds, quantities, and qualities of that domain, which supervene upon the essential natures of those things. This account is, I believe, in tune with the metaphysical framework that Mumford presents but nonetheless escapes his arguments against laws.

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Mumford presents the friends of laws with a Central Dilemma, either horn of which is supposed to be utterly unpalatable. The thrust of the dilemma is this: laws are either external or internal to their instances. If they are external, they cannot govern (or determine) their instances. If they are internal, they cannot govern (or determine) their instances. *Ergo*, laws cannot govern (or determine) their instances. The role of this dilemma is central to Mumford's argument against laws: they are supposed to have no credible role to play. The dilemma rests on the premise that laws, if they exist, must do something: they must play a governing role. Of course, it is one thing to say that laws play a governing role and it is quite another to say that laws must play *some* role. Mumford (§9.4) agonises a lot about this, but his considered view is that laws must play an *x-role* in virtue of which they make a difference in the determination of the world's history. As Mumford is fully aware, the supposed 'governing role' of laws might be just a metaphor. Still, he thinks his Central Dilemma is powerful against *any* x-role that laws are supposed to play. We shall see later that this is not so. For the time being, let us play along. The Central Dilemma is faulty, anyway.

The first horn of the dilemma begins with the supposition that laws are external to the things they govern, viz., the properties of the particulars that fall under the laws. To fix our ideas, let us say that a

law is external to the properties that instantiate it if the properties do not determine the law, that is if the law can vary independently of the properties that instantiate it. A broadly Humean metaphysics of distinct and separate existences – which are not bound together with any necessary connections – leads to externalism. Even if, for instance, all *P*s are *Q*s, or even if *P*-ness (contingently) necessitates *Q*-ness, it could still be the case that all *P*s are *F*s or that *P*-ness (contingently) necessitates F-ness (where being F is incompatible with being *Q*). Mumford's claim is that if this externalist conception of laws is allowed, there is no story to be told as to how laws govern their instances, that is how the gap is bridged between the law and the things it governs. Mumford focuses his attention on ADT-laws (Armstrong–Dretske–Tooley laws) and claims that even if laws (*qua* contingent necessitating relations among universals) are instantiated in certain causal sequences of events, it is not clear that they govern (or determine) these causal sequences. But what exactly is his argument for this supposed unclarity? In essence (p. 148), it is that the relation of instantiation is distinct from the supposed relation of governing. But given the malleability of 'governing' it is not clear to me that ADT-laws do not govern their instances. If N(*P*, *Q*) is a law, then *P*-ness and *Q*-ness are (contingently) co-instantiated by virtue of the nomological relation N that holds between them. Hence, N(*P*, *Q*) makes it the case that there is a pattern in the actual world, which would be absent if there was no necessitating relation N between *P* and *Q*. It is in virtue of this 'governing' role that laws such that N(*P*, *Q*) support counterfactuals. In my book, this is governing enough. It is a significant fact of the world we live in (that is of its history, in Mumford's sense) that *P*-ness is co-instantiated with *Q*-ness (and hence that N(*P*, *Q*) 'governs' this world) rather than with *F*-ness (and hence that N(*P*, *F*) does *not* govern this world). But it seems that Mumford's real worry is with the contingency of this pattern of co-instantiation. If N(*P*, *Q*) is a *contingent* law, there is a possible world in which *P*-ness and *Q*-ness are not co-instantiated. In this other world, N(*P*, *Q*) would not govern *P*-ness and *Q*-ness, but why does that leave unaccounted for the claim that N(*P*, *Q*) *does* govern *P*-ness and *Q*-ness in the actual world? It does not. To think otherwise is to think that laws, if they exist, must be necessary (they must hold in all possible worlds). Seen in this light, the first horn of the Central Dilemma merely summarises

the claim that laws are not (should not be taken to be) contingent. But this is flatly question-begging!

Mumford's first horn is a non-sequitur. To save it, Mumford brings in the charge of quidditism. If laws can vary independently of properties, Mumford says, properties must be seen as having a quiddity, an individuating factor that makes them what they are independently of their nomic role. Quidditism is supposed to be implausible, incredible, contrary to our intuitions and the like. These are notorious rhetorical devices that, unfortunately, we have all appealed to in some context or another. I wish we had all found more solid arguments that do not appeal to (what we take to be clear and forceful) intuitions. What is so bad with the thought that a property could retain its identity even if its nomic role changed? Approaching this question, we should leave behind epistemic issues. The problem should *not* be that properties are told apart from other properties by means of their causal roles. The problem at hand, Mumford agrees, is metaphysical: what properties are. The thought that Mumford airs and defends is that causal powers are exhaustive of properties (p. 150). I shall discuss this view in some detail later on, but for the time being let us focus on the 'incredible' alternative, viz., that a property retains its identity even if its causal/nomic role changes. Here we are supposed to face a dilemma: either a property has a quiddity that is independent of its nomic role, or a property is (exhausted by) its nomic role. With a bow to Kripke, we may say that this is a false dilemma. A property (e.g., mass) has certain characteristics (some of which may be such that they enable it to do things), but it is (to be identified with) neither (some of) these characteristics nor (with) something 'behind' them. I see no reason to place properties in either of the above straightjackets. We can recognise a property as the same again, to use Frege's phrase, without having to mould it in either of the foregoing straightjackets.

Having said this, I do not think that quidditism is implausible. My prime reason for this comes from Duns Scotus. One (maybe not the most telling) argument that can be extracted from Scotus is that what we call the nomic/causal role of a property is open-ended. (Intuitively, properties can acquire and lose powers.) Because of this, two properties could be distinct even though they may have the same nomic role (as far as we can tell); and conversely, two properties could be identical and have different nomic

roles (since the latter are open-ended). The image of the world as an array of properties with fully completed and (pre-)determined powers is wrong on many counts. More specifically, it is wrong empirically. I am not a friend of (irreducible) powers, but as Cartwright (who is a friend of powers) has noted, "there is no fact of the matter about what a system can do just by virtue of having a given [power]. What it does depends on its setting ..." (1999, p. 73). As a matter of fact, a system may do absolutely nothing at all by virtue of its powers, simply because nothing activates the powers. A stick may have the power to move a rock but something else (an external agent) is needed for the activation of this power. Could it be that Mumford's is an *ideal* image? Could we envisage a completed set of nomic roles for each and every property? Though I think that nomic roles are genuinely open-ended, one could still argue against the idealised image that nomic roles would be the wrong sort of thing to fix the identity of properties. The prime reason for this is metaphysical. The idealised image amounts to causal (or nomic) structuralism: the identity of properties is exhausted by their causal/nomic profile. Structuralism does not cut through isomorphism. Whether or not it made any difference, it would be a significant fact about the world if, say, it were the case that two properties A and B acted in tandem to generate a certain nomic profile Q. Suppose, further, that A or B, taken individually, did not have any further nomic role. Causal structuralism entails that, all else being equal, a world $W_1$with $A\&B$ having nomic profile Q would be identical with a world W_2 in which a *single* property C had nomic profile Q. We may never be able to figure out whether we live in W_1 or W_2, but to make sense of this metaphysical difference we need to go beyond nomic roles. So, if I were forced to play the game of choosing between quiddities and nomic roles, I would go for quiddities. This might be unpalatable, but the palate is something that can be trained to accept strange flavours.

The second horn of the Central Dilemma begins with the supposition that laws are internal to the things they govern, viz., the properties of the particulars that fall under the laws. Mumford urges us to think of some ways in which an internal nomological relation can be specified and then argues that no such relation can be such that the governing or determining function of laws can be accounted for. To fix our ideas, let us say that a relation is internal to its *relata* if it is fully determined by them. Internal relations are,

in this sense, not inflationary ontologically. Reduction or supervenience are such relations. Take, then, someone who thinks that laws are internal to some properties: they 'flow' from them in the sense that they are reducible to, or supervenient on, the properties that feature in the laws. I have no sympathy for this internalist conception of laws, but Mumford's argument against it is far from conclusive. He claims that it is unclear how an internal relation can govern or determine its *relata* (p. 155). But what exactly is his argument for this supposed unclarity? Mumford says that internalist conceptions do not explain how laws *make* one attribute characterise another. Why couldn't an internalist reply as follows? *Making* has a counterfactual implication: the law *makes* it the case that if this object had not been a raven, it would not have been black (or conversely). Blackness would then be *made* a characterising attribute of ravens (see p. 156) in virtue of an internal *nomological* relation between ravenhood (or ravens) and blackness. In the absence of this nomological relation, blackness would simply *be* a characterising attribute of ravens. In any case, there is no conceptual difficulty in thinking that a supervenient relation, in some sense, determines (governs) its *relata*. I take it that being a solid wooden cube supervenes on having six wooden square sides of equal areas, but being a cube determines (in some clear sense) what arrangement must be in place among the elements of the subvenient basis.

So much about the Central Dilemma. Friends of laws are not threatened by it. But something more can be said which is important for the dialectic of Mumford's argument. He sets it up in a way that *nomic* roles play a central role in it. In the externalist horn, they carry the weight against quidditism. In the internalist horn, they carry the weight against the governing role of a supervenient relation. (If that's not immediately clear, bear in mind that, if Mumford is right in his 'implausibility' judgement, internalist conceptions of lawhood too need to avoid quidditism; hence they too need to identify properties by means of nomic roles. But if nomological relations are internal to properties, so are their nomic roles. *Ergo*, supervenient nomic roles do not, argues Mumford, explain the determining function of laws.) So, for the Central Dilemma to get off the ground it is necessary to assume nomic roles. If, as he concludes, there are no laws, there are no nomic roles either. Mumford is happy with this, since his dilemma is a *reductio* of the

thesis that there are laws. But if there are no nomic roles to play with (since there are no laws), quidditism does not sound that bad! Mumford's conclusion removes one of the premises that was centrally employed in its derivation. If the Central Dilemma worked, it would not only reduce to absurdity the thesis that there are laws. By entailing that there are no nomic roles either, it would restore the plausibility of quidditism.

I take it that part of Mumford's positive thesis (see Chapter 10) is to find a substitute for the missing nomic roles. The general rubric for this substitute is the 'modal role' of properties. Properties, Mumford says, are modally loaded (p. 161). Properties are distinct and separate, yet they bear certain relations to each other, viz., relations of necessary connection, exclusion and production (this last covers Mumford's claim that properties have the power or the disposition to bring about things). Properties, we are told, are clusters of powers whose identity is fixed "by extension" (p. 171). Would then *any* set of powers (extensionally understood) constitute (or exhaust) a property? This would be a recipe for disaster. Consider, for instance, the set of all unmanifestable powers. This is a perfectly sensible set (in so far as there are unmanifestable powers), but no sensible (perhaps, no *simpliciter*) property. And what would happen if a property lost one of its powers? Extensionally, it would be a different property, but this is hardly credible! Mumford denies that there is any bundling relation that ties a class of powers together (p. 173), but admits that some powers are internally connected with others: if something has the power to break *easily*, then it has the power to break. But how much mileage can we gain out of such special cases of internal connections? An aspirin (that is the property of being an aspirin) has the power to relieve headaches, the power to produce a white image on the retina of a human eye, the power to go through a slot of a certain size, the power to dissolve in water and many more. (Given the Scotist point made above, an aspirin has an open-ended set of powers; hence it cannot be exhausted by them, anyway). It's hard to see how all these powers can be internally connected to each other. If we claim that all these powers 'flow' from the nature of aspirin, we move too closely to essentialism, which Mumford denounces (rightly in my opinion). If we allow this clustering to be a brute fact, as Mumford seems to suggest, then we cannot explain it in terms of any internal connections. An appealing (to me, anyway) alternative is to think of this

clustering as a matter of law. It might well be that laws hold some powers together. Hence, it seems that we cannot just do with powers. We also need laws as our building blocks. This issue has a ramification. Why is it the case that nothing has the power to move faster than light? The absence of a certain power might also be the consequence of a natural law. The laws that might be at play here might be higher-order (contingent) necessitating relations among universals (as the ADT-view suggests) or regularities. Either way, they seem necessary to offer an informative answer to the clustering relation problem.

The issue raised in the previous paragraph connects with the issue of natural properties. There are plenty of reasons to accept their existence and whatever else we think of them, we should take them to be different from a mere set identified by extension. Mumford does express his hope to explain the notion of a "*natural* cluster of powers" (p. 173). But the explanation will beg several questions unless it is cast in terms of laws: those clusters of powers are natural that feature in natural laws and/or are clustered together as a matter of law. Only this explanation is broad enough to allow for clustering of disparate powers.

Mumford freely talks about the causal role of properties: causal role replaces nomic role. But causation goes hand in hand with laws. Causal role *is* nomic role. One could, of course, take causation to be genuinely singular. But is this view open to Mumford? There is no explicit account of causation in Mumford's book (other than the claim that causation is not reducible to non-causal, non-modal, elements). But I feel that a singularist approach to causation does not sit well with his overall view, the reason being that singularist approaches have a hurdle to jump: the presence of regularity in nature. Singular causation is token-causation. To be able to get regular behaviour out of causal connection, one needs to rise to the level of types. Type-level claims such that property-type A causes property-type B are necessary for explaining regularities of the form All As are B.

One could, of course, get to the level of types by means of inductive generalisations over token-sequences, or by some other kind of explanatory argument. This is not, I take it, the approach favoured by Mumford since he wants to ground causal roles on the internal relations among property-types. So, on Mumford's view (if I read him correctly), causation must be general: it must connect property-types.

If it is general, there is hope, at least, that it can explain regular behaviour. Causation itself is not an internal relation if only because it implicates external (spatio-temporal) relations among its *relata*. To say the least, a full account of causation in terms of internal relations among properties will require some external relations too. Even if this is granted, Mumford's approach cannot avoid the inference problem – that is the problem of how we pass from relations among properties to regularities in the world.

Contrasting his views with the ADT-view of laws (which does face the inference problem), Mumford (p. 197) claims that his own appeal to internal relations among properties evades this problem, the reason being that an internal relation is not something added on to its *relata*. Using the 'governing' metaphor, Mumford claims that modal properties are self-governing. Suppose we grant that "there is no gap across which properties must exert their influences" (p. 197). How can we get from the fact that there is an internal relation between property *A* and property *B* to the fact that all *A*s are *B*? Perhaps, there is an answer to this question if properties have the determinable/determinate relation. But the much more interesting cases of what Mumford calls "dispositional necessity" (p. 177) are recalcitrant. Even if property *A* necessitates property *B* (where this necessitating relation is internal), it does not follow that all *A*s are *B*. The former relation is consistent with no *A*s being *B*. To use a quick-and-dirty example, though drinking a quart of plutonium necessitates death, there is no such regularity (for obvious reasons).

Mumford insists that Humean theories of laws are vacuous *qua* theories of *laws*, since, he claims, the Humean metaphysics is lawless. Though it is true that Humean laws are regularities, it is not true that regularities are not the sort of thing laws consist in. Only if we pack the concept of law with claims about necessary connections is it the case that regularities are not laws. But this is flatly question-begging. Humeans reduce laws to regularities but, contrary to what Mumford says (p. 26), they do not reduce them away. What then about this metaphor of the governing role of laws? Some Humeans (notably Helen Beebee, 2000) protest that this metaphor is already loaded with non-Humean connotations. She claims that the 'governing' metaphor requires that laws must do something, but denies that Humeans have to take seriously this requirement.

I am not so sure that Humeans have to follow her counsel. As Mumford rightly claims, the governing metaphor is a loose meta-

phor. A Humean can live happily with it. This metaphor goes back to the eighteenth century and the idea that the world works like a mechanically working time-keeper. Arguably, Newton thought of the world as a clock and clocks (those bulky tower clocks) required a governor's regular adjustment in order to be kept in time. Arguably, Leibniz thought of the world as a watch (*montre*) and watches (those that used a pendulum to regulate the motion of the weight) did not require governors: they were self-governing, as it were. I am not claiming any historical accuracy here, but a Humean conception of laws might well employ this self-governing metaphor: regularities (like the regular motion of the pendulum) govern themselves, thereby placing constraints on whatever falls under them. When we say, for instance, that Newton's law 'governs' the motion of the planets we can simply mean that the motion of the planets is subsumed under a wider (more fundamental) regularity. I have claimed elsewhere (2002, pp. 292–293) that the right way to think of the Humean conception of laws is that it is committed to the world having a certain structure of regularities.

The driving force behind Mumford's (and others') charge is the claim that there is necessity in nature which anything less than modal properties leaves unaccounted for. To paraphrase Anscombe, I think these are the dogmatic slumbers of the day. 'Necessity in nature!' We'd better find some other reason.

A last word: I have been critical, but I strongly believe that Mumford's book is outstanding. In it, there is novelty, much sound argument and insight. What more could one expect from a philosophy book?

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Author's Reply

By Stephen Mumford

I cannot do justice in this short reply to the wealth of criticism that the commentators have provided but I will indicate where any disagreement lies on my part and point to other places where I address some outstanding issues.