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To sum up, *Nietzsche and Science* includes enough substantial scholarship and fresh approaches to deserve recommendation. Most of the work included is both accessible and of interest even to non-specialist students of the brush-bearded philosopher. Those with a strictly analytical background should be prepared, however. Especially the pieces by Babich and Acampora are likely to test their patience. Hussein's, Brobjer's and most other essays, by contrast, would make for a reasonably smooth transition into the field of historical Nietzsche exegesis. Those interested in nineteenth-century science *per se* will be additionally pleased by the descriptive and anecdotal detail that saturates the book nearly throughout. It should be added that despite the stated overall goal of the collection – namely of highlighting both breadth and depth of Nietzsche's scientific preoccupations – one can hardly help noticing in many of the essays a thematic preponderance of the discipline of physiology. This leaves one with the impression that, while a constant source of his imagery and in some respects integral to his work, Nietzsche's active philosophical engagement with the natural sciences was somewhat limited in scope after all.

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Stephen Mumford: *Laws in Nature*. London & New York: Routledge 2004, ISBN 0-415-31128-4; £ 65.00, EUR 96,50 (Hardback); xvi + 230 pages

The theory that there are real laws of nature is the view that there are certain fundamental truths about the world that explain the world's regularities. In his recent book, Mumford asks the metaphysical question whether there are laws *in* nature, whether laws describe something real in the natural world. His reply is a resounding no. He outlines and motivates an alternative, according to which all the world's necessity can be found in powerful modal properties and their relations, a view he calls *realist lawlessness*. It is *realist* in so far as it agrees with the nomological realist view that there is natural necessity in nature; it is *lawless* in so far as it disagrees that laws are responsible for this nomic role. Mumford argues that talk of a metaphysics of laws is a harmful metaphor, which results in a misleading view of the universe as consisting of discrete and inert categorical properties which depend upon the laws of nature for animation. Mumford attacks this view by arguing for two central claims: that there is no existing credible account of the role of laws and that once realist lawlessness is accepted there is no vacant role that laws would be needed to fill anyway.

This book is a refreshing and stimulating discussion of laws aimed at both the scientist and the metaphysician. It not only presents an interesting alternative view to nomological realism, but also a dilemma argument against the claim that real laws play a governing role in nature. The book is suitable reading for advanced undergraduates, postgraduates and academics in both the sciences and philosophy.

In Chapter 1, Mumford presents three competing metaphysical pictures of reality, *Humean Lawlessness*, *Nomological Realism* and his own *Realist Lawlessness*. The rest of the book is divided into three sections, one for each of these pictures. The first two of these provide a comprehensive and detailed discussion of a central debate in metaphysics and the philosophy of science regarding Humean and realist views of laws of nature. Contrary to the usual portrayal of the regularity view of laws, Mumford claims that the Humean metaphysic is in fact lawless. He characterises the central dispute between Humeans and Realists as directly related to the inferences that they make from the denial or acceptance of necessary connections in nature. The Humean denies that there is natural necessity in nature, which according to Mumford, entails that there are no laws in nature. In contrast, the realists affirm that there is natural necessity in nature, which they take to entail that there are laws in nature. In Section III, Mumford advances his own theory of Realist Lawlessness, which

denies the inference from natural necessity to laws: that natural necessity is a necessary but not a sufficient condition for laws. I turn now to these sections in further detail.

In *Section I*, Mumford sets out an alternative reading of the Neo-Humean Regularity View of Laws. The standard construal of the regularity view claims that laws simply are or supervene upon regularities. This way of reading the regularity view understands it to be a realist theory of laws. Mumford argues that this is misleading, as he takes regularity theorists to believe neither that there are laws nor that there is causation. The naïve regularity view (attributed to Hume) claims that the inference from observed regularities to a necessary connection is grounded in epistemic facts about our habits and practices, rather than in any real necessary connection in nature. The sophisticated Neo-Humean regularity view (Mill, Ramsey, Lewis) holds that regularities must cohere with other regularities and that the laws will be expressed by the best systemization of reality, one that combines the best combination of simplicity, strength and coherence. Mumford argues that the grounding feature that distinguishes laws from accidents on both these views is epistemic, rather than ontological.

It is not clear that Mumford's account here does justice to the sophisticated regularity view of laws, at least in David Lewis's version. Lewis took great pains to give his account an ontological component in so far as it is not coherence or generality alone that allows us to consider a generalisation a law but it must also fit with other truths to make a best possible system. The system must fit reality in so far as all of the world's lawful regularities would be derivable from it, whereas the accidental ones would not. *Contra* Mumford's this seems to assume that the world does indeed have a neat nomological structure. Admittedly, it is an open question whether several systemisations might compete in their representations of reality so that finding the *best* system may become difficult or impossible. Lewis's (1994: 232) reply to this is that if fortune favours us that the best system will come out best and that if it does not then lawhood might be merely a psychological matter. Mumford takes this to be a concession on Lewis' part that there is a psychologistic element in his account. For this reason, he takes even the most metaphysical of the sophisticated regularity views to be epistemic rather than metaphysical.

Mumford makes the interesting claim that attempts to spell out the epistemic commitments that determine the regularity we attribute to nature have misconstrued the original metaphysical sentiment of the Humean picture. So, Mumford's alternative metaphysical reading of Hume denies that laws should be understood in the epistemic way that they have been interpreted in the literature. So Mumford accepts the Lewisean (1986b: ix) reading of Hume which portrays Hume in a distinctly ontological vein; namely as the great denier of necessary connections in nature, rather than as a regularity theorist about laws. It is interesting to point out that in fact Mill, who is the earliest proponent of the more sophisticated regularity view goes to great lengths in *A System of Logic* (1843) to distance his epistemic regularity view of laws from the more metaphysical views of Hume and Reid. Therefore, earlier empiricist readings of Hume's regularity view corroborate Mumford's reading of Hume. I might add then that the regularity theory of laws, understood in its epistemic sense should really be attributed to Mill.

Pure Regularity theory, according to Mumford, depicts a world of unconnected particulars with no intrinsic causal powers and no real laws. Mumford uses the title *Pure Regularity Theory* to signal his reading of Hume in a distinctly metaphysical light. So, Mumford does not interpret Hume as simply making the epistemic claim that we cannot rationalise the necessity we impugn to nature, but the far stronger negative metaphysical claim that there is in fact no necessity in nature. Although, Hume did not explicitly discuss laws of nature, Mumford takes this entirely contingentist view of the universe to entail an anti-realist conception of laws.

Mumford argues that it is Hume's account of modal knowledge, which motivates his claim that there is no necessity in nature. He agrees with Hume that an object's causal powers cannot be known *a priori*, but denies Hume's further claim that we cannot know them *a posteriori* either. This is a direct result of Hume's conceivability criterion of possibility, which motivates the claim that because it is *conceivable* that an event *A* might not be followed by an event *B*, although they have been constantly conjoined in the past. Therefore, it is possible that *A* & *B* are not necessarily connected. However, Mumford argues that since, our psychologies are not good indicators of what is ontologically possible, we should not draw metaphysical conclusions about possibility based upon what we can conceive. In particular, the conclusion that there is no necessity in nature is motivated by the conceivability criterion of possibility. Moreover, as Mumford rightly points out, even taking the Humean view on board, there is a responsibility for anyone who accepts this lawless metaphysic to explain why there appears to be so much order and regularity in nature. For the remainder of this book, Mumford takes up this challenge with great zeal.

Section II addresses the commitments we would need to make if we were to accept that there are necessary connections in nature. In particular, Mumford examines nomological realism, where the inference from necessary connections in nature to the existence of laws in nature that are grounded by this necessity, is made. Some may feel that the inference from necessity to laws is obvious. However, Mumford outlines a nomological argument, a position he takes to be based on the inference from necessary connections in nature to laws in nature. The nomological argument moves from the claim that there is a set *S* of features in the world to the claim that *x* (the laws of nature) are responsible for *S*. Now what philosophers take *S* to be varies a great deal (e.g. regularities, order, universality, objectivity, explanation, prediction, necessity or counterfactualty). Nevertheless, they are all broadly committed to the claim that there are some such features *S* in the world.

It is the inference from *S* to the claim that laws are responsible for *S* that Mumford rejects. First of all, alternative possibilities have not been considered. It is not clear that laws are the only characteristics that could ground *S*. Moreover, there is always the possibility that *S* is a cosmic coincidence. Therefore, the nomological argument cannot directly substantiate laws. Although the nomological argument is judged unpersuasive, Mumford examines some of the metaphysical packages provided by different realist theories of laws, in case some theory of laws might substantiate our inference from *S* to the claim that laws of nature ground the modal facts. In particular, he examines both the nomic necessitarian and essentialist views of laws of nature.

On a nomic necessitation view of laws, (Dretske (1977), Tooley (1977), Armstrong (1968)), laws are taken to be higher order universals; they are relations whose relata are first order-universals. For any law there is a relation of natural necessitation between two universals *F* & *G*:

$$(1) N(F, G)$$

Laws do not relate particulars directly. Rather, they relate the universals that those particulars instantiate. Moreover, the natural necessitation relation entails the universal conditional used to express the law by material implication:

$$(2) (N(F, G)) \rightarrow (\forall x (Fx \rightarrow Gx))$$

Therefore, the relation 'N' of natural necessitation grounds both the law and the features 'S' that the realist wants to hold onto. One of the chief difficulties with this account is that the 'N' relation is obscure. For one thing, it seems jointly to possess both necessity and contingency. So, despite the relation N, in the nomic necessitation view of laws, it is contingent which properties nomically necessitate which other properties. So, although the relation of natural

necessitation happens to pertain to our world, there could be another possible world where it does not in fact hold and where the laws of nature are different. Hence,, on this view the governing role of laws is external to the properties that are instantiated in the instantiations of those laws. The problem is that there is nothing essential that makes the properties behave in the way that they do. If one accepts that laws are external to properties, then the identity of a property must be entirely independent of laws. The only thing that could then determine the identity of a property despite a change of laws is an individual essence of a property (a *quidditas*). The problem then, according to Mumford, that faces a nomic necessitation view of laws is that it entails quidditism about properties.

On an essentialist view of laws, the governing role of laws is internal to the properties of the ontology. Essentialists claim that the laws of nature spell out the essential properties of natural kinds. All members of a natural kind have the same essential properties. The problem that faces this view is that if the activity of particulars is provided entirely by the presence of essential powerful and causal properties then there is no job left for the laws to do. Therefore, essentialism is really a reductive picture. The governing role of laws is reduced to the powers possessed essentially by the properties of natural kinds.

Now as we have seen on the necessitarian view of laws, laws are external to the properties that they govern and on an essentialist view of laws, laws are internal to the properties that they govern. Mumford, in Chapter 9, presents a central dilemma argument against the view that laws play a governing role, either external to or internal to the properties they relate. If laws are external to the properties they govern then the identity of a property must be entirely independent of the law, which entails quidditism about properties; and if laws are internal to their properties, then it is unclear how laws could play any governing role. In fact, it would seem that laws are then reduced to those properties. So, since one way or the other it is unclear how laws can play a governing role, we ought to reject the claim that they do. In other words, eliminativism is our only option.

Now if we accept eliminativism about laws, ought we to reject the claim that there are necessary connections in nature altogether? In Section III, Mumford claims not; once the harmful laws metaphor is eliminated, then the path is paved for a new metaphysical picture; *realist lawlessness*. Mumford provides a metaphysical argument for the claim that the world's properties are powerful. The properties provide the world with natural necessity and possibility and they are the truthmakers of modal truths. Mumford's argues that the metaphysical picture is corroborated by the amount it explains. Firstly, by accepting a metaphysical picture with powerful properties the difficulties that arise from the central dilemma are avoided. There is no need for laws, so we need not explain their governing role. Moreover, the world is animated by its properties (rather than its laws) and relations between the properties provide the necessary connection that we think grounds the regularity and order perceived in reality.

So how can properties replace laws? According to Mumford, the identity of a property is determined by the relation(s) it bears to other properties in the cluster of properties. Necessary connections in the world are grounded in powerful properties. Therefore, a dual metaphysics of laws and properties is replaced simply by a singular metaphysics of powerful properties whose essence and identity are determined by their place in the web of properties. Moreover, there is no extra *quidditas* that is possessed by the property independently of its role in relation to others. Mumford argues *pace* Lewis that the actual world contains necessity and possibility as intrinsic features *de re*. Mumford uses Armstrong's (1998, 2004c) combinatorial model of natural necessity and possibility as a good model for articulating modal truths. However, his model is more relaxed than Armstrong's because he relaxes the instantiation requirement for properties. Therefore, a property can remain logically possible even though it has never in fact been instantiated in the actual world. Possibility for Mumford

is grounded in powers and the other connections between properties. Therefore, this view has the attraction of apparently accommodating both necessity and possibility.

Thus, Mumford's chief metaphysical argument to support realist lawlessness is that it accounts for many of the things that neither the nomological realist nor the Humean Lawless accounts can explain, while at the same time avoiding many of their difficulties (including the central dilemma) which face the two alternative views; nomological realism and dispositional essentialism. One of my difficulties with this kind of argument is that it rests on a realist intuition about a metaphysical grounding for natural necessity. An empiricist might just respond by agreeing that this is what we might like; namely a conceptually tidy picture of reality, but denying that we have in fact any reason to respect this intuition regarding natural necessity. Cosmic coincidence remains a possibility. It seems then that the realist and the empiricist are still at loggerheads about the modality of possibility. Some further justification other than this realist intuition is needed to establish Mumford's metaphysical picture.

Mumford's account also faces more specific challenges, some of which he neatly addresses in chapter 11. His dilemma argument against nomological realism is considerably interesting, but his metaphysical picture could use more development and defence. Firstly, I am unsure as to whether the holistic picture of properties that he portrays is as unproblematic as he claims. He claims that a holistic view of the world is more attractive than its alternative. However, is this essentially the same realist intuition we have already considered? We might ask attractive to whom? It would be attractive to a realist, but we don't want an argument that merely preaches to the converted. Secondly, in spite of his case to the contrary, I remain unconvinced that the dispute is metaphysical rather than verbal. Realists about laws might claim that in fact what Mumford has done is given a reductive account of laws by providing their truthmakers. So, in fact both the nomological realist and the lawless realist might be seen to be undertaking the same metaphysical task (i.e. seeking the ground of necessity) and the claim that one is a lawless metaphysic whereas the other is lawful is merely a linguistic debate. Thirdly, it is unclear why he thinks he can remain non-committal on what we take clusters of properties to be. In fact, in order to differentiate his account from the nearby essentialist one, he needs to explain why these clusters cannot be arranged into a hierarchical natural kind structure as an essentialist like Ellis might argue. This is even more important in so far as the distinction between the elimination of laws (which Mumford endorses) and the reduction of laws (which the essentialist endorses) depends on whether laws are needed to describe the essential properties of natural kinds. Putting this another way, given certain accounts of clusters of properties, might we not claim that laws are needed to explain the relations between properties in a natural cluster?

Whatever the strength of these challenges to Mumford's account, one of the most important contributions of this book lies in its re-interpretation of Humean metaphysics. The misunderstanding of this metaphysics by contemporary metaphysicians has corroborated and reinforced what Mumford calls the laws metaphor, making a laws metaphysic seem like our only option. By locating the problems associated with this limited metaphysical viewpoint in the misunderstanding of the Humean problem in the first place, Mumford has cleared the conceptual ground for some new and interesting lawless alternatives and has gone a long way towards developing one of them. This book makes an excellent contribution to the laws of nature debate.

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