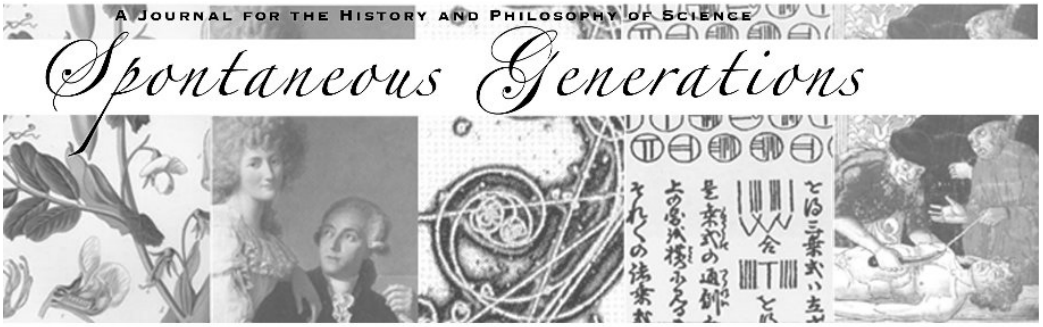

REVIEW: Marc Lange, *Laws and Lawmakers: Science, Metaphysics, and the Laws of Nature.*

Author(s): Christopher Belanger

Source: *Spontaneous Generations: A Journal for the History and Philosophy of Science*, Vol. 4, No. 1 (2010) 266-269.

Published by: The University of Toronto
DOI: 10.4245/sponge.v4i1.12682

E D I T O R I A L O F F I C E S

Institute for the History and Philosophy of Science and Technology
Room 316 Victoria College, 91 Charles Street West
Toronto, Ontario, Canada M5S 1K7
hapsat.society@utoronto.ca

Published online at jps.library.utoronto.ca/index.php/SpontaneousGenerations
ISSN 1913 0465

REVIEWS

Marc Lange. *Laws and Lawmakers: Science, Metaphysics, and the Laws of Nature.* xvi + 257 pp. Oxford: Oxford University Press, 2009.*

Christopher Belanger†

In *Laws and Lawmakers: Science, Metaphysics, and the Laws of Nature*, Marc Lange has presented an engagingly written, tightly argued, and novel philosophical account of the laws of nature. One of the intuitions behind the notion of a law of nature is, roughly, that of the many regularities we observe in the world there are some which appear to be due to mere happen-stance ("accidental" regularities, in the philosopher's jargon), while others, which we call "laws," seem to be possessed of a degree of necessity. For example, if the only music ever to come out of my stereo system during the entirety of its existence were that of James Brown, we would term this an accidental regularity: it seems that it *could* have been otherwise had the world been different, perhaps by the stereo having a different owner or my having different tastes. On the other hand, the various relations and properties that determine the electrical functioning of my stereo seem more necessary and lawlike: presumably Ohm's law would have held even had my stereo never been built.[1] But even if Ohm's law is somehow necessary, it seems less necessary than other "broadly logical" truths. Certainly Ohm's law *could* have been different, perhaps by a factor of two, yet it seems unreasonable to say that the number 6 *could* have been prime. Although many philosophers, and certainly most scientists, will readily agree that there is a difference between logical, law-like, and accidental regularities, spelling out the nature of this difference has proved a remarkably difficult task. It is precisely this puzzle which Lange intends *Laws and Lawmakers* to address. In this review I shall first give a quick and broad outline of Lange's account of natural laws as

* Accepted February 2010.

† Christopher Belanger is a PhD student at the Institute for the History and Philosophy of Science at the University of Toronto. His interests range broadly across the philosophy of science, with emphasis on the philosophy of physics. His current work is on chaos theory, determinism, and underdetermination.

[1] "Ohm's law" is the name given to a particular relation between voltage, current, and resistance. Although this relation is called a law, by referring to it as such I do not wish to beg the question of its lawhood.

I understand it, followed by a brief summary of the contents of the book, and then close with a few critical comments.

Lange's account is ontologically and metaphysically "thick," in that laws are real elements of the universe independent of what we know or think of them at any point in time. This sets Lange's position in opposition to many of the popular deflationary accounts of laws, in which laws are seen as elegant yet strictly false summaries of knowledge, propositions which best summarize contingent yet unnecessary regularities in nature, or otherwise somehow more closely akin to human constructions than real elements of the world. One of Lange's major claims is that we can come to know the laws of nature through logical analysis, since they can be identified in a non ad-hoc way as exactly those truths belonging to sets with particular logical properties. This is not to say that Lange is embracing a completely rationalist account of laws, since presumably which propositions are true of nature can only be determined through empirical means. Lange's analysis relies heavily on counterfactuals and modal logic. Although he does briefly introduce both of these concepts, readers should be aware that he assumes a degree of familiarity with them.

Lange begins with the observation that counterfactuals whose consequents involve laws seem to preserve their truth values under a wider range of antecedents than those involving mere accidents. Consider the antecedent "Had the world exploded at 9:02am...," which renders false a large number of counterfactuals involving accidental facts ("...you would still be reading this review") but seems to leave untouched those involving laws ("...Ohm's law would still have held"). Of course, the antecedent "Had Ohm's law not been a *law*..." renders false most counterfactuals involving Ohm's law, but this seems qualitatively different from the previous example: while the first antecedent concerns facts, the latter antecedent concerns a fact *about* facts. Based on this observation, Lange develops the idea of a hierarchy of facts, each level of which constrains (or "governs"), but does not exhaustively determine, the level below it (p. 18). On the bottom level sit the sub-nomic facts, which are facts about nature which contain no nomic terms and do not 'boss around' any other facts (e.g. "In this circuit voltage equals current times resistance"). Above them sit the nomic facts, which constrain the sub-nomic facts (e.g. "It is *a law* that in this circuit voltage equals current times resistance"). Above the nomic facts there sits another layer of meta-laws such as symmetry principles, which constrain the nomic facts, and so on. Lange declines to place an upper limit on this hierarchy, deferring to science to tell us where it ends (p. 19).

Lange's proposed definition of lawhood hinges on the notion of "sub-nomic stability." Informally, a set of sub-nomic truths is sub-nomically stable "if and only if whatever the conversational context, the set's

members would all still have held under every sub-nomic counterfactual (or subjunctive) supposition that is logically consistent with the set" (p. 29). Sub-nomic stability thus captures the preservation under counterfactuals that was outlined above, while at the same time ruling out the sorts of law-laden, and therefore *not* sub-nomic, antecedents that caused problems. Lange's major claim is that the set of first-order laws, which he calls "Λ," is the largest non-maximal sub-nomically stable set. Furthermore, for a truth to possess a certain kind of necessity, in other words *for a truth to be a law*, is just to belong to such a non-maximal sub-nomically stable set (p. 46).

This is a difficult concept, and the remainder of the book is dedicated to the elaboration, exploration, and defense of the idea. In chapter 2, Lange argues that the concept of sub-nomic stability can be extended to apply to any level of the hierarchy of facts, at each stage generating a more exclusive and necessary set of laws. Lange's account thus provides an uncontrived explanation of the different varieties of necessity possessed by different sorts of facts, from totally unnecessary accidents, to sort-of necessary natural laws, to very necessary logical truths. In chapter 3 Lange develops some further advantages of his account. First, it allows a tidy explanation of why the laws must be immutable, or valid for all times and in all places. Second, it extends naturally to meta-laws, such as symmetry principles, which are laws governing other laws. Finally, Lange's account also deals naturally with the relationship between chancy facts and deterministic laws, something which previous accounts of natural law–in particular David Lewis's Best System account and David Armstrong's theory of metaphysically necessary relations among universals–could account for only through ad hoc tweaking (p. 122). The fourth and final chapter outlines one of the most interesting, and certainly most controversial, suggestions in the book, which is that subjunctive facts constitute the "ontological bedrock" of the world (p. 136). That is, subjunctive facts are the lawmakers: rather than laws supporting counterfactuals, as is often assumed, the situation is quite the reverse. Although a fuller discussion of this point is impossible here, I have no doubt that it will inspire a lively debate.

Lange's arguments are meticulous in their detail, and he takes great pains to identify and meet possible objections. However, as with all metaphysics, one's prior sensibilities will colour one's reception of some of his arguments. For example, those who favour parsimony in nature may be alarmed to learn that if m is a law, then all logical consequences of m are also laws, and thus Λ must be a very large set indeed (p. 16). Even beyond simplicity considerations, defining conjunctions of laws as themselves laws makes it difficult to see how laws could be confirmed by their positive

instances. If the conjunct of two totally unrelated laws, say one concerning cows and one concerning uranium, is also considered a law, some have argued that it is difficult to see how observation of a compatible cow should lend confirmational support to the claim about uranium (cf., for example, Maudlin *The Metaphysics Within Physics* [Oxford 2007], 35-36). This is not a decisive counterargument in the least, but it does raise interesting questions about laws and confirmation on Lange's account. In my estimation the book contains at least one weak argument, which is also the last. Lange proposes a *reductio* to prove that the laws of nature must not have any "gaps" in them, or leave the outcome of any event totally unspecified (p. 181-88). Space and format prohibit a fuller discussion here, but there is evidence that Lange himself considers the argument somewhat incomplete, particularly since the end notes contain a summary of an apparently unpublished debate on the subject between him and John Carroll. Still, in his own words, Lange has never been afraid to stick his neck out, and if the book ends on a slightly uncertain note that should only serve as encouragement that there is yet more work to be done.

Those familiar with Lange's previous work, and in particular with his *Introduction to the Philosophy of Physics,* should have gathered that *Laws and Lawmakers* is very different in both tone and intent. Although Lange is a patient and gifted communicator, this book is not meant to serve as an introduction to the philosophical literature on laws of nature. Rather, it is a focussed and technical argument for Lange's own position and, as such, other philosophical accounts of nature's laws enter the picture only as foils for his own proposal. It is thus somewhat strange that the book's back jacket indicates that it is targeted not only at professional and aspiring philosophers, but also at "undergraduate scientists interested in the logical foundations of science." It is certainly not my intent to deter any potential readers, but they should be warned that at least some philosophical training and familiarity with modal logic are highly recommended. Notwithstanding these caveats, those with the background and the interest will find *Laws and Lawmakers* a fascinating and challenging read, certain to advance the debate over the laws of nature.

CHRISTOPHER BELANGER
IHPST, University of Toronto
91 Charles Street West
Toronto, Ontario M5S 1K7
chris.belanger@utoronto.ca