

Roberts, John T. 2008. *The Law-Governed Universe*. New York: Oxford University Press (407 pages, Euro 66,99).

John T. Roberts develops a refreshingly unorthodox way to answer the question “what is law of nature?”. Roberts’s book is refreshing because it does not have the goal to defend a view on either side of the great, unmoving Humean/anti-Humean divide in the debate on laws of nature. Instead it might be an apt understanding of Roberts’s intention to say that he suggests that the distinction is often unfruitful and he wants to convince his readers to supersede this distinction. Roberts positively argues for an account of laws he calls the *measurability account of laws* (henceforth, MAL). Roberts’s book divides into 10 chapters and an Appendix.

In chapter 1, Roberts convincingly motivates why it is *important* to ask the question “what is a law of nature?” in the first place – a section that is often underdeveloped in many philosophy books. According to Roberts, a person informed by contemporary science entertains a view which Roberts calls “the law-governed world-picture” (p. 26). This “world-picture” is summarized by the conjunction of the following four claims:

1. THE LAWHOOD THESIS: There is a distinct class of facts, or true propositions, fittingly called the *laws of nature*; alternatively, there is a property fittingly called *lawhood* that some but not all facts or true propositions (and no false propositions) have.
2. THE DISCOVERABILITY THESIS: Science is in principle capable of discovering which propositions are the laws of nature [...].
3. THE GOVERNING THESIS: The laws of nature govern the universe in some non-figurative sense of “govern”. It is not just that everything behaves *as if* it were governed by laws; the evolution of the universe *really is* governed by laws.
4. THE SCIENCE-SAYS-SO THESIS: We can be justified in believing that the laws of nature govern the universe [...] without appealing to any extra-scientific source of epistemic justification (p. 26).

It is a bit misleading that Roberts calls the *conjunction* of these four theses “the law-governed world-picture”, because one could easily get the impression that he is only referring to the Governing Thesis. However, in order to follow Roberts’s discussion of other views, it is important to keep in mind that he is in fact referring to *all* of the four claims. Roberts claims that an adequate account of laws should preserve these four claims: “If we are interested in the most basic question of metaphysics – ‘what is reality like?’ – and we are inclined to take modern science seriously, then we should be interested in the question whether the law-governed world-picture is accurate [...] and how exactly that picture should be interpreted” (p. 4). Roberts’s MAL is intended to be an explication of laws respecting the law-governed picture of the world (for the sake of brevity, I will mostly ignore the Science-Says-So Thesis). The basic idea of MAL is that it is a “meta-theoretic” approach to laws, i. e. lawhood is explicated with respect to the specific *role that lawful propositions play in a theory T*. To be a law depends on playing a specific role in our *representations* of the world (a theory, whatever a theory may be) – it does *not* depend on the *world* itself. As the name of Roberts’s theory indicates, the law-role consists in guaranteeing the reliability of *measurements*: “what it is for someone to regard something as a law of nature is for it to be one of the principles that guarantee the reliability of the methods they regard as good measurement methods” (p. 37).

In chapter 2, Roberts defends several ‘received views’ concerning laws of nature: most, importantly that, first, laws are true propositions (including *ceteris paribus* laws which Roberts explicitly considers to be true and not “lying”, pp. 48–50), and, second, that laws are metaphysically contingently true propositions (see pp. 56–79 for a critical discussion of dispositional essentialism).

In chapter 3, Roberts explains the *meta*-theoretic aspect of MAL. According to Roberts, MAL is a meta-theoretic approach to laws because it assumes that the conjunction of the following three claims is true:

- MT1: A proposition P is a law of a theory T iff P plays a role R within T (p. 91).
 MT2: “A proposition P is a law of nature” is true at a world w in a context k iff there is a theory T such that T is salient in k, T is true at w, and P is law of T (p. 113).
 MT3: A theory T is salient in a conversational context k if T “comprises all the true theoretical commitments of the members of the extended epistemic community of the speakers” (p. 117).

The meta-theoretic outlook encoded in MT1–3 has important implications for the features of law statements: there is no such thing as a law *simpliciter*. A statement has the property of lawhood *only relative to a theory* T (as MT1 says). Moreover, the truth-conditions for law statements are context-dependent (as MT1&2 state). This is an innovative feature of Roberts’s approach (which is also to be found in a different form in the work of Roberts’s colleague Marc Lange, see Lange 2000, 2009). Roberts argues that if the laws are characterized in this meta-theoretic fashion and if the laws bear an intimate relationship to reliable methods of measurement (I will return to this point shortly when I focus on chapter 8), then the sciences have in principle the means to discover which propositions play the law-role in a given theory T (Discoverability Thesis).

In chapter 4, Roberts presents one of his main arguments for MAL: the “epistemological argument”. The upshot of this argument is that any non-meta-theoretic account of laws is unable to support the law-governed world-picture, while MAL is able to do so. Roberts explores two traditions that are non-meta-theoretic: Lewis’s best system analysis and Armstrong’s necessitarian account. According to Roberts, these accounts of laws are non-meta-theoretic (“first-order”) because lawhood depends on features of the (concrete or abstract features of) the world (e.g. regularities, relations between universals). By contrast, lawhood – meta-theoretically conceived – depends on the features of our representations of the world. According to the best system analysis, one can discover the laws by observing the regularities in the world. Thus, the Discoverability Thesis is true. However, one has to pay a price for this success: the best system analysis fails to support the Governing Thesis, because according to Lewis the law statements are *mere summaries* of contingently obtaining regularities. On the other hand, Armstrong’s necessitarian account can indeed make sense of non-metaphorical governing: laws govern in the sense that there is a necessitation relation among universals (N(F,G)). Yet, as Roberts argues at length, Armstrong’s view faces an epistemological problem concerning the Discoverability Thesis: Armstrongian laws are radically underdetermined by particular facts in a world. That is, two worlds might agree on all the particular facts and still differ in the nomic facts. Hence, there is no evidence in these worlds that enables us to determine what the laws are, because all the evidence we could ever have is evidence of particular facts. Therefore, Armstrong’s account cannot underwrite the Discoverability Thesis. In the sections 4.3–4.7, Roberts provides a thoughtful and illuminating discussion of several objections against his epistemological argument.

In chapter 5, Roberts argues for the Governing Thesis. What does it mean that a law governs? One option is that laws are somehow causally active entities. This is a view that Roberts rejects (because propositions cannot be causes). The option Roberts in fact explores is this one: given that laws are propositions, governing consists in the modal fact that laws are “inevitably true” (p. 175). Roberts spells out the idea of inevitable truth by drawing on Marc Lange’s concept of nomic preservation (see Lange 2000, 48f.; 2009, 20). Roberts captures the preservation of the laws under counterfactual non-nomic circumstances as follows: for all non-nomic propositions P and Q, if Q is consistent with the lawhood of all

and only the actual laws, and the lawhood of all and only the actual laws logically entails P (i. e., a sentence of the form “it is actually a law that ...” entails P), then: if Q were the case, then P would be the case (cf. p. 191). Roberts argues that the laws govern (that is, they are inevitably true) to the extent that the laws conform to the principle of nomic preservation. Chapter 6 addresses the follow-up question “When would the laws have been different?”. In chapter 7, Roberts advocates the claim that nomic preservation is not an empirical claim that can be tested. Rather, nomic preservation is an “indispensable presupposition of scientific inquiry” (p. 257). Roberts uses this claim in order to support the Science-Says-So Thesis.

In chapter 8, Roberts describes how laws and measurements are related. Any *empirical* scientific theory T is accompanied with a set of procedures for measuring the quantities postulated by T. “Legitimate” measurement procedures require measurement reliability conditions. The latter are expressed as follows: “Whenever C, K(P, Q) where C is some condition such that we can tell whether it is true via empirical means, P is some quantity we are already able to measure, and Q is a quantity we would like to measure [K represents a correlation, A. R.]” (293). In analogy to nomic preservation, Roberts argues that (a) reliable measurements are indispensable for empirical science, and (b) reliable measurements essentially involve counterfactual statements. This thought is captured in the *legitimate measurement preservation*: for any proposition A that is logically consistent with all of the true propositions about which methods are legitimate measurement procedures, and any proposition C that is entailed by the truths about which methods are legitimate measurement procedures: if A were the case, then C would be the case (p. 287). The upshot of measurement reliability conditions for MAL can be reconstructed in terms of the following explication of a law of nature: A proposition P is a law of nature iff there is a theory T such that (1) T is salient in k, (2) T is true at w, and (3) P plays *the law-role*, i. e. P is a *logical consequence of the propositions expressing measurement reliability conditions relative to T* (p. 292, 323–325). This definition comprises MT1, MT2, MT3, and it specifies the law role in terms of measurement reliability conditions.

Chapter 9 summarizes the MAL account in the light of the preceding eight chapters. Chapter 10 is a pledge for MAL as an account of governing laws which is nonetheless compatible with, among other things, Humean supervenience. The Appendix nicely shows how MAL can be successfully applied to theories of (classical) physics. It is worth emphasizing that Roberts is optimistic that MAL might also do work as an explication of laws in the special sciences: “for example, perhaps the principle of natural selection is a law of the Neo-Darwinian theory of evolution, on the ground that it underwrites the reliability of methods of measuring fitnesses [...]” (p. 381).

I will conclude by raising four worries for Roberts’s interesting MAL.

First, Roberts argues in Chapter 10 that MAL is compatible with the claim of Humean supervenience. According to Humean supervenience, nomic facts supervene on non-nomic facts. However, it is not entirely clear *why* Roberts thinks that MAL and Humean supervenience are compatible. In fact, a problem seems to arise because Roberts uses “non-nomic” ambiguously. On the one hand, he uses “non-nomic fact” in the sense of particular fact – this is the orthodox sense presupposed in the debate between Humeans and anti-Humeans. On the other hand, Roberts uses “non-nomic” in an idiosyncratic way such that “f=ma” expresses a non-nomic proposition, while “it is a law that f=ma” expresses a nomic proposition. The second reading is not the one used in the debate on the metaphysics of laws of nature. Even if it is the case, according to MAL, that the nomic-facts (in the idiosyncratic reading) supervene on the non-nomic facts (in the idiosyncratic reading), it does not follow that it is also the case that the nomic-facts (in the orthodox reading) supervene on the non-nomic facts (in the orthodox reading). Roberts is in need for an argument in favor of the latter supervenience claim.

Second, Roberts has been one of the harshest critics of *ceteris paribus* laws (see Earman & Roberts 1999). In his book, he is more liberal and claims that MAL is compatible *ceteris paribus* clauses. He suggests that a proponent of *ceteris paribus* clauses should *feel free* to hedge the measurement reliability conditions by a *ceteris paribus* clause (p. 48). However, I think it is not merely an *option* to attach a *ceteris paribus* clause to measurement reliability conditions. Quite the contrary, Roberts's own characterization of measurement reliability conditions clearly relies on an *in-built* *ceteris paribus* clause: the "set-up conditions" of a measurement procedure specify "that whatever *enabling* conditions must be in place for the measurement to be possible are true, and that any *interferences* or *defeating conditions* that would disrupt the measurement are *absent*" (p.275, my emphases). This is precisely the kind of *ceteris paribus* clause to which Roberts has objected in earlier writings.

Third, from a Humean point of view one might still want an answer to the following questions: what are the truth-conditions for the counterfactuals that figure in Roberts's central principles of *legitimate measurement preservation* and *nomoc preservation*? Can Roberts account for the typical logical features of counterfactuals (see Loewer 2011: 38f who addresses this question to Lange 2009)? Although it is *more obvious* to ask these questions from a Humean point of view (because Humeans prefer a reductive account of truth-conditions for counterfactuals), the questions remain for anti-Humeans. Unfortunately, Roberts does not provide a semantics (nor a logic) for the conditionals that are essential for MAL. This is a weakness of the account that Roberts should get rid of.

Fourth and last, even if one accepts the context-dependent semantics and the theory relativity of law statements, one might object that specifying the law role by reliable *measurements* is too *subjective* and, in fact, dispensable for the metaphysics of laws. One might agree with Roberts that reliable measurements are essential for successful science because these methods capture how scientists test their theories. However, one might remain unconvinced by Roberts's suggestion that this methodological observation cuts any metaphysical ice – that is, whether measurements tell us what laws *are*. A natural objection runs as follows: if Roberts aspires (among other things) to provide metaphysical insights about laws, then his account requires that certain counterfactuals are true (relative to a theory T). Whether scientists are able to reliably test whether these conditionals are true is methodologically crucial – but not metaphysically. In other words, certain counterfactual dependence relations obtain between the magnitudes referred to by the relevant theory T (in context *k* and a world *w*). However, these dependence relations would hold even if there were no people carrying out measurements (or if the right conditions are not in place for any measurement device to work at all, e.g. because of extreme temperatures). It would be helpful if Roberts provided a more elaborated account of what an objective measurement is and how this account deals with such (apparent counterexamples).

Despite this challenge, I want to emphasize that Roberts has written an original, unorthodox and stimulating book. I warmly recommend it to everyone working on laws of nature and related areas in philosophy of science and metaphysics.

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References

- Earman, J./Roberts, J. 1999. *Ceteris Paribus*, There is no Problem of Provisos. *Synthese* 118, 439–478.
- Lange, M. 2000. *Natural Laws in Scientific Practice*. New York: Oxford University Press.
- Lange, M. 2009. *Laws and Lawmakers*. New York: Oxford University Press.

Loewer, B. 2011. Book Symposium. Counterfactuals all the way down? Marc Lange: Laws and lawmakers. *Metascience* 20, 27–52.

Woodward, J. 2003. *Making Things Happen*. New York: Oxford University Press.

Ebert, Theodor/Nortmann, Ulrich. 2007. *Aristoteles: Analytica priora, Buch 1*. Berlin: Akademie (924 pages, EUR 98.00. ISBN 978-3-05-004427-9).

This book is an important and much-needed contribution to the history of logic. It offers an up-to-date German translation of *Prior Analytics* Book 1, an introduction to Aristotle's system of syllogistic which is easily approachable, a detailed bibliography, and a full and lengthy commentary which takes up the bulk of the book (pp. 209–906). The translation is accessible, and the commentary is thorough – it covers all parts of *An Pr* Book 1, which includes the non-modal syllogistic and the modal syllogistic. Ebert is mostly responsible for the commentary on the non-modal syllogistic, Nortmann for the commentary on the modal syllogistic. The discussion of the modal syllogistic covers both the apodeictic (i. e., the syllogisms about necessity) and the problematic (i. e., the syllogisms involving possibilities). There are a number of features of this book which contribute to its value. First, the up-to-date German translation of *AnPr* Book 1 would even on its own make the book an important advance. Second, the extensive commentary contains impressive detail. The authors have included in their commentary very helpful discussions in which they review different ways scholars have sought to explain the interpretive puzzles that arise from Aristotle's text. This places the interpretive discussion right in among the exegetical material, and provides a useful link, as well, to recent secondary literature. All of these features combine to make the book essential reading for anyone working in this area. In fact, the commentary is so rich and thorough that we might hope to someday see an English translation.

The commentary provides line-by-line discussions of famous interpretive puzzles about Aristotle's logical system, and it is Ebert and Nortmann's approach to these which we make the focus of this review. For whenever the project is interpreting Aristotle's logic there are certain questions which arise immediately. The first of these must be about when and whether the crucial interpretive problems are due to the minutiae of Aristotle's Greek, and when they are due to the logic. When it is the latter then a further question arises about whether it is appropriate to give a *formal* representation of Aristotle's logic – a representation using some logical system which modern readers know how to understand. Ebert and Nortmann clearly think this is appropriate in the analysis of Aristotle. They aim their commentary and interpretation at philosophers and set out a formal representation of Aristotle's logic using standard modern tools. This places Ebert and Nortmann's study in a special class. In recent years some interpreters have sought to explain Aristotle's syllogistic without getting involved in any formal representations. In fact such approaches have proved rather popular – but any reader who demands rigour and precision will want more. Ebert and Nortmann provide more. And it is certainly one of the book's great strengths that their commentary is guided at all stages by the spirit of capable logicians.

Ebert and Nortmann use standard lower predicate calculus to represent Aristotle's non-modal syllogistic premises, and modal predicate logic to represent Aristotle's modals. The use of predicate logic is sometimes supposed to be a controversial matter. But once an interpreter has made the decision to give a formal representation, then using predicate logic is not usually any real problem since most other formal representations of Aristotle's logic can be translated into predicate logic with no loss of clarity. One immediate effect of Ebert and Nortmann's use of predicate logic is that on the whole they make it relatively easy for a philosophical reader to begin to be able to appreciate the real logical structure of Aristotle's approach in *AnPr*.