MEASURING AND GOVERNING

John T. Roberts, *The Law-Governed Universe*. New York: Oxford University Press, 2008. Pp. xii + 407. US$ 100.00 HB.

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John Roberts' treatise on laws of nature sticks out of the bulk of philosophical literature on the topic for two reasons: first, it presents an original theory of law-hood, the so-called *measurability account of laws* (MAL), and second, Roberts' argument in favour of that account is of transparent conditional form. He starts with four theses that characterize his pre-theoretic understanding of the notion of a law of nature, and then argues that MAL theoretically reproduces those four theses; hence, MAL can be said to be adequate conditional on the truth of those pre-theoretic assumptions. By contrast, standard studies of lawhood normally aim to produce unconditional knockdown arguments for corresponding theories, with the result that rival analyses are often implicitly guided by incompatible pre-theoretic intuitions as to the ontological, epistemological, or methodological status of laws. In consequence, respective debates tend to end in unprofitable standoffs between the two major theoretical camps: the Humeans who, in the broadest sense, opt for anti-realist and reductionist accounts of lawhood and the Non-Humeans who endorse realist and non-reductionist views. By laying his pre-theoretic cards on the table from the outset and by thus setting a clear agenda for his discussion, Roberts succeeds in steering around this impasse.

On the one hand, Roberts shares the metaphysical scruples of the Humeans and, correspondingly, subscribes to Humean Supervenience. Moreover, on his view, what counts as a law of nature is not independent of our way of theorizing about nature and of the scientific practices we adopt. On the other hand, he joins in with the Non-Humeans in claiming that laws of nature govern the world in more than a mere metaphorical sense. This middle course is determined by the four theses Roberts' account is designed to theoretically capture (26):

Lawhood: There is a distinct class of facts, or true propositions, fittingly called *the laws of nature*.

Discoverability: Science is in principle capable of discovering which propositions are the laws of nature.

Governing: The laws of nature govern the universe, in some robust, non-figurative sense of 'govern'.

Science-Says-So: We can be justified in believing that the laws of nature govern the universe without appealing to any extra-scientific source of epistemic justification.

Furthermore, he chooses a terminology according to which laws of nature are true propositions that can be subdivided into a *Core Set* comprising the most fundamental laws and a *Closed Set* consisting of the logico-mathematical closure of the Core Set (52).

Roberts' argument in favour of MAL has two parts: in the first part, chs. 3-4, he contends that the combination of Lawhood, Discoverability, and Governing can be reproduced only by a *meta-theoretic* account of laws, and the second part, chs. 5-9, is devoted to establishing that a specific variant of a meta-theoretic account, the measurability account, is needed to mirror both Governing and Science-Says-So. A meta-theoretic account of laws differs from what Roberts calls a *first-order* account insofar as the latter takes statements of the form "P is a law of nature" to be the primary analysandum, whereas the former considers "P is a law of theory T" to be primary. Subject to a first-order account, it is not excluded that two theories share all non-nomic content but disagree with respect to the lawhood of certain propositions, which, according to Roberts, creates significant problems for such an account. By contrast, Roberts requires a meta-theoretic analysis to reveal some particular role a proposition plays within a theory, the so-called *law-role*, which must be determined by the non-nomic content of the theory only. Consequently, there cannot exist two theories that differ only nomically. Roberts then suggests that, given a meta-theoretic analysis of lawhood, first-order law statements can be understood along contextualist lines (113):

(MT2) '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 a law of T,

where "[t]he default salient theory in a context k is that theory which comprises all the true theoretical commitments of the members of the extended epistemic community of the speakers" (117).

Chs. 5 and 6 are concerned with spelling out Governing by means of counterfactual conditionals. Roberts evaluates counterfactuals based on standard Lewisian semantics, but adopts a radically different similarity measure for possible worlds. Very roughly, while Lewis takes possible worlds to be similar if they have maximal factual overlap and slight nomic differences, Roberts requires complete nomic overlap for similarity. As a result, deterministic worlds that are governed by the same laws may count as similar even though they have no factual overlap whatsoever. Based on this similarity measure, Roberts then claims that laws govern the universe in the sense given by (NP), where "@-laws" designates the laws of the world at which (NP) is asserted (191):

(NP) $\forall Q \forall P$(if Q is consistent with the lawhood of all and only the @-laws, and the lawhood of all and only the @-laws logically entails P, then $Q \,\square\!\!\rightarrow P$).

Since (NP) provides a sufficient condition for the truth of certain counterfactuals and the latter cannot be empirically confirmed, (NP) itself is not empirically confirmable. We can only be justified in believing (NP) if it is shown to be an indispensable presupposition of all scientific reasoning (ch. 7)—analogously, say, to the principle of the uniformity of nature. In ch. 8, Roberts then argues that the only place in empirical science where non-trivial counterfactuals play an indispensable role is when it comes to recognizing something as an observation or measurement, which, after all, constitutes the ultimate source of evidence for all scientific inquiry. Calling some action 'measurement' presupposes a commitment to the counterfactual reliability of the relevant measurement procedure. Legitimate measurement procedures require *measurement reliability conditions*, or MRCs for short. MRCs are of the form "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" (293). Every scientific theory T comes with a set of MRCs that guarantee the counterfactual reliability of the procedures that measure the quantities T is about. In chs. 8 and 9, Roberts contends that the logical consequences of the MRCs of T are just the laws of T. The core of this measurability account of laws can be expressed as follows (292, 324-325):

(MT) P is a law of T iff P is a logically contingent logical consequence of the propositions that are MRCs according to T.

Roberts concludes his argument by defending the claim that the laws of the theories that are salient in scientific contexts, on account of (MT2), yield just the laws of nature that govern the universe as articulated in (NP). All in all, he maintains that (MT) and (MT2) theoretically reproduce all four theses that constitute his pre-theoretic starting point.

Although Roberts' overall argument is clearly spelled out, the details of his analysis are not transparent at all points. For instance, the truth conditions of (NP) remain indeterminate. Given Roberts' preferred similarity measure for counterfactuals, according to which complete nomic overlap is necessary for similarity, it seems to be a conceptual truth that the same laws (which entail P) govern all the closest Q-worlds, as stated by $Q \boxright P$. Nonetheless, while Roberts insists on the truth of (NP) in scientific contexts, in ch. 6 he extensively discusses a number of counterfactuals whose truth-values he takes to render (NP) false in non-scientific contexts. In fact, however, none of these counterfactuals satisfies the antecedent of (NP), for the consequents of none of them are actually entailed by corresponding @-laws. Hence, none of Roberts' alleged counterexamples to (NP) de facto renders (NP) false. Should it turn out that, in the end, (NP) indeed is a conceptual truth, it can hardly be considered an adequate representation of Governing, which, at any rate, is not tautologous. Even if there should actually exist real counterexamples to (NP), the contextualist character of (MT2) makes me doubt that MAL could possibly yield more than a figurative anti-realist notion of Governing.

Moreover, Roberts does not sufficiently substantiate (MT). For instance, he claims that for some laws—e.g. Newton's third law—it holds that all of their "special cases can serve as a reliability condition expressing the reliability of some method of measurement" (384, similarly 330). According to (MT), therefore, it must be possible to deductively recover such a law from its special cases. However, no arbitrarily long conjunction of special cases of a law P, which constitute MRCs of a corresponding theory, actually entails P. To retrieve a law from a set ϕ of its special cases, an additional assumption is needed stating that ϕ contains *all* of P's special cases or *all* physically possible cases of a particular type. Yet, such a completeness assumption, presumably, is not itself an MRC. What is more, while Roberts argues at some length that if P is a law of T, P is entailed by the MRCs of T, the other direction of the biconditional asserted by (MT) is not really substantiated.

In sum, while Roberts opens up an original path around traditional pitfalls of debates about laws of nature and points to hitherto unthought-of interdependencies between scientific practices and the notion of lawhood, the details of this path remain to be worked out before its merits can be conclusively assessed.

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