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Review of Stuart Glennan, *The New Mechanical Philosophy*

Philippe Huneman^{*†}

Stuart Glennan, *The New Mechanical Philosophy*. New York: Oxford University Press (2017), 256 pp., \$42.95 (cloth).

Stuart Glennan has been producing now for 2 decades major contributions to the concepts of mechanism and mechanistic explanation in philosophy of science. It might be fair to say that, together with Bill Bechtel, Lindley Darden, and Carl Craver he has helped to elaborate a view of scientific explanation that now shapes the debates on explanation in our discipline. It is therefore a notable event in the history of ‘mechanism’ in philosophy of science when Glennan writes a whole book to explain his conception, defends it against other understandings of mechanism, and forges, on this basis, a joint account of what ‘explain’ means and of how the world should be, so that explanation is possible.

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Thus, *The New Mechanical Philosophy* is an important book both for philosophers interested in explanation and for metaphysicians eager to make sense of causation, laws, kinds, and other metaphysical concepts. This essay review starts by presenting some of the book’s major claims and arguments, emphasizing aspects that struck me as original with respect to what has already been published by Glennan and others in the context of mechanical philosophy. The last part will engage more precisely with some novel contributions made by the book.

Part of the strength and importance of the book lies in the attempt to make “mechanism” into a central concept tying epistemology of science

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to metaphysics. Articulating together two theses, about science and about the world, Glennan writes that “scientific methods are chiefly directed toward the discovery and representation not of laws but of mechanisms” and also that the “phenomena that constitute our world are the products of mechanisms: car engines are mechanisms for rotating drive shafts, etc” (3). Such a dual thesis entails that “the New Mechanical Philosophy is a view both about nature and about science. The philosophical views in this book are accordingly at the intersection of natural philosophy and the philosophy of science” (9). Hence, Glennan situates himself in the tradition of the Mechanical Philosophy so influential in the seventeenth century after Descartes and the Cartesians, a philosophy according to which laws of Cartesian—or later Leibnizian or Newtonian—mechanics govern the things whose assemblage constitute the world. Nowhere more than in this book is made obvious the fact that the hallmark of philosophical mechanism is such a unity of epistemology and ontology. While Pascal famously summarized Cartesianism by “tout se fait par figures et mouvements,” Glennan, Craver, and the New Mechanism say that “entities,” “activities or interactions,” and their “organization” are the major explanantia and rulers of everything. Yet in a more recent history, Glennan relates the New Mechanical Philosophy to “a shift in focus amongst philosophers from thinking about laws to thinking about mechanisms and from thinking about theories to thinking about models” (7).

The book starts with a definition of “mechanisms” nourished by the theoretical elaborations of these notions since Glennan (1996) and Machamer, Darden, and Craver (2000). “I call minimal mechanism: A mechanism for a phenomenon consists of entities (or parts) whose activities and interactions are organized so as to be responsible for the phenomenon” (27). The author discusses in detail what entities, activities, and organization should mean, as well as “responsible,” justifying why one must add “interactions” to “activities.”

Glennan holds a specific perspective within the New Mechanicism community, and in this book the difference with other approaches is firmly explained. While for Craver mechanism is something in the world and explains as something in the world—instantiating the mechanists’ suspicion regarding the Hempelian assumption that explanations are arguments—Glennan holds a “model first” approach to mechanistic science that allows us to think that explanation is always done by the model. This position is defended in chapters 2 and 3, devoted to mechanisms and mechanism models. The rest of the book could be seen as revisiting two major metaphysical notions: kinds and similarity on the one hand (chaps. 4 and 5) and causation of the other hand (chaps. 6 and 7). Then the last chapter proposes a typology of explanations in general, considering what could be out of the reach of mechanist explanations.

Glennan’s “model first” position has several important consequences. First, the New Mechanism accounts for the distinction colloquially made by

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scientists between “phenomenological” and “mechanistic” models: models “are . . . representations that describe (in some degrees and respects) the mechanism that is responsible for some phenomenon. As such, mechanistic models are to be contrasted with phenomenal models, which may be useful for describing and predicting the behavior of a mechanism, but do not explain how that behavior is produced” (66).

Second, it allows conceiving of the unity of different systems even though mechanisms are always particular and different: “particular mechanisms fall under a kind in virtue of their being adequately represented by a certain kind of model” (14). While Glennan situates himself within a move away from laws in philosophy of science, he can account for the generality of scientific explanations by relying on this “model first” approach, and an important part of the book is devoted to exploring the conditions under which similar mechanisms fall under kinds. The claim here is that “entities are of the same kind when a same model can be used to represent them” (88). Talking of the “use” of models entails that kind-ness is not purely ontologically defined. To this extent, some pluralism is included in the understanding of kinds and types. Yet, ultimately not any use is possible: uses of models are still constrained by reality, and this prevents kind-ness and similarity from being purely subjective.

Third, while many mechanists subscribe to Salmon’s (1985) famous distinction between ontic, epistemic, and modal explanations and consider mechanistic explanations as ontic explanations (i.e., setting the phenomena into the causal structure of the world), Glennan argues that those varieties of explanations are not competing ones but are three aspects of a complete scientific explanation (220). All explanations have an *epistemic* element (the fact that any explanation is representation intended to explain something) and an *ontic* element (i.e., that “what actually occurs in the world” decides on the value of an explanation). Regarding the “modal” aspect, Salmon’s original distinction relied on a too strict understanding of “modal” as appealing to a non-Humean view of causal necessitation (such as Harré and Madden’s; Glennan, 221). However, the modal aspect of explanations consists in their always being about dependence, even though dependence is not necessitation. Given that Glennan recognizes that not all dependence is causal dependence, this integrated view of the three dimensions of explanations appears as one of the most complete pictures of scientific explanation.

This departure from Salmon’s threefold distinction also goes with a departure from Salmon’s view of causation as production: in a word, Glennan rejects Salmon’s insistence on physical processes as making up causal relations and holds a less physics-centered view of causal production. All and all, the book takes great care in both expressing its debts to Salmon’s view and specifying what separates the New Mechanism from Salmon’s influential conceptions of causation and explanation, which undoubtedly were a condition of its emergence in contemporary times.

More generally, the book is rich in important model-based distinctions to be considered: distinguishing mechanisms from systems and processes; differentiating constitutive and nonconstitutive mechanisms (depending on whether the whole system yields the outcome or a sequence of parts' activities eventually causes it); distinguishing input-output mechanisms, mechanisms producing phenomena with no input, or homeostatic mechanisms; distinguishing one-off and recurring mechanisms; and distinguishing the types of mechanisms' etiologies.

From the metaphysical viewpoint, Glennan argues that causation has to be understood in the context of mechanisms, rather than trying to make sense of mechanism based on causation. "C causes e" is true in case there exists a mechanism by which c contributes to the production of e (155). Thus, for Glennan several kinds of mechanisms give rise to various aspects of causation.

The metaphysics of causation is generally concerned by the difference between two classes of accounts, one that focuses on relations of dependence (such as difference making) and another that considers mostly production, often derived from Salmon's influential view of causal processes and interactions. Hall (2004) famously argued that this implies the heterogeneity of two concepts of causation. Glennan devotes two chapters to account for those two dimensions in his "model first" mechanical philosophy. He calls 'production' and 'relevance' the two aspects of causation. He argues that, first, mechanisms, as underlying causation claims, make true the production and relevance claims (155) and, second, production is more fundamental because "causal relevance claims are comparative claims about actual or possible causal mechanisms" (155). The whole view respects the initial commitment that mechanisms are particulars and that what exists are essentially particulars. Hence, Glennan subscribes to Anscombe's idea that ontologically, first, there exists various activities of nailing, heating, tying, and so on, and then we appeal to general terms like "cause" in order to build representations of processes that include many distinct activities (184).

Distinctions about causation are at the same time epistemological. While "one very important way to explain why some phenomenon occurs is to show how that phenomenon occurs, . . . sometimes you can explain why something is without showing how it happened" (68). "Showing how" defines complete mechanisms; saying why—in the sense of pointing out a dependence—without showing how is what Glennan calls "bare causal explanations." In such explanations, actually "cause" and "explain" are synonymous (226).

A noticeable consequence of the claim that explanations are based on mechanisms, which are particulars, is that the long-standing difference between explanation and narration in philosophy appears as one of a degree. Historical narratives are precisely explaining why by showing how, like mechanisms and unlike bare causal explanations. Glennan's interesting

thesis says that “the chief difference between historical and scientific narratives is not one of kind, but of degree. Historians . . . are concerned more with the explanations of singular events. . . . Scientists, conversely, tend to be more concerned with more robust mechanisms that give rise to more regular phenomena” (85). Another difference is that mechanisms involve both causal and constitutive relations, while historical narratives privilege causal links.

Hempel also wanted a theory of explanation that includes historical explanations. Since according to him explanations were nomothetico deductive, he considered how the principle of rationality could play the role of one of the laws, in the argument supposed to constitute the historical explanation. In Glennan’s view, mechanisms involve some narration, since events lead to other events. Notwithstanding the generality of the entities and activities considered, “there is still a story to be told.” And inversely, historical narratives describe how interactions and activities of the individuals produce what happens, especially how they constitute “larger interactions and events”: these narratives are thus a sort of mechanistic model.

q3

This claim has an interesting consequence. Nowadays, social science as well as biology use computer simulations such as agent-based models. Those are arguably instantiating a kind of narrative: agents do such and such things, those other things happen, and we end up understanding the system in the way we listen to a story. Thus, Glennan’s monistic claim about narratives and mechanisms captures this growing affinity between natural and social science, as he indicates (84). Epstein’s notion of “growing artificial society” (Epstein and Axtell 1996), or supporters of quantitative history along the lines defined by “Cliodynamics” (Turchin 2003; see papers in the journal of this name), exemplifies such an affinity: simulations indifferently model growth and behavior of organisms, species, communities, and societies.

Glennan’s argument is attractive because it dismisses a misguided epistemological divide. Mechanisms are particular, even though there are kinds of mechanisms: they can explain one-off phenomena, there even exist “ephemeral mechanisms” whose etiology may rely on chance. So from the viewpoint of mechanism the fact that an event is unique, while some properties are general, cannot justify an essential difference between two sorts of explanations. Yet, having dissipated the illusion that the difference between singular events versus general features entails an epistemological difference leaves room for another classical difference, not addressed in Glennan’s theory of narratives, namely, reasons versus causes. In historical narratives, one understands not only by identifying individuals and their activities—which, put together with others’ activities, are responsible of the phenomena—but also by pinpointing reasons for these activities. Otherwise two similar activities could contribute to divergent narratives because their reasons are not the same: killing is an activity and can be involved in a historical narrative. But depending on the reason to kill, it can be a mass shooting, terrorism, a pilot

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committing suicide, and so on, and corresponding narratives will greatly differ. Those domains of social science that use simulations are often interested in a level where behaviors aggregate in a way that this difference in reasons somehow average away, and here Glennan's equivalence thesis holds. Yet, at the level before aggregation, there are still narratives to be told that are possibly not mechanisms.

This leads me to question the limits of mechanisms. Glennan is much aware of this issue, and the last chapter, a major achievement in the book, tries to map the whole domain of explanations; he distinguishes "bare causal explanations," "mechanistic explanations," and "non causal explanations." He clearly avoids the sort of hubris sometimes attributed (often wrongly) to mechanists: not all explanations are mechanistic. Regarding noncausal ones, he insists that some explanations rely on properties of space and therefore are not mechanisms strictly speaking: "All causal mechanisms act within some space, and . . . sometimes the best way to explain how these mechanisms behave or where they end up is . . . to show how the structure of that space (its geometry or topology) constrains or shapes the behavior of those mechanisms. Space here is a metaphor that can be cashed out in various ways to yield different varieties of non-causal explanation. The space might be physical space-time itself . . . a social space, or a fitness landscape, or indeed the state space of any dynamical system" (230). I agree that properties of space can be by themselves explanatory—in the sense that the explanandum may depend only on them—which makes the explanation mechanism-free. However, one could be reluctant to see space as a "metaphor." Two avenues of answer (at least) occur here.

One could resist Glennan's intent to make room for noncausal explanation. Mechanisms requiring activities or interactions, entities, and organization, space as a metaphor could ultimately mean organization itself. Thus, the purported noncausal explanations would be in fact explanations in which organization plays the major explanatory role, not entities and their interactions. Craver might advocate such a solution. The other answer would, on the contrary, acknowledge the autonomy of spatial property as explanatory—but not as physical space. What physical space, phase spaces, social space, and so on, have in common is not that they are related by a metaphor, but that they instantiate various mathematical spaces. Thereby, they include explanatory resources in virtue of them being instances of those spaces. So here, mathematical structures defining those spaces are what explains. Interpreting the "metaphor" as a family of mathematical structures allows one to stand with Glennan's characterization of such explanations as noncausal. Debates over the limits of mechanistic explanations may eventually hinge on the choice between those two answers to Glennan's idea of space as a metaphor.

To conclude, I will emphasize the impressive wealth of detailed examples used to support Glennan's analyses, ranging from cognitive science to

q5

quantum physics and embracing evolutionary biology, physiology, or war history. Together with the rigor, systematicity, and originality of the argumentation, this recommends the book to any reader interested in the epistemology of science, the metaphysics of causation or kinds, and above all their interrelations.

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Q1. Au: Your article has been edited for grammar, clarity, consistency, and conformity to journal style. Please read the article to make sure that your meaning has been retained. Note that we may be unable to make revisions that conflict with journal style or create grammatical problems. Thank you.

Q2. Au: Do you intend “New Mechanicism community” (as written) or “New Mechanism community”?

Q3. Au: Is “there is still a story to be told” quoted from Glennan? If yes, please provide page number.

Q4. Au: Do you intend “responsible of the phenomena” here (as written) or “responsible for the phenomena”?

Q5. Au: Please clarify sentence beginning “Mechanisms requiring” here, especially “interactions, entities, and organization, space.” Should it be “interactions, entities, organization, and space” or “interactions, entities, and organization or space” or something else?