In any case, resolving that dispute is not the real payoff of this excellent book. Alongside a cogent, integrated reading of Hobbes's philosophy of religion, we are given a real sense of where to place it within the sweep of modern philosophy and social science. Bayle and Hume (appreciative) and Leibniz (critical) emerge as particularly astute readers of Hobbes on these themes. Hobbes can also be read as a forerunner to the idealist George Berkeley, who devised a better-known expressivist theory of religious language (13). Holden has provided us with an entirely new understanding of Hobbes's contribution to the Enlightenment. And if, in more modern contexts, some aspects of Hobbes's philosophy of religion (its psychological projectionism) anticipate modernists like Freud, others anticipate Wittgenstein, Austin, and modern language philosophy. Holden has convincingly demonstrated the theoretical centrality of Hobbes's philosophy of religious language, almost all of which has "performative use" rather than descriptive value (21). It is no major complaint that this merely advances, rather than decisively closes, the debate about the "real" nature of Hobbes's religion. That debate is almost certainly unresolvable, but anyone approaching it henceforth will need to start with this book.

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Jill North, *Physics, Structure, and Reality.*
Oxford: Oxford University Press, 2021. x + 252 pp.

This is a very good book. It addresses central questions about the interpretation of physical theories; it develops, in a nuanced way, some important possible answers to these questions; the writing is clear; there is diligent attention to the literature; and the author's philosophical temperament—open-minded, resourceful—is vivid throughout. Furthermore, the writing is, by the standards of much of the current literature in philosophy of physics, nontechnical. So the book forms a natural entry point for philosophers who want to learn about these questions and this literature.

In this praise, I concur with several previous reviews: a happy convergence. (It is just unfortunate that this review is late, owing to administrative delays that are the fault of neither this journal nor this reviewer.) And accordingly, I propose to use this review as an invitation to newcomers to the subject.

So I will spell out some main themes and claims of North's book, leaving details (and corrections) to other reviews and the journal literature.

North is concerned with a cluster of questions about how we infer, and how we should infer, features of the world from successful physical theories that are mathematically formulated. Her opening chapter announces that she will address these questions as a scientific realist of a "standard or old-fashioned type" (9): fine by me! She also announces that her overarching theme will be that what we can and should infer is *structure*: hence the book's title. But she qualifies this statement in two ways. Again, both are fine by me. Indeed, the first is surely uncontroversial; namely, according to the views she will develop, these inferences, even when impeccable, are defeasible: scientific realism should be fallibilist.

The second qualification is that although her book is largely nontechnical and she will engage with some recent literature about the analytic metaphysics of physics, nevertheless she does not take 'structure' to be contrasted with 'intrinsic nature', in the way that much current discussion of so-called structural realism does. Thus it is not part of her doctrine *either* that there might be facts about the intrinsic nature of the objects in the world that we cannot infer from even the most successful physical theory (i.e., a version of epistemic structural realism) *or* that there are no such facts—though there might seem to be, according to yesterday's wrong-headed object-centered metaphysics (i.e., a version of ontic structural realism).

Instead, North's understanding of 'structure' is molded by those other buzzwords of modern physics and its philosophy: 'symmetry' and its cousin 'invariance'. The main idea is from mathematics rather than physics. A symmetry is a map (function) on a set endowed with structure in the sense that some properties and relations (collectively, for short: attributes) are defined on its elements. The map is to preserve—that is, keep invariant—the structure, in the sense that the values—that is, outputs—of the map have the properties and relations iff their respective arguments—that is, inputs—do so. (Hence, in mathematics symmetries are also called 'isomorphisms'.)

It is a grand centuries-long theme of mathematics that one gets insight into structures by studying the associated sets of symmetries (which usually form a group under composition of functions). One famous example is Klein's Erlangen program of 1872, which proposed to study geometries via the groups of transformations (maps) between certain privileged coordinates: for example, the geometry of the Euclidean plane, via the Euclidean group of transformations (translations and rotations) between Cartesian coordinates. And from the late nineteenth century onward, this theme has had an enormous influence on philosophy of mathematics and science. In particular, it prompted the vaguer and controversial idea that one could understand, or even define, what is objective (or real) as what is invariant between (preserved by appropriate maps between) different "perspectives." This theme of objectivity as invariance has had a very long run, also in branches of philosophy other than philosophy of science and mathematics. Consider, for example, Russell's *Our Knowledge of the External World* (1912) and Nozick's *Invariances* (2001).

North's book lies squarely in this tradition of using symmetries to articulate structure (or what is objective or perspective-independent) for physical theories. Much of the book is devoted to judicious investigations of two main cases: geometry (i.e., applied or physical geometry, the geometry of empirical space and/or space-time), and mechanics. Each of these is really a science not a theory. Thus North considers different formulations, assessing what can be inferred from each about the perspective-independent features of space, or time, or the ontology of mechanics. In pursuing these investigations, North articulates several themes that span the whole book and give it a satisfying unity of purpose. I will report two, again neglecting subtleties that are taken up in other reviews and the journal literature.

From the mention of geometry and mechanics as case studies, one might well guess what my first chosen theme is—namely, the interplay between the geometry of space (or spacetime) and the laws describing the behavior of matter. Thus in several passages (and throughout chapter 5) North addresses the centuries-old debate between "absolute" and "relative" conceptions of space and time, whose first, and epoch-making, round was fought out by Newton and Leibniz. Here, 'absolute' connotes that the geometry of space and the metric structure of time (its division into measurable intervals) are independent of the details of how matter behaves, and even that they would be attributes of space and time in a universe without any matter, while 'relative' connotes the denial of this, and even that the geometry of space and metric structure of time are determined by (supervenient upon) the behavior of matter. (Nowadays the two sides are usually called 'substantivalism' and 'relationism'.)

About this debate, North's main position is twofold. First, by examining the details of our theories (mostly varieties of classical mechanics set in Euclidean space), she argues that the substantivalist and the relationist can posit the same amount of structure for space and time. Thus she rejects the traditional complaint against the relationist that the behavior of matter does not underwrite all the structure needed for an empirically adequate theory of motion. (This is the moral of Newton's thought experiments with the bucket and the two globes.) Her rationale (building on various relationist efforts in the literature) is that by appealing to counterfactuals a relationist theory can indeed be empirically adequate. But second, despite these matching structures, North favors substantivalism. She does this by invoking a notion I have not yet mentioned—namely, that the theories at issue are fundamental. 'Fundamental' is of course itself vague and contested. But, for North, it amounts, for spatiotemporal structure, to a suitable sort of independence from matter—so that relationism is incorrect (150–52, 154–60).

My second chosen theme is more general. It is that, other things being equal, we should postulate the least structure (both mathematical and physical) that is required in order to state the laws of our theory. North endorses this principle, labeling it the 'minimize-structure principle'. First she distinguishes it from some cousins in the literature—for example, those due to Earman and Myrvold, and the obvious venerable predecessor, Occam's razor (60–67, 75). Later she applies it to cases (including physical geometry, as in my first theme above). In particular, she compares two formulations of classical mechanics, called 'Newtonian' and 'Lagrangian'. In short, while the former describes motion as caused by forces, the latter adverts to energy (for examples, see 88–107). She argues that the Lagrangian formulation posits less structure (about the geometry of space) and so is favored by the minimize-structure principle (117–27).

It is clear that the idea of minimizing structure is philosophically intriguing. One needs to make precise, in the context of specific theories, notions such as law, causation, and one theory (or mathematical object) having more or less structure than another. Of this list, it is worth pausing on the last topic, since it is more specific to North's enterprise.

The first suggestion that a philosopher, considering the idea of a structure as some attributes defined on the elements of a set, might make is that 'more structure' should simply mean a larger number of attributes. (Think of counting the number of primitive predicates in some formalization of the theory.)

This suggestion is rough, in at least two ways. First, one needs to allow for patterns of co-occurrence of attributes (coextension of predicates) in all the theory's models, thanks to the theory's laws. In philosophical jargon: one needs to decide whether to distinguish nomologically coextensive attributes. Second, one needs the suggestion to respect the idea above that structure should be objective, with perspective-dependent aspects like coordinate systems washed away (in the jargon: quotiented out) by the action of the symmetries. Here one needs to allow for the fact that our theories as usually formulated make much use of such aspects. For coordinate systems and their ilk (another buzzword: notions that are *gauge*) are not just handy but well-nigh indispensable.

However, as North explains (40–51, 117), in several limited and mathematically precise contexts, the suggestion can be made precise and delivers the intuitively correct verdicts. One standard sort of example is a sequence of successively logically stronger (so: more structured) notions of a space—for example, the trio: topological space, Hausdorff space, metric space. And in such examples, adding more structure usually corresponds, as one would expect, to having a smaller symmetry group.

So much by way of a *tour d'horizon* of this fine book: I hope to have whetted the reader's appetite for it.

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Gillian K. Russell, *Barriers to Entailment.*
Oxford: Oxford University Press, 2023. xii + 303 pp.

Gillian Russell's new book *Barriers to Entailment* (hereafter *BE*) takes on the ambitious project of formulating and proving five barriers of entailment in a unified framework. Each barrier states that a certain class of sentences does not follow from another class of sentences:

- The particular/universal barrier: no universal claims from particular ones.
- The past/future barrier: no claims about the future from those about the past.
- The *is/must* barrier: no claims about how things must be from those about how things are.
- The indexical barrier: no indexical claims from nonindexical ones.
- The *is/ought* barrier: no normative claims from descriptive ones.

The last barrier is known as Hume's law, a controversial thesis in logic and metaethics. *BE* makes a compelling case for studying these barriers together and developing a general account of them. It begins with an extensive survey of formal and informal counterexamples to Hume's law found in the literature and convincingly demonstrates that they can be reconstructed to challenge the other barriers (chap. 1).

The primary technical feature of this book is Russell's model-theoretic approach to sentence classification for each barrier, developed and expanded from her previous work (Restall and Russell 2010). This original approach allows a systematic and generalizable sentence classification method, which is an important novel alternative to syntactic or lexical methods that classify sentences based on the mere presence or absence of particular logical operators or linguistic items. To illustrate the central idea of the model-theoretic approach, consider a pair of particular and universal sentences, Fa and $\forall xFx$, in first-order logic (FOL). Suppose that both Fa and $\forall xFx$ are true in a certain model. When adding a new object, such as b where $\neg Fb$, in the domain of the model, the truth value of Fa does not change, while that of $\forall xFx$ does. Thus, the truth