

edge *vanishes* under skeptical pressure. But such a view may be inevitable given the broader picture at work in the book. As Moss's compositional semantics is probabilistic all the way down, so knowledge is probabilistic through and through: knowers are afloat on a fully Bayesian sea.

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Anjan Chakravartty, *Scientific Ontology*.
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What does science tell us about ontology? That's the driving question of Anjan Chakravartty's new book *Scientific Ontology*. Chakravartty answers the driving question by combining a naturalistic approach in metaphysics with a voluntarist approach in epistemology. *Naturalized metaphysics* refers to the idea that scientific ontology—conclusions about the ontological consequences of the sciences—should be informed by and continuous with the empirical content of the sciences. *Voluntarist epistemology* refers to the idea that views about the ontological consequences of the sciences always depend on a background episte-

mology that agents can freely choose. Put together, the two theses yield a broad and bold vision. This book is recommended for anyone working on philosophical methodology, the metaphysics of science, or metaontology. In what follows, I review Chakravarthy's principal claims and conclusions (sec. 1), and then raise some concerns about his master argument for the underdetermination of ontology by science (sec. 2), before concluding with remarks on the view's contribution to contemporary metaontology (sec. 3).

1. Chakravarthy's Combination of Naturalized Metaphysics with Voluntarist Epistemology

The book has three sections. The first part serves as an extended introduction to the main themes of the book, with a special focus on the idea that the sciences underdetermine ontology. In the second part, Chakravarthy illustrates the underdetermination of ontology by the sciences with two case studies. In the third part, Chakravarthy discusses his voluntaristic approach in epistemology in more detail.

The main point of chapter 1 is that scientific ontology is inherently *metascientific*. That is, the outputs of the sciences do not *directly* entail ontological consequences. Deriving ontological conclusions from the sciences requires a metascientific view on what kind of knowledge we can get from the sciences. Chakravarthy introduces two main metascientific contenders: empiricism, according to which the sciences yield knowledge about only observables, and scientific realism, according to which the sciences yield knowledge about both observables and unobservables. Chapter 2 refines the view introduced in chapter 1. Chakravarthy introduces the notion of an "epistemic stance" as a cluster of "attitudes, commitments, and strategies relevant to the *production* of allegedly factual beliefs" (47). Empiricists characteristically adopt an empiricist stance, and scientific realists characteristically adopt a realist one. He goes on to assert that any conclusions about the ontological consequences of the sciences rests on the adoption of an epistemic stance, which is another way of saying that scientific ontology is inherently metascientific. Chakravarthy adds that the choice of an epistemic stance has a significant *a priori* dimension. For example, here is what he says about the adoption of an empiricist stance:

The recourse to metaphysical inference is important not only to distinguish straightforward, ontology-guiding experiences from optical illusions and hallucinations, but also to help in determining the quality of the empirical information one does acquire. Not all observations are created equal, whether in the lab or in the field. Differentiating good from bad and better from best once again typically requires the employment of metaphysical inferences involving theories or hypotheses concerning things (e.g., the functioning of instruments of detection and measurement) beyond the realm of the observable. (56)

Here and elsewhere, Chakravarty uses the notion of a “metaphysical inference” very broadly, for any inference with a “significant *a priori* dimension” (19). The upshot is that any conclusions about the ontological consequences of the sciences involve inferences with a significant *a priori* dimension. Chapter 3 provides Chakravarty’s argument for the underdetermination of ontology by the sciences. The argument is, in very short, that ontological conclusions require a stance—“no stance in, no ontology out”—but the decision between stances cannot be made on scientific grounds. In chapter 4, Chakravarty illustrates the underdetermination of ontology by the sciences by discussing the metaphysics of dispositions, and in chapter 5, he turns to debates concerning structural realism. Chapters 6 and 7 discuss different kinds of epistemological uncertainty. Chapter 6 discusses uncertainty with regard to the nature of certain entities; and chapter 7 discusses uncertainty with regard to when we are licensed to form beliefs (as opposed to cases where it is better to suspend judgment).

In my commentary, I will not be able to cover every aspect of Chakravarty’s rich discussion. Instead, I will focus on his argument for the underdetermination of ontology by science (chap. 3).

2. The Underdetermination of Ontology by Science

Chakravarty’s master argument for the underdetermination of ontology by science (in chap. 3.4) focuses on the disagreement between scientific realists and empiricists. Scientific realists think that science yields knowledge about unobservables; empiricists think that it doesn’t. Chakravarty argues that drawing conclusions about the ontological consequences of the sciences requires taking a stance in the debate between empiricists and scientific realists, but this disagreement cannot be settled on scientific grounds. The main argument for this view appears to be the following:

1. The best arguments for the existence of unobservable entities are inferences to the best explanation; arguments of the form ‘Such and so observable phenomena are best explained by the existence of such and so unobservable entities’.
2. The question of whether unobservables have sufficient explanatory power to justify belief in them is not a scientific question.

It is not entirely obvious that this is Chakravarty’s main argument, as he makes his main claims in a roundabout way.

Chakravarty begins by describing the *common ground* between realists and empiricists. Members of both camps, he suggests, can subscribe to “the norm of naturalized metaphysics,” according to which:

Naturalized Metaphysics. Only metaphysical inferences and propositions that are sufficiently informed by or sensitive to scientific-empirical investigations yield ontological knowledge relating to the sciences. (67)

The intended upshot of this principle is that knowledge of the ontological consequences of science must in some way be empirically informed. Scientific ontology must be “continuous with” empirical inquiry. The principle as stated is very broad. One can imagine a wide range of views on what may count as “sufficient” information or sensitivity, and on how ontological knowledge may “relate” to the sciences. But this is Chakravartty’s very point. He thinks that, even though empiricists and realists all subscribe to the norm of naturalized metaphysics, they interpret this norm in different ways, and therefore arrive at different views on how much ontology we can derive from the sciences.

In order to explain the different ways in which empiricists and scientific realists interpret the norm of naturalized metaphysics, Chakravartty introduces a battery of technical terms.

- ‘magnitudes of metaphysical inferences’: a measure of the degree to which a metaphysical inference (an inference with a significant *a priori* dimension) is continuous with empirical inquiry (67)
- ‘epistemic risk’: a proposition is epistemically risky when we cannot judge with certainty whether it is true (84)
- ‘empirical vulnerability’: a proposition is empirically vulnerable when experience can show it to be false (85)
- ‘explanatory power’: “a measure of how well a metaphysical inference or resulting proposition satisfies the criteria typically associated with good explanations of the data of observation and experience ... including simplicity, internal consistency, coherence with other knowledge, and the capacity to unify otherwise disparate phenomena” (87)

Using these terms, Chakravartty suggests that a proposition is “sufficiently informed by or sensitive to scientific-empirical investigations”—as required by the norm of naturalized metaphysics—only if it is not too epistemically risky. But empiricists and scientific realists assess the epistemic risk of given propositions differently. For scientific realists, the explanatory power of unobservable entities makes belief in them sufficiently unrisky (safe), but this is not so for empiricists. In other words, scientific realists think that the explanatory power of unobservables justifies belief in them, but empiricists think the relevant phenomena are better explained without appeal to unobservables.

If we now assume (1) that drawing ontological conclusions requires taking a stance in the debate between empiricists and realists, and (2) that questions about the explanatory power of unobservable entities cannot be settled on scientific grounds, we get to the desired conclusion: science underdetermines ontology. It seems to me that this reasoning assumes some of the main claims which in fact require an argument. Two examples:

- (1) Chakravartty throughout asserts that epistemology is prior to ontology. That is, in order to answer certain ontological questions, we

first have to answer epistemological questions. No clear argument is ever given for this claim, but an argument seems to be needed. Contemporary metaphysicians in general do not seem to think that they first have to do epistemology before they may engage with topics in metaphysics. Furthermore, the literature on skepticism contains explicit alternatives to Chakravartty's view: "Dogmatists," such as Pryor (2000), deny that we first have to rule out external world skepticism before we can know that we have hands, and Moore (1939) argues that the fact that I have hands provides evidence against skepticism. So, the general view that epistemology comes before ontology requires an argument. Sometimes Chakravartty's view sounds like a quasi-psychological thesis, to the effect that when people arrive at ontological conclusions, these conclusions are in fact based on epistemological consideration (see p. 45). Such a psychological thesis would need a psychological argument, or perhaps a study in experimental philosophy to establish its truth.

- (2) Why should it be impossible to make the decision between the stances of empiricists and of scientific realists on scientific grounds? Chakravartty introduces the notion of an epistemic stance by saying that stances are "not believed but rather adopted by people, held by them and expressed in their action." On his view, the acceptance of an epistemic stance is not a propositional attitude, even though it can "eventuate in belief" (47). But this is a tendentious description. It seems more natural to say that scientific realists *believe that* the explanatory power of unobservables justifies belief in them, while empiricists *deny* this very proposition. It would be nice to have a clear epistemological argument for Chakravartty's view; for example, an argument to the effect that claims about explanatory power are nonfactual. It is not obvious what this argument could be, which makes the exercise of finding one challenging and interesting.

3. Epistemic Stances

Despite my concerns about Chakravartty's argument in support of his view, the view itself still contributes an original and interesting option to the debate. Since Carnap's "Empiricism, Semantics and Ontology" ([1950] 1956), philosophers have repeatedly floated the idea that ontologists of seemingly incompatible viewpoints merely accept different "frameworks." Typically, philosophers develop this idea by construing "frameworks" as interpreted languages, and arguing that ontologists of seemingly different viewpoints in fact talk past each other (see Hirsch 2011 and Thomasson 2015). Chakravartty, however, construes "frame-

works" as clusters of *epistemological* principles—rules for the evaluation of evidence and assessment of propositions. The effect is that, on this view, ontologists of seemingly different viewpoints are understood not as talking past each other but as assessing the truth of propositions in different ways. This is an interesting and new idea, and very much worth a thorough investigation.

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Kris McDaniel, *The Fragmentation of Being*.
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According to *ontological pluralism*, being isn't univocal—there is more than one kind of being or way to exist. And let *ontological degreeism* be the view that being is gradable—some entities enjoy more being or a greater degree of existence than others. Being *fragments* just in case either ontological pluralism or degreeism is true. While the idea that being fragments has played an import role in the history of philosophy, it's perhaps an understatement to say that it hasn't held much currency in contemporary analytic metaphysics. In his book *The Fragmentation of Being*, Kris McDaniel argues, however, that both ontological pluralism and degreeism are reasonable and fruitful views deserving of our consideration.

The first six chapters of *The Fragmentation of Being* are devoted to ontological pluralism. In the first chapter McDaniel develops a version of this thesis that combines elements of views articulated by Heidegger and Theodore Sider. According to this Sidergarian view, while the unrestricted quantifier captures a generic notion of being, there are special restricted quantifiers that both capture more specific notions of being and are more natural (i.e., carve reality