Kevin C. Elliott and Ted Richards (eds.)
Exploring Inductive Risk: Case Studies of Values in Science, (Oxford: Oxford University Press, 2017), 312 pages. ISBN: 9780190467715/9780190467722. Hardback/Paperback: $99.00/$39.95.

Do non-epistemic values have a role to play in scientific reasoning? Many philosophers of science would now answer "yes," in large part because of the argument from inductive risk. First articulated in the mid-twentieth century, the argument was recently revived by Heather Douglas (2000). The surge of philosophical interest in science and values since then is reflected in the new book *Exploring Inductive Risk: Case Studies of Values in Science*, edited by Kevin C. Elliott and Ted Richards. This collection of eleven self-contained essays, plus helpful introductory and concluding chapters by the editors, provides an excellent snapshot of current thinking about inductive risk in philosophy of science.

The canonical formulation of the argument from inductive risk follows Richard Rudner (1953). Rudner points out that, because empirical hypotheses are never confirmed with absolute certainty, scientists have to decide when they have enough evidence to accept them. A scientist choosing an evidential threshold faces two possible errors: rejection of a true hypothesis or acceptance of a false hypothesis. Adopting a high threshold increases the chance of the first kind of error, while adopting a low threshold increases the chance of the second. Often these errors are associated with different practical consequences. Mistakenly accepting that a dangerous drug is safe, for example, may cause harm to the patients who take it, while mistakenly concluding that a safe drug is dangerous may lead to lost profits and the continued suffering of would-be patients. (Jacob Stegenga's contribution to this volume, "Drug Regulation and the Inductive Risk Calculus," concerns these kinds of risks.) The argument from inductive risk claims that one's choice of evidential threshold can or should reflect non-epistemic values about which type of error is worse.

There are two well-known replies to the argument, both of which are critically discussed in this collection. The first, typically attributed to Isaac Levi (1960), asserts that error trade-offs should be made in accordance with epistemic values. In "Decisions, Decisions: Inductive Risk and the Higgs Boson," Kent W. Staley challenges this reading of Levi. According to Staley, Levi advocates the equal treatment of different kinds of errors and defends the possibility of inquiry that seeks "the truth and nothing but the truth" (p. 44). Staley claims, however, that even the search for the Higgs boson was not inquiry of this kind, concluding that Levi's reply has limited real-world relevance.

The second common reply is defended by Richard Jeffrey (1956), who proposes that scientists manage uncertainty by assigning probabilities to hypotheses rather than accepting or rejecting them outright. In "Making Uncertainties Explicit: The Jeffreyan Value-Free Ideal and its Limits," David M. Frank argues that Jeffrey's proposal is feasible only when three conditions are satisfied: decision-makers can understand the uncertainties, no one is likely to manipulate representations of uncertainty for their own ends, and there is minimal higher-order uncertainty (that is, uncertainty about the probabilistic representation of uncertainties). Frank claims that these conditions are rarely met in complex, policy-relevant sciences like climate science. Joyce C. Havstad and Matthew J. Brown also discuss the Jeffreyan reply in "Inductive Risk, Deferred Decisions, and Climate Science Advising." They claim that the "pragmatic-enlightened model" of science advising, proposed by members of the Intergovernmental Panel on Climate Change, unwisely follows Jeffrey in trying to defer value judgments to policymakers (p. 103). To make good on the model's pragmatist principles, they argue, space must be made for non-scientist "stakeholders" to actively participate in scientific research.

Moving beyond extensions to the Rudner–Levi–Jeffrey dialectic, another theme that emerges from the collection concerns the foreseeability of scientific choices' consequences. One of the most interesting essays is Robin Andreasen and Heather Doty's "Measuring Inequality: the Role of Values and Inductive Risk." Using a case study about data on women in STEM disciplines, Andreasen and Doty emphasize that it is often impossible for scientists to predict how their methodological choices will affect the probability of different types of errors. In such cases, they claim, values can't play a role in managing inductive risk. Roger Stanev seems to reach the opposite conclusion in his "Inductive Risk and Values in Composite Outcome Measures." He observes that it can be difficult to predict how using a composite outcome variable in a clinical trial will affect its outcome. But he concludes that in such situations, "non-epistemic values can play an important role" in helping investigators decide whether to use a composite variable or not (p. 183). This is an intriguing point of disagreement that merits further discussion. Do scientists need to be able to foresee the consequences of a scientific choice in order for values to play a role in that choice? This issue has implications for other essays, such as David B. Resnik's "Dual-Use Research and Inductive Risk." Dual-use research is work that has the potential to be "employed for beneficial or harmful purposes" (p. 60). One might wonder whether it is possible to use values to manage inductive risk in dual-use contexts, as Resnik proposes, given that it is difficult to predict the future applications of scientific research.

Another theme that runs through Elliott & Richards' collection is that there are a great variety of scientific situations subject to inductive risk. Anya Plutynski's "Safe or Sorry? Cancer Screening and Inductive Risk" presents three kinds of choices that she claims involve risk trade-offs in assessments of the effectiveness of mammography. One of the lessons Robyn Bluhm draws in her "Inductive Risk and the Role of Values in Clinical Trials" is that inductive risk need not involve trade-offs at all. In "The Inductive Risk of 'Demasculinization,'" Jack Powers argues that the characterization of phenomena runs inductive risks. He proposes an extremely broad definition according to which inductive risk is the risk of engaging in any scientific activity that is "incongruous with the fulfillment of favored criteria based on favored values" (p. 243).

Only one essay, Justin B. Biddle and Rebecca Kukla's "The Geography of Epistemic Risk," pushes back against the tendency to include almost any locus of value influence under the banner of inductive risk. Biddle and Kukla propose a new typology in which inductive risk, or "the risk of wrongly accepting or rejecting a hypothesis on the basis of evidence" (p. 216), is a subtype of "epistemic risk," which covers "any risk of epistemic error that arises anywhere during knowledge practices" (p. 218). Epistemic risks also include (what they call) "analytic," "alethic," and most importantly, "phronetic risks," which are "epistemic risks that arise during the course of activities that are preconditions for or parts of empirical reasoning, insofar as these are risks that need to be managed and balanced in light of values and interests" (p. 220). The typology also includes "ethical risk," which they define as "the risk of harms" (p. 219).

I share Biddle and Kukla's worry that the concept of inductive risk has been expanded almost beyond recognition, but I have concerns about their proposed typology. First, their notion of "epistemic risk" depends on the unexplained concept of "epistemic error," which they say isn't just false belief. Moreover, since "phronetic risk" is defined in terms of value influence, reclassifying choices that have been said to involve inductive risk in terms of phronetic risk begs the question against those who think values shouldn't play a role in such choices. Lastly, the categories in Biddle & Kukla's typology do not have the same structure, making the relationships among them unclear: there are risks *of doing things* (alethic, inductive, analytic), risks *of consequences* (ethical), and risks *that arise in particular contexts* (phronetic). These problems

make me skeptical that distinguishing between types of risk is the best way of carving up the philosophical landscape.

Although I've tried to draw attention to some of their disagreements, the contributors to the collection are uniformly sympathetic to the argument from inductive risk. One thing the book is missing, then, are dissenting voices. In the editors' concluding chapter, they are forced to speculate about what opponents of the argument from inductive risk would say (p. 269). It is true that this aspect of the collection merely reflects the state of the field, where there is near-consensus in favor of the argument. Nevertheless, there remain a few holdouts whose perspectives could have been represented.

With one or two exceptions, all of the contributors to the collection were also philosophers of science. Given the venue of this review, I'd like to close with a plug: discussions about inductive risk would benefit enormously from participation by moral and political philosophers. In my view, for example, we philosophers of science have gotten by with an intuitive but extremely vague understanding of what values are and what they do. Another topic ripe for cross-fertilization is technocracy. Some believe it is unacceptable for value judgments in policy-relevant science to be made by scientists who lack accountability or democratic legitimacy. Political philosophers could help determine which kinds of value influence are compatible with democratic principles. I hope that Elliott and Richards' collection serves as a catalyst for such collaborative work.

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