is, to produce new avenues of research. The failure to accomodate new insights is taken as evidence that no more are forthcoming as long as the principle is held. In this way, principles, although they are not theories, are governed by abductive reasoning. Thus, they are not merely ad hoc as Popper argued (162) but subject to reasoned acceptance and rejection.

I admire Magnani's approach to the problem of abduction in this book. He claims, I think, that abduction is an integral part of the cycle of scientific reasoning in which each component presupposes the logic of the others. Thus, no part can be considered irrational. I tend to accept this claim even though Magnani has not clinched it. Skeptics will still find grounds for objection that Magnani has not establihsed the rationality of abduction as such. For example, Magnani presents the NEOANEMIA program as an exemplar of his select-and-test account of abduction. He claims that it models how reasoning about anemia *should* occur, not how it actually occurs in doctors' minds (88) and describes its performance as satisfactory (85). But how do we judge that it does satisfactorily model how diagnosis *should* occur? A simple comparison of the program's performance with that of the relevant doctors would beg the question. Magnani does not offer any other basis for comparison, thus his assertion remains open to question. The same could be said of the generate-and-test account in general.

In any case, Magnani opens up a promising avenue of progress on this perennial topic in the philosophy of science. The book is a challenging read as the discussion is carried on mostly in the abstract with too few elaborated examples, compounded by Magnani's liberal and unelaborated use of technical jargon. Nevertheless, this book presents a thorough review of the literature within a unified frame of reference, and provides many insights bound to stimulate interested readers.

CAMERON SHELLEY

David Howie, ***Interpreting Probability: Controversies and Developments in the Early Twentieth Century.*** Cambridge: Cambridge University Press (2002), xi + 262 pp., $60.00 cloth.

Bayesian methods (broadly construed) have been enjoying something of a renaissance lately in many areas of inquiry, including statistics (Bernardo and Smith 2000), artificial intelligence (Pearl 2000), psychology (Glymour 2001), philosophy (Talbott 2001, Swinburne 2002), and sociology of science (Press and Tanur 2001). This has resparked the age-old and ever-heated debate between Bayesians and non-Bayesians (of various ilks) concerning the foundations of probability and statistical inference.

Anyone who is curious about this important debate will be well served by a careful reading of David Howie's new book.

Howie's book focuses on one of the most important historical time-slices of the Bayes/non-Bayes debate: the early-to-mid twentieth century. The heart of the book consists in a nuanced and sympathetic discussion of the subtle debates (and relationship) between R. A. Fisher and Harold Jeffreys. Fisher and Jeffreys were two of the most important and influential twentieth-century statisticians (and scientists). They each contributed sophisticated and powerful methods to the field of statistics, and, they each had different views about the proper framework for thinking about and using probabilistic techniques in scientific inference. Roughly, Fisher's methods and outlook were non-Bayesian (in particular, "frequentist"), while Jeffreys's were Bayesian. But, as Howie so skillfully explains, the data concerning the Fisher-Jeffreys debate are quite subtle, and they resist such a simple-minded, dichotomous classification.

Interpreting Probability begins with a very clear introductory chapter, which nicely lays out the aims and structure of the book. In chapter 2, Howie presents a readable discussion of pre-twentieth-century thinking about probability and statistics. Early developments involving Classical Probability and games of chance (à la Laplace) are discussed, and then the turn to "frequentist" thinking, and subsequently to statistical applications of probability in the social sciences are documented. Here, and throughout the book, Howie displays great skill in telling the historical tale about the salient developments in probability and statistics, without getting bogged down in unnecessary technical or philosophical details (although, later on, some readers may crave these missing technicalia—see below).

In chapter 3, Howie carefully but fascinatingly details Fisher's development as a scientist (i.e., a mathematical biologist) and a statistician. Several aspects of Fisher's scientific temperament are featured, including his desire for mathematical rigor and objectivity, and his focus on concrete applications of statistical theory to biological inference problems. Here, Howie makes a compelling case that the source of Fisher's "frequentism" (and his moving away from Bayesian personalism in thinking about probability) was the application of probability theory to Mendelian genetics, where the probabilities entailed by Mendel's models are: (i) objective, (ii) exhibited in long-run frequencies, and (iii) do not depend on the prior degrees of belief of any experimenter. Howie also gives a very accessible (again, with a minimum of technical details) reconstruction of Fisher's infamous "fiducial argument," which was Fisher's attempt to provide a "frequentist" alternative to the Bayesian account of inverse probability.

In chapter 4, Howie gives an analogous trace of the intellectual devel-

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opment of Harold Jeffreys. In particular, Howie focuses on Jeffreys's background as a scientist (i.e., a mathematical physicist) and a probabilist. Like Fisher, Jeffreys was after mathematically rigorous and scientifically respectable methods for statistical inference. But, unlike Fisher, Jeffreys was interested in applications of probabilistic methods to scientific theories which (seem to) involve no "objective probabilities" (e.g., gravitational theories). Howie explains how this (together with Jeffreys's early exposure to the teachings of Johnson, Keynes, and others) led Jeffreys to lean toward "logical" or "inductive" schools of thought about probability.

In chapter 5, Howie marshals an impressive array of sources to reconstruct a vivid and plausible picture of the Fisher-Jeffreys correspondence, debate, and relationship. I found this to be the book's most impressive and edifying chapter. Its most important virtue is its deep sympathy for the views of both men. Howie succeeds in charitably reconstructing the arguments on both sides of the most contentious issues separating Fisher and Jeffreys. In the end, the reader is left with the very satisfying understanding of the motivations, presuppositions, and arguments of all parties involved. While dogmatic Bayesian or non-Bayesian readers may not agree with Howie's own conclusion (171) that "each of Fisher's and Jeffreys's methods was coherently defensible, and . . . the clash between them was not a consequence of error on one side," I think all readers must agree that Howie has done an excellent job of chronicling a crucial set of debates in the development of probability and statistics.

In chapter 6, Howie tries to place the work (and debate) of Fisher and Jeffreys in the broader context of probabilistic thought in the 1930s. I think the most valuable part of this chapter is the discussion of Neyman's work and its influence on the practice of statistics (the reactions of Fisher and Jeffreys to Neyman's work are also fascinating and important here). But, some of the other parts of this chapter seem a bit rough, and could use a bit more fleshing out. For instance, more careful discussions of the work of Kolmogorov, de Finetti, and Popper would have been useful here. At one point, Howie (219) claims that Kolmogorov "defined probability as a measure property of a set within a field constructed according to a series of axioms." Later in the chapter, Howie (221) refers to Popper's propensity account of probability as a "half-baked attempt to apply the probabilities of von Mises's collectives to individual events." Finally, Howie (227) refers to de Finetti's representation theorem as his "representation theory." These and several other claims and references in chapter 6 are (at best) misleading.

My only complaint about this book is that it sometimes lacks the technical and philosophical details that an expert in the field might want to see (for more detailed discussions of various interpretations and applications of probability, the reader should consult Fine 1973, Gillies 2000, Hájek 2002, and the other references cited in the first paragraph of this review). This is only a minor complaint. And, I think the trade-off is better made in the direction of fewer technical details and more general accessibility. I highly recommend *Interpreting Probability.* It is a great read for anyone interested in probability and statistics and their historical development.

BRANDEN FITELSON, UNIVERSITY OF CALIFORNIA-BERKELEY

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