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REVIEW

ALEXANDER BIRD
Philosophy of Science

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Science students depend on textbooks, often to the exclusion of the professional literature. Philosophy students, by contrast, enter the subject from the deep end, reading in their first term some of the same classic and recent work that their teachers study. Nevertheless, philosophical textbooks can be valuable. They can compensate for the inaccessibility of much of the professional literature. In the philosophy of science, some of our most important writers, such as Popper, Hempel, and Kuhn, also wrote well; but many of our colleagues are much more difficult to digest. Textbooks can also provide the sort of synoptic view that many of us try for in our lectures, and many students benefit from getting this by eye as well as by ear. Finally, a few philosophical books manage very effectively to combine the functions of textbook and professional contribution, a combination virtually unheard of in science writing.

Alex Bird's book gives philosophical textbooks a good name. Students studying philosophy of science will be in his debt; professionals will be stimulated and provoked. After an introductory chapter that uses the debate over 'Creation Science' to motivate questions about the nature of real science, the book is divided into two parts, metaphysical and epistemological. The metaphysical part has chapters on laws of nature, explanation, natural kinds, and realism; the epistemological part on inductive scepticism, probability and scientific inference, inductive knowledge, and method and progress. The authors mentioned include Lewis and Armstrong (laws), Hempel and Achinstein (explanation), Putnam and Kripke (natural kinds), Van Fraassen (realism), Popper (induction), and Lakatos and Kuhn (method and progress).

The starting point of Bird's discussions is often Humean, but the ending points are not. Bird's metaphysics includes universals and necessitation relations, and his epistemology is optimistic and broadly reliabilist. There is no Scientific Method, because scientific methods are piecemeal and because

research depends on moves that are not methodological. There is, however, a form of reasoning ubiquitous both in science and, by description, in this book: inference to the best explanation.

Bird is a clear and stylish writer who explains things from the ground up, without patronising. The treatment is accurate and up-to-date. The book requires a certain intellectual commitment, in part because its discussions often loft more than one philosophical ball into the air at a time. This strategy brings out connections between the different issues, one of the particular attractions of this book, but it means that the book cannot be recommended as bedtime reading. On its own, the book could bring a dedicated layperson into the subject, but it will be most useful as part of a course in the philosophy of science. As a companion to my own undergraduate lectures, it will be nearly ideal, both in coverage and approach.

Before turning to what Bird has to say to the professionals, I have a very few criticisms from the students' point of view. Although this book addresses diverse issues and mentions some useful scientific examples, its general approach stays within traditional philosophical boundaries. More substantial engagement with the work going on in other areas of Science Studies would have been welcome. (One might make the same criticism of my lectures, in case you were wondering.) Bird also lets the scientific realists win too easily. He rejects the miracle argument for realism, and for good reasons, but does not put enough replacement realist argument in its place. Finally, although his discussion of Kuhn is for the most part very helpful, his characterisation of incommensurability is questionable. Bird says that it means incomparability (pp. 277, 291–2); but while incommensurability entails fundamental difficulties of comparison, to suppose that it makes comparison impossible does not do justice to Kuhn's position. (It is also something Kuhn himself denied.) Bird also suggests that, on a strong reading, Kuhnian incommensurability entails a kind of idealism that rejects a belief-independent world (p. 281). A better characterisation of Kuhn's metaphysics is rather that of a dynamic Kantian, according to which there is a mind-independent world, but the only world to which we have empirical access is one structured by the process of inquiry. For Kant, that human contribution is invariant; for Kuhn it changes across scientific revolutions.

I turn now to two aspects of the Bird's-eye view that will be of particular interest to professionals. One is his description of inductive methods as *a posteriori* and subject specific, justifiable by appeal to their structure and track record. He outlines an attractive account of scientific inquiry that lies between the implausible extremes of a monolithic Scientific Method and epistemological anarchy, an account that brings out the extensive interaction between inferential method and background belief. Bird considers and answers the objection that his reliance on inductive justifications of inductive methods

is viciously circular; but his answer could use more articulation. He says that vicious circularity is avoided, because the justifications are not required for knowledge as the reliabilist construes it. In so far as our methods are in fact reliable, they generate knowledge, and so can also be used to investigate their own reliability (p. 226). Scientists obviously do rightly use one instrument to test another; but asking a witness whether he is reliable is not a good way to assess his reliability, even if he is in fact reliable. So more needs to be said to distinguish virtuous inductive justifications from vicious ones.

The second aspect of Bird's view that will be of special interest to professionals is also the most provocative feature of this book. It concerns criteria. Bird rejects the analytic project of providing necessary and sufficient conditions or truth conditions for the central concepts that philosophers of science discuss. Instead, concepts such as those of law, explanation and confirmation are to be illuminated by describing the criteria for their application. Criteria here are Wittgensteinian: it is part of the meaning of the concept being explained that meeting its criteria is good evidence that the concept applies. Criterial evidence is defeasible, but its evidential status is analytic and *a priori*. Although Bird does not explicitly attribute the idea to Wittgenstein, he introduces his discussion with a distinctly Wittgensteinian example. Someone who eats with gusto may not be hungry, but on a criterial view of behaviour the connection between the behaviour and the hunger is not merely inductive or symptomatic. It is part of what we mean by hunger that eating with gusto is good evidence for it, and this is what makes the behaviour a criterion for the hunger (p. 56).

Bird applies the criterial approach first and foremost to laws (pp. 37–60). After rejecting a simple regularity theory, he considers a Ramsey-Lewis best system view, according to which laws are the true generalizations that fall within the system that exhibits the best combination of strength and simplicity, and the Armstrong view that laws are necessitation relations between universals. The best system view is rejected as providing necessary and sufficient conditions on diverse grounds: simplicity is subjective, there may be no unique best system and no generalizations common to all the best systems, a generalisation in the best system could none the less be a coincidence, and laws explain their instances but generalizations do not, whether or not they are part of the best system. Bird finds the necessitation view more attractive, but it has a fatal flaw: there is no adequate account of the necessitation relation to which it appeals. Bird's novel solution is to retain the necessitation picture, while treating the best system's conditions of strength and simplicity as criteria, not truth conditions. Armstrong provides the metaphysical picture, Lewis the semantically privileged epistemology, and the truth conditions will not be missed.

The criterial approach is subsequently applied elsewhere, for example to the concept of explanation. The conditions laid down by the Deductive-Nomological (D-N) model cannot be necessary and sufficient for explanation, for familiar

reasons, but they do provide criteria (p. 84). Having D-N form is necessarily a reason for saying that the argument is an explanation, but this reason may be overridden, most obviously by another incompatible D-N argument with better credentials. In addition to explaining concepts, Bird uses the criterial approach to solve certain epistemological problems. For example, one may wonder why inference to the best explanation should be truth-tropic. Why should we suppose that the account that would be most explanatory if it were correct is therefore most likely to be correct? Why should the loveliest explanation also be the likeliest? Bird's answer is that what makes an explanation lovely is that it makes general claims that meet the best system criteria for lawfulness, from which it follows that being a good explanation is a good reason to believe that the explanation is correct (p. 91). The features that make an explanation lovely are criteria for its correctness, and so necessarily good evidence for correctness.

It is easy to accept that what philosophers say are truth-conditions are often only fallible symptoms, and that we can illuminate concepts by saying what counts as evidence for their instantiation. But symptoms are not criteria, and what is harder to accept is that the evidential relationship in question is analytic, part of the meaning of being hungry, being a law, or being an explanation. Those who have trouble with analyticity in general will obviously have difficulty here, but even many who tolerate the idea of semantic convention will still balk at the claim that these *evidential* relations are conventional. It is particularly difficult to see how to combine the criterial view with realism, as Bird wishes. He holds that science reveals the existence of unobservable entities and processes and comes up with true, high-level theories, and I do not see how to reconcile this with a view according to which reasons for belief or acceptance may be a matter of convention. Moreover, this problem seems exacerbated in the particular case of Bird's account of laws, where simplicity is claimed to be both criterial and subjective.

The criterial approach may also be in tension with Bird's view that inductive relations are *a posteriori*. Criteria provide inconclusive, defeasible reasons; in that sense they are inductive. Why then should their evidential value be analytic, when other merely symptomatic inductive relations are not? This is not an issue that Bird addresses, but there are several ways one might try to make a principled demarcation. One motivation for introducing criterial relations is the thought that we have no independent access to what the criteria support. In such cases it is claimed that there is no access to a correlation that would support an ordinary and contingent inductive relation, so the relation must be conventional. For example, the claim that we have no proper access to mental states independently of behaviour is taken to support the idea that the relationship between behaviour and mental state is criterial rather than merely symptomatic. Thus one might distinguish between symptomatic and criterial

relations according to whether or not the investigator has independent access to the phenomenon in question. This is not an option for Bird, however, since he allows scientists symptomatic inductive relations to unobservable entities and processes.

In addition, the features that Bird wants to use as criteria for lawfulness may not have the sort of epistemic accessibility that criteria are supposed to enjoy. For the notion of a best system on the Ramsey-Lewis proposal adopts the perspective of omniscience: what counts is what would be inside the best combination of strength and simplicity in a systematisation of *all* the facts, not just those we know. This may not be a problem for an account that aims to give the truth conditions for being a law, but it does seem to rule out an evidential role, criterial or symptomatic. What we have access to is only what is the best sytematization of what we currently believe, which will leave out many truths and include many falsehoods.

To avoid the accessibility problem, the criteria for lawfulness must be features of current belief, not of all truths, and this I think is Bird's intention. The price of meeting the accessibility condition on criteria in this way, however, seems to be to violate the a prioricity condition. For it is difficult to see how it can be an *a priori* truth that having a certain position within our current beliefs, however partial and error-ridden those beliefs may be, is a good reason for saying that the generalization in question is a law of nature. The rule that a statement is objectively likely to be true if it has a particular place in our current beliefs is not, so far as I can see, something that could be known *a priori*.

Another possible way of drawing a demarcation between symptom and criterion would appeal to the distinction between empirical and super-empirical virtues. On this view, the evidential force of data would be contingent and *a posteriori*, whereas that of factors such as simplicity, unification and fit with background belief would be necessary and *a priori*. This approach seems to fit well with Bird's view on the relationship between the loveliest and the likeliest explanation, according to which the super-empirical virtues are what make one explanation lovelier than another. But how could all the super-empirical virtues be criterial? As Bird says, 'It cannot be a matter of logic that good explanations are more likely to be true' (p. 90). The connection between loveliness and truth seems both contingent and *a posteriori*.

Especially because I share Bird's commitment to realism and to the contingency and a posterioricity of inductive relations, the criterial view is not for me. But this does not lessen my admiration for Bird's book. His application of the criterial view is creative and provocative. He also handles this material with a light touch, so even those unsympathetic with this particular aspect of his position will still find his approach to the philosophy of science exceptionally clear and helpful. Whatever one thinks of criteria, this book can be strongly recommended to all students of the philosophy of science.