

Book Review

DAVIS BAIRD: *Thing Knowledge: A Philosophy of Scientific Instruments*, University of California Press, Berkeley, 2004, xxi + 273 pp. [ISBN 0-520-23249-6].

It is not news to observe that philosophy of science, as a field, has been obsessed with theory throughout the 20th century. While it is true that we have recently seen something called the New Experimentalists emerge, they are few and even then the extent to which they are focused on real live experiments in their social and historical messiness is often not clear. This lack of concern with what goes on in the laboratory from epistemological and even metaphysical perspectives leave philosophers of chemistry in something of a quandary, for chemistry is not a field overly concerned with theory and the kinds of experiments chemists engage in appear, at least on the surface, to differ in significant ways from those of, say, biologists. Chemists are often interested in creating new substances with interesting and exploitable properties and they do so using a variety of instruments.

There is much for philosophers of chemistry to work on, especially if they are interested in the history and philosophy of chemistry. For example, the transformation from alchemy to chemistry still requires further studies. Answers to questions about the scientific status of early 17th-century chemistry remain murky to the extent that they invoke anachronistic concepts, and then we can always have another go at the Periodic Table. But, to a large extent, to proceed in these ways forces historians and philosophers of chemistry back into the unhelpful framework of more tradi-

tional philosophy of science. What we have been looking for is some way to capture what is different about chemistry, while still placing it in the orbit of the more traditional sciences.

In *Thing Knowledge* Davis Baird takes us a long way toward that goal. Rejecting the more or less common understanding of scientific instruments as things we use to achieve specific scientific objectives and the view that the knowledge of the experimenter is the key to successful experimentation, Baird focus on the epistemological content of the instruments themselves. The move is significant for two reasons. First, by attending to the instruments, Baird's account applies to all the physical sciences, thereby shifting the focus away from the primacy of theory. Second, he provides historians and philosophers of chemistry with that unique angle they have been seeking to identify what makes chemistry interesting from a scientific and philosophical point of view.

While Baird uses a number of examples from history, and indeed even claims that "my arguments for understanding instruments as scientific knowledge, have, then, to be understood historically," (p. 5) the thrust of his case is directed toward how we need to understand the role of instruments in science *today*. As I understand him, the bulk of his claim is that by looking at the evolution of scientific instruments, we can see something that has been hitherto unacknowledged: over time, scientific knowledge becomes embedded in instruments in ways that allow the instruments to survive the replacement of theories. It is also a claim about the changing face of science. Contemporary science is very different from

17th-century science, and one of the reasons for this difference is the nature of the instruments we use, *i.e.*, they now contain knowledge in addition to contributing to the development of new knowledge. To make this case, Baird has to be quite adventuresome, *i.e.*, he has to develop a totally different epistemology, what he calls a material epistemology, a theory of knowledge that accounts for the knowledge things, specifically instruments, have. This, he claims, is not to reject traditional epistemology, but to augment it.

Baird examines three different types of instruments. First, there are models. He acknowledges that models are in many ways similar to theories in that they are used to provide representational accounts of the world. Second, he looks at what he calls instruments with working knowledge. These are instruments that create knowledge. They can be relied upon to produce certain effects primarily because the knowledge of how to do so “has been separated from human agency and built into the reliable behavior of an artifact” (p. 12). Finally he examines a class of instruments that are hybrids of the first two, measuring instruments.

Baird also invokes different kinds of arguments to make his case for these different types of instruments. He argues by analogy, he appeals to the “cognitive autonomy” of instruments, and, finally, he employs substantial appeal to history. These materials, the delineation of different types of instruments and the use of different forms of arguments, plus the historical account of how we have come to see that instruments embody knowledge, take up the first five chapters of the book and the material here is very convincing. In my opinion the historical argument is the strongest and opens the door to profitable research.

Chapter Six is more theoretical. Here Baird gives us his epistemology of instruments. Briefly put, having made the case for the knowledge producing func-

tions of models, measuring devices, and working knowledge, Baird attempts to extend his account of material epistemology in such a way as to take us from the instruments of science to the epistemological importance of things in general. To this end he employs Karl Popper’s concept of objective knowledge. In Popper’s epistemology there are three ‘worlds’, the world of things, the world of desires and mental events, and the world of objective knowledge. This third world of objective knowledge is the world of theory and various epistemological claims about the world. It is a public world, not restricted to the inner thoughts of individuals. Baird’s move is to move scientific instruments out of the first world, where Popper would have them, and move them into the third world. I am not convinced yet by this move, for it seems to solve the problem by fiat. Here is my concern: Baird wants to argue that instruments belong in the third world because they produce knowledge. Models produce representations, working knowledge instruments produce reliable data, and measuring instrument produce measurements. Hence, just like theories, they produce knowledge. However, I would argue, it takes human beings to recognize the model-produced representations as representations, measurements produced by measuring instruments as measurements, *etc.* In short, instruments, like disembodied theories do not speak for themselves. What turns theoretical knowledge and thing knowledge into *knowledge*, I propose, is what people do with it. All that said, I am not yet convinced that Baird and I are at odds, since he is up front about the pragmatic slant to his epistemology. Suffice it to say here, limitations of space and time at fault, much more needs to be done to unravel these intricacies. While I am now convinced that there is a serious epistemological dimension to contemporary scientific instruments, the specific epistemology to

account for that dimension, if it is to be Baird's, still needs work.

My favorite part of the book concerns Baird's skillful use of history. He is adept at showing how, in historical context, instruments emerge from living room entertainment to essential components of the scientific mission. Nowhere does he do this better than in his account of the development of the direct-reading spectrometer. For historians and philosophers of chemistry this episode can be viewed as canonical when making the case for the special place of chemistry in the world of contemporary science. In short, while not a book exclusively about the philosophy of chemistry, Baird's *Thing Knowledge* opens the door to serious philosophical analysis of chemical practices and their products. It is important and it raises profound questions about the nature of knowledge that cannot be dismissed. Thanks to Baird's insistence of the notion of material epistemology, we may have finally emerged from the tyranny of the linguistic philosophy of the 20th century and been given a significant philosophical job for the 21st. For, in a world increasingly marked by the things we have made, it is time we pay attention to what they contribute to that world in more than a practical fashion.

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