Coordinating science

Peter Lipton

Reconstructing Scientific Revolutions: Thomas S. Kuhn's Philosophy of Science.

By Paul Hoyningen-Huene. University of Chicago Press: 1993. Pp. 310. £30.50, \$43.75 (hbk); £12.75, \$18.25 (pbk).

World Changes: Thomas Kuhn and the Nature of Science. Edited by Paul Horwich. MIT Press: 1993. Pp. 356. \$45, £40.50.

The Structure of Scientific Revolutions is the most widely read book ever written by a philosopher of science: it is also the most widely misunderstood. Thomas Kuhn's flowing prose is an invitation to quick and careless reading, but even careful readers have found his account of the nature and development of the sciences at once suggestive and elusive. Part of the difficulty is that each of the two central terms of his account covers an enormous and variable amount of ground. 'Paradigm' refers to anything or everything that a group of scientists share during a period of productive consensus; 'incommensurability' refers to anything or everything that makes it difficult for the members of the group to assess competing theories when the consensus breaks down.

Kuhn has clarified his position in subsequent work, but the need remains for a careful and detailed exposition, and this is just what Paul Hoyningen-Huene provides. Originally published in German three years ago, *Reconstructing Scientific Revolutions* is based on a close reading of everything Kuhn has published up to 1990, and on a year of frequent discussions with the master himself, who offers a ringing endorsement in the foreword. Hoyningen-Huene gives a scrupulous, intelligent and revealing account of just what Kuhn was up to in *Structure*, and of how his views have developed since then. *Reconstructing Scientific Revolutions* will become the Baedeker to Kuhn's philosophy of science.

What then is Kuhn's view? As a historian of science, Kuhn was struck by the degree of coordination of research strategies within particular scientific specialties during most periods of their history. The members of such a specialty share much more than theory; they agree about the choice of new problems, the way to attack them and the appropriate standards for assessing putative solutions. During such a period of 'normal science', it is as if the members of the group shared an explicit and detailed set of rules for research. Because such explicit rules do not really exist, Kuhn's problem was to find what stands in their stead.

What he found are exemplars, the central component of his capacious notion of a paradigm. Exemplars are concrete and strikingly successful problem-solutions in the group's specialty, the sort of standard examples that eventually appear in textbooks as illustrations and as chapter-end problems. They work by analogy, leading investigators to select new problems that look similar to the exemplary problems, to try techniques similar to those that worked in the exemplars, and to judge success by the standards implicit in the exemplars. In short, although they are specific in content, exemplars are general in their methodological import, focusing and coordinating the course of research. Normal science, however, never lasts. Exemplars eventually reach their limit, pointing towards new problems but no longer supporting new solutions. The result is a scientific revolution, where new exemplars replace the old ones and a different normal science tradition begins.

Kuhn's work has inspired an enormous critical literature, to which *World Changes* is the latest contribution, based on a conference held at the Massachusetts Institute of Technology in 1990. The contributors include distinguished philosophers and historians of science, as well as Kuhn himself, who gives a characteristically stimulating set of replies. The collection covers diverse aspects of Kuhn's work and several of the articles are essential reading for professional philosophers of science, but the collection as a whole does not reach the level of interest of the less polite but more provocative Kuhn-Popper confrontation, published 23 years ago under the very Popperian title *Criticism and the Growth of Knowledge* (edited by I. Lakatos and A. Musgrave, Cambridge University Press, 1970).

As the articles in *World Changes* illustrate, Kuhn's critics often press two sorts of objection. Historians and sociologists of science have argued that Kuhn underestimates the influence of external social and political factors on scientific research. Nor is this an accidental feature of his account, since the exemplar mechanism depends on the cognitive insulation of science from the rest of society. If scientists cannot choose their own problems, they cannot exploit the analogy to the exemplars that is at the heart of the Kuhnian mechanism. Most philosophers of science have found Kuhn's internalism less troublesome, but many of them have objected to his claim that the switch of exemplars that marks a scientific revolution produces a discontinuity so severe that it makes no sense to speak of scientific progress as progress towards the truth about the world.

Hoyningen-Huene gives a particularly helpful account of how Kuhn uses the innocent-looking exemplar mechanism to undermine the idea that science provides increasingly accurate and comprehensive

descriptions of a mind-independent reality. Like the great eighteenth-century philosopher Immanuel Kant, Kuhn posits a distinction between the world as it is in itself and the world as structured by our concepts. The world in itself contains the course of experience and the results of experiments, but we can know nothing about its nature. Only the other sort of world is knowable, a world we have in part created.

For Kuhn, it is the exemplars that do this creative work, because they not only guide scientists' research but also give meaning to their terms and so impose a taxonomy on nature. Kuhn, however, is Kant on wheels. For Kant, the imposed taxonomy could take only one form; but for Kuhn there is a radical change of taxonomy with each change of exemplars. (This change of meaning is the root cause of incommensurability.) Scientists are therefore not only forever ignorant of the world as it is in itself, but the world they do investigate at a particular time has only a limited lifespan, and is bound to be replaced with a new and incompatible world. Because the scientists' world changes, the notion of a single truth has no application.

Kuhn's arguments in support of changing worlds and against truth are intelligent, original and probing, but they do not in my view come close to establishing such implausible claims. They have been firmly resisted by those philosophers who hold that science does provide a fallible, but increasingly accurate, description of the world as it is in itself. Whatever one's view on the truth question, however, Kuhn's arguments cannot and will not be ignored, and these two valuable books show that it is at least possible to discover the truth about Kuhn's philosophy of science. □

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