***The Intelligibility of Nature: How Science makes sense of the World*. By Peter Dear. Pp. xii, 242, Chicago and London, The University of Chicago Press, 2006.**

Philosophers of science often tell undergraduates that there are two ways of understanding what natural science really is. One way has it that natural science is in the business of producing descriptions of the world, as accurately as possible. According to the other way, science just seeks correct predictions of certain variables. Both ways have ardent defenders in current literature, and engaging in their disputes is rightly considered a commendable kind of philosophical formation. The historical depth of the issue, however, is often neglected. In this book, Peter Dear supplies the missing ingredient. He scans about four centuries of intellectual history to uncover the traces of these two ways of understanding science. For him, the origin of the entire issue lies within the conceptual baggage of the ancient Greeks, who had established a distinction between knowing and doing. It is because of this distinction that a scientific statement can nowadays be considered either as a description of the world or as an instrument that allows us to do something.

The book has six chapters; each one covers a specific period of scientific innovation. Using Kuhnian jargon, one can say that Dear offers us a captivating tour of six revolutions. They deal with: the mechanical universe; the classification of nature; chemistry; biological evolution; the aether; and quantum mechanics. The major aim during each of these revolutions was simple: to make sense of the world. Dear assumes no absolute meaning of 'intelligible'. At one time, scientists make sense of the world according to one set of criteria for intelligibility. At another times, they make sense of it according to another set of criteria. The very meaning of intelligibility is shifting all the time. Dear supports this thesis by a rich assortment of historical case studies. He shows, for instance, how Newton's mysterious gravitational forces gave the Cartesian mechanical worldview a new twist. Moreover, the Newtonian synthesis, for all its success, left something out. Saying how one mass would behave in the vicinity of other masses is not the same thing as saying why one mass is of one kind and another mass is of another. The Newtonian synthesis wasn't enough to make sense of the world. Hence Dear rightly argues that the centuries-old effort to classify the world into definite kinds is in fact another indispensable dimension of the meaning of 'intelligibility'. He shows how the great French taxonomists oscillated between two positions. At times, they thought they were deciphering God's plan of organic creation. At other times, they thought they were simply describing the basic functional structure of animals.

The 18th century revolution in chemistry offers further interesting insights into how the meaning of 'intelligibility' shifts. Dear's most precious section here highlights the tension that arose between Lavoisier and his British critics over the importance of precise measurements. Lavoisier was very proud of the exactitude of his experiments. For him, quantitative reasoning was at the very core of what making sense of the world should mean. Joseph Priestly and William Nicholson disagreed. For them, scrupulosity with numbers was an irresponsible rhetorical trick, perpetrated with the intention of substituting the convincing power of scientific demonstration, which should be based on experience accessible to everyone, by the say-so of an élite.

As regards biology, Dear explores Darwin's contribution in its historical context. William Paley's *Natural Theology* was required reading for all undergraduates at Cambridge

University in Darwin's time. It constituted the accepted way of making sense of the organic world. Dear follows Darwin's reasoning step by step. What we have here is the emergence of an alternative way of making sense of this organic world. The surprising element in this picture is that Darwin in fact resorted more to imagination than to reason. Dear uncovers how Darwin repeatedly turns to indefinitely large numbers, especially when it came to periods of time: 'Time, for Darwin, was like a railway line, always extendible: when the line sought to reach a given station, he always wanted there to be more track available' (p. 102–3). Indulging in imagination in this way made Darwin veer off from the standard practice of seeking facts to support one's hypothesis. Darwin was in fact resorting to what we nowadays call inference to the best explanation. In his day, however, very few were convinced that his explanation was indeed the best.

As science developed on another front, the concept of energy made headway in unison with the new concept of field. Faraday started charting lines of force as an aid to understand electrical and magnetic forces, but soon came to believe that they were real: literally present in space. Their intelligibility resided in the fact that he could manipulate them. This made him retrieve gravity from the Newtonian limbo where it had been abandoned: he made it intelligible as a perturbation of a medium of some kind. Maxwell extended this to cover also electromagnetic forces. The study of these episodes leads Dear into the thick of the Quantum Mechanics revolution, where the concept of intelligibility had to undergo its greatest ordeal. With the endorsement of Neil Bohr's Copenhagen Interpretation, we see scientists swinging definitely towards instrumentalism, in spite of Einstein's opposition. Nevertheless, with David Bohm's more recent efforts to identify hidden variables, we see the return of natural philosophy. The ancient Greek knowing-doing dichotomy doesn't seem to wash off easily. These historical studies have convinced Dear that realist and instrumentalist accounts of science should not be seen as antagonistic, as is often done by twentieth-century philosophers of science. Science should be seen, by contrast, as a practical enterprise through and through: a symbiosis of natural philosophy, the aim of which is to make sense of the world, and instrumentality, the aim of which is to control the world.

Elegantly written, this book revisits well-known episodes in the history of science but breaks new ground in its exploration of some of their undervalued aspects. Moreover, it includes a Bibliographical Essay at the end which can be of great help to advanced students keen on further reading. Although at times the reader may get the impression that the logical argument underpinning the whole book remains elusive till the very last few pages, the overall result is positive. By being very sensitive to the historical context of each major scientific revolution, Dear has practically suggested a new way of making sense – not of the world but of the history of science.

Louis Caruana