Review

Reviewed Work(s): The Cognitive Structure of Scientific Revolutions by Hanne Andersen, Peter Barker and Xiang Chen

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HANNE ANDERSEN, PETER BARKER and XIANG CHEN, **The Cognitive Structure of Scientific Revolutions.** Cambridge: Cambridge University Press, 2006. Pp. xvii + 199. ISBN 978-0-521-85575-4. £45.00 (hardback).
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Despite sustained and influential criticism, Thomas Kuhn's *The Structure of Scientific Revolutions* still, nearly fifty years on from its original publication, frames much of the serious academic study of the scientific enterprise. Strikingly, Kuhn's claims about the cognition of scientists were largely anecdotal, impressionistic, even metaphorical in character: think gestalt-switches, anomalous playing cards, and the duck-rabbit figure. The ambitions of Andersen, Barker and Chen's *The Cognitive Structure of Scientific Revolutions* therefore hold considerable interest, for these authors revisit Kuhn with the tools of contemporary cognitive science in hand. They aim to 'recover and extend Kuhn's account of scientific change by showing that its most important features are consequences of the nature of concepts, as currently understood in cognitive psychology and cognitive science' (p. 164), and demonstrate the need for a 'cognitive history of science' recognizing the pivotal role of conceptual change.

Much that emerges is valuable and interesting. The authors seem well versed in the full range of Kuhn's writings, and offer informative discussions of intriguing developments in recent cognitive science. Furthermore, many details of the historical case studies used – pre-/post-Darwinian taxonomy, the discovery of nuclear fission, the Copernican revolution – are fascinating and important in their own right. Regarding the authors' central aims, however, the tools imported from contemporary cognitive science prove more effective in describing central aspects of Kuhn's account of science than in explaining how they arise or how we respond to them. The feeling one gets is of being engaged in something of an extended translation exercise. If we are willing to follow the authors in embracing Barsalou's 'dynamic-frames' theory of concepts, our reward is a description in the terms of that theory of what a Kuhnian anomaly would be, what incommensurability would be, what revolutionary science would be, and so on. This may indeed show that contemporary cognitive science is capable of countenancing Kuhnian cognitive phenomena, but it does not do much to deepen our understanding of their causes or consequences. For example, starting from the Kuhnian idea that a particular phenomenon is an anomaly because its existence is not permitted by a given scientific concept, the further information that, in dynamic-frames terms, anomaly is a matter of a phenomenon's properties violating a concept's constraints on the assignment of values to attributes, or that the anomaly might be resolved by revising such constraints, seems to add little explanatory insight or power to Kuhn's original proposal.

Moreover, some of the authors' identifications of central Kuhnian notions seem suspect. Kuhnian incommensurability, for example, surely precludes the comparison of incommensurable items from some neutral standpoint. But the machinery of dynamic frames seems to show just how to effect such comparisons even when the differences between concepts are sufficient to produce what the authors identify as incommensurability between them. As the authors themselves repeatedly illustrate, 'incommensurable' conceptual structures (patterns of concepts) can

be compared simply by noting the differences in attributes (and their possible values) that each concept assigns to the phenomena, and how these would force a reassignment of existing objects to subcategories from one concept to the other that is nonconservative (i.e. does not leave intact existing classifications under the concept). But this would mean that Lavoisier was in a position to articulate, without remainder, his supposedly incommensurable conception of combustion to Priestley in terms that Priestley would have understood perfectly well and that neutral observers might have used to compare the adequacy of the two concepts objectively (likewise for Prout and Berthollet on compounds, another of Kuhn's central examples). It is thus hard to see the dynamic-frames apparatus as capturing incommensurability of the most significant or radical variety Kuhn originally envisaged. The authors make much of Kuhn's later weakening of the notion so as to permit incommensurability to be partial and to allow that it need not preclude successful communication, but whether the fault lies with Kuhn's backpedalling or with the authors' further development, the theoretical interest of the original notion would seem considerably diluted. Their fascinating discussion of why Ida Noddack's early suggestion of the existence of nuclear fission was ignored, for example, tellingly shows only why Noddack's proposal was implausible to nuclear physicists, not (as they claim) why it was 'unthinkable' (p. 101), 'incomprehens[ible]' or 'nonsensical' (p. 103; see also p. 179).

This same example illustrates the somewhat limited relevance of the dynamic-frames apparatus for the authors' efforts to champion the 'cognitive history of science'. It turns out that nuclear physicists were able simply to ignore Noddack's suggestion because she reached this proposal and evaluated its plausibility by thinking of the process and its products in fundamentally chemical rather than physical terms. I found it difficult to imagine reaching this insight by representing the actors' concepts in terms of dynamic frames, were we not already convinced of it by more conventional historical analysis. Indeed, here and in general, the apparatus of dynamic frames seemed superimposed on an already convincing historical account after the fact, rather than offering an effective tool for actually conducting the relevant historical research.

In the end, however, I think the authors do offer powerful illustrations of why consideration of concepts and conceptual change must be an integral part of any convincing history of science, just as they urge against some competing views. Although their case studies are complex, the recommended apparatus of dynamic frames is shown to provide an effective vehicle for clearly presenting and describing, albeit not explaining, changes in the content of concepts over the course of inquiry in a scientific field. Indeed, such a restricted expository role also serves the authors' purposes better than I suspect they imagine. For I was struck by their curious silence on what seemed to me the deepest puzzle posed by a reflexive application of their own account. As cognitive science is itself a science, accepting a Kuhnian trajectory for it would seem to undermine any straightforward warrant for simply believing what contemporary theorists report about the nature and character of human concepts in the first place.

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David N. Livingstone and Charles W. J. Withers (eds.), **Geography and Revolution.** Chicago and London: The University of Chicago Press, 2005. Pp. viii + 433. ISBN 0-226-48733-4. £45.00 (hardback).
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This important volume challenges prospective reviewers with the sheer range and depth of its contributions. Divided into three principal parts – 'Geography and scientific revolution', 'Geography and technical revolution' and 'Geography and political revolution' – it consists of some dozen papers from scholars in several disciplines including history of science, cultural history and historical geography. Each section is admirably prefaced by a short synoptic piece by