ESSAY REVIEW

Thomas S. Kuhn's Mysterious Worlds

Katherine Hawley*


In 1962, Kuhn's The Structure of Scientific Revolutions sketched a new picture of science, then drew seemingly extraordinary epistemological and metaphysical conclusions from that picture. The key idea was that of change: scientists work within a framework, or paradigm, until more and more phenomena prove difficult to account for within that framework. This accumulation of anomalies prompts the development of an alternative way of working, and scientists may change wholesale from one paradigm to the other, changing their ways of talking and thinking about the world. Between these changes, or revolutions, the main activity of scientists is that of 'puzzle-solving'. This is a worthy endeavour, but it is not quite the great march towards truth in which scientists had previously seemed to be involved. After each revolution, different puzzles present themselves, and the process begins again.

Although this picture of science was very different from earlier ones, philosophers have not, in general, spent their time assessing the historical accuracy of Kuhn's claims about the workings of science. This is understandable, in part because questions of historical accuracy are better answered by historians. Another reason for this neglect is that the philosophical consequences of the picture, often only alluded to in Structure, can seem exhilarating, outrageous or extravagant, depending upon the interpretation of the text and the taste of the reader. The past 30 years have seen interpretations,
Exploration of Kuhn's world-change thesis requires an understanding of his incommensurability doctrine: one reason for believing in world changes is that they can be used to explain the phenomenon of incommensurability. This evidential relation may seem suspicious, since world-changes are a matter of metaphysics, whereas incommensurability seems to be an epistemological issue. After giving basic sketches of the incommensurability thesis and of the doctrine of world-changes, I will take up two rather different approaches to this problem complex: that of Hoyningen-Huene, and that of Ian Hacking, as set out in his contribution to the Horwich collection. Each attempts to draw the two issues together, and each provides a framework for understanding their interdependence.

Incommensurability

The claim that successive theories are incommensurable seems to concern oddities in the epistemological relationship between scientists and sciences on either side of a revolution. During such shifts, the language of science changes, as do its priorities, its problems, and what it considers to be an acceptable approach to these problems. One consequence of this large-scale change is a conceptual distance between scientists working within a certain paradigm, and the ways of thinking embodied in another, different paradigm. The later Kuhn seems to suggest only that one cannot simultaneously participate in more than one paradigm, that one cannot think in more than one way at once. Readers of Structure, however, often took Kuhn to be implying that different theories were incomparable, and hence that there was no rational method of choosing between them.

This suggestion of incomparability has explosive consequences. Since scientists appeared not to use rational methods to choose between their theories, sociological and psychological factors were invoked in order to explain how, nevertheless, they end up choosing one theory rather than another. At the same time, criticism was harsh. It seemed that all that was required in order to refute Kuhn was a demonstration of one's understanding of some past science, one's ability to make comparisons across the paradigms, one's rational choice of theory. Indeed, any attempt to demonstrate incommensurability could be seen as self-refuting: the very notion of explaining what it is about a distant paradigm that makes it incomprehensible was sometimes thought to be incoherent.

Kuhn denies responsibility for this furore. Subsequent to The Structure of Scientific Revolutions, he insists that incommensurability is not a question of incomparability, or of mutual failure of understanding. Of what, then, is it a question?

As time goes on, Kuhn's answer is more and more often couched in terms of meaning, reference and concept-application. We learn to use words by
smaller than it did in *Structure*, when incommensurability seemed to have all sorts of sources, not just linguistic ones, and to pose a real threat to communication and understanding. The claim is important, nevertheless, because of its connection with the world-change thesis. The phenomenon of linguistic incommensurability is taken as evidence for the disparity of underlying conceptual schemes, and, as I shall discuss below, conceptual schemes play an important role in constituting the Kuhnian world. This evidential role means that, far from being a weaker substitute for the doctrine of world-changes, the linguistic incommensurability thesis provides a key to understanding Kuhn’s pronouncements on this subject.

**World Changes**

The *Structure of Scientific Revolutions* has a chapter entitled ‘Revolutions as Changes of World View’, in which Kuhn tries to explain his thesis that when a paradigm changes, the world changes with it. He is strangely equivocal, seeming to say both that the world changes, and that it does not change. As is notorious, the chapter contains statements like ‘...though the world does not change with a paradigm, the scientist afterward works in a different world...I am convinced that we must learn to make sense of statements that at least resemble these’. Is this metaphor or is this out-and-out idealism?

Ian Hacking’s contribution to the Horwich collection focuses on the world-change doctrine, providing a restrained interpretation of Kuhn’s ideas and managing both to explain the equivocation of the original writings, and to show how linguistic incommensurability emerges as a consequence. Hacking suggests a nominalist account of ‘scientific kinds’—his refinement of the notion of natural kinds—and relates this to the world-change thesis, as follows. Individuals exist, independently of us, and can be divided into kinds, although kinds are nothing over and above the individuals that make them up. The world of individuals is more-or-less stable; a change of paradigm does not bring individuals into or out of existence. In this sense, the world stays the same during a revolution. When a paradigm changes, the kinds-structure, or, as Hacking labels it, the taxonomy, within which we live and work can change radically. The world contains different kinds of things, and in this sense we live in a different world after a revolution.

How does the phenomenon of linguistic incommensurability emerge from this picture? To make the link between taxonomy and language, Hacking adopts the term ‘lexicon’, a term which Kuhn has used more and more since the early 1980s. A lexicon is something like a vocabulary of scientific-kind terms. The structure of the lexicon mirrors that of the kinds to which its terms refer.

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Kuhn and the Phenomenal World

As might be expected, Kuhn himself is more expansive about the notion of a lexicon. He refers to the lexicon as “the module in which members of a speech community store the community’s kind-terms”. It is not the sort of thing which can be true or false, but has the logical status of convention: “Each lexicon makes possible a corresponding form of life within which the truth or falsity of propositions may be both claimed and rationally justified, but the justification of lexicons or of lexical change can only be pragmatic.” This characterization has, of course, all sorts of connotations, but the connotations which Kuhn has begun to emphasize are Kantian. “Like the Kantian categories, the lexicon supplies preconditions of possible experience. But lexical categories, unlike their Kantian forebears, can and do change, both with time and with the passage from one community to another.”

A strength of Reconstructing Scientific Revolutions is the ease with which Hoeningen-Huene draws on both the analytic and the continental traditions in philosophy. He fleshes out the tacitly Kantian aspects of even Kuhn’s early writings, using tools borrowed from Husserl, Hegel and Heidegger, whilst acknowledging that Kuhn’s unfamiliarity with these tools is not surprising “in an American historian and philosopher of science of the latter half of the twentieth century”. Some credit must be due to the translator, Alexander T. Levine, as well as to Hoeningen-Huene himself, for the way in which these often unfamiliar concepts are rendered intelligible.

The style of Hoeningen-Huene’s approach to the complex of problems involved in world-change, linguistic incommensurability and the lexicon is, at least superficially, rather different from that of Hacking’s approach. Instead of the world of individuals and the world of kinds, which are supposed to correspond to Kuhn’s stable and shifting worlds, Hoeningen-Huene begins by talking of the ‘world-in-itself’ and of a ‘phenomenal’ world: a clear echo of Kant’s noumenal/phenomenal and things-in-themselves/appearances distinctions, with the additional twist that, unlike Kant, Kuhn allows for a plurality of phenomenal worlds, both over time and between different communities.

Hoeningen-Huene and Hacking do, however, share a general framework of analysis. Both emphasise the dual aspect of the world concept in The Structure of Scientific Revolutions and so both make sense of Kuhn’s equivocations about ‘world changes’: Both highlight the importance of conceptual structure to the constitution of the shifting world, whether that is the phenomenal world, or the world of kinds.

The importance of classificatory structures in constituting the unstable world within which scientists work helps explain why the notion of incommensurability remained intractable for so long. Although Kuhn claims that incommensurability was not supposed to be a question of understanding, interpretation or incomparability, the phenomenon was clearly mind-dependent. It had something to do with the ways in which scientists and historians move between different paradigms. Seeing linguistic incommensurability as the sign of taxonomy change, and taxonomy as constitutive of a phenomenal world explains why Kuhn takes the epistemological difficulty of moving between paradigms to be a symptom of metaphysical change.

The familiar distinction between epistemology and metaphysics breaks down here. Kuhn’s incommensurability thesis combines a claim about the possibility of thinking in different paradigms, with a claim about the way the world is: a metaphysical claim about a mind-dependent world.

Reference and Realism

Hoeningen-Huene and Hacking each explain the link between world changes and incommensurability. The differences between these explanations, however, go beyond the immediately obvious differences of style and vocabulary, and have consequences for Kuhn’s anti-realist philosophy of science. Although Hacking deals with a very Kuhnian phenomenon—incommensurability—his conclusions clash with other aspects of Kuhn’s philosophy, aspects which Hoeningen-Huene carefully distils from his reading of Kuhn, and from their conversations. I shall explore these clashes, before considering the merits of Hacking’s alternative explanation of incommensurability, independent of its relationship to Kuhn.

The debate between scientific realists and anti-realists concerns the access that scientists have to some objective, mind-independent world. Two kinds of access are in question: referential and perceptual access. Most realists claim that the terms of mature scientific theories typically refer to actual entities, and that scientists can gain direct or indirect perceptual information about these entities.
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Most anti-realists deny one or both of these claims. In particular, Kuhn firmly denies that we have perceptual access to a stable, mind-independent world. Instead, inter-revolutionary normal science is an investigation of the local phenomenal world, and there is no sense in which science draws closer to 'the' truth over the course of revolutions.

Kuhn's position on referential access is less clear, but can be inferred from his theory of reference. According to this theory, the reference of a term is determined by the net of beliefs associated with the term. Meaning, in the sense of associated descriptions or concepts, determines reference: in more Kuhnian terms, the position of a term in the lexicon determines the referent of that term. This has the consequence that when beliefs and lexical structures change, as they do during a revolution, then the referents of terms also change. An often cited example of this change is the shift between Newtonian and Einsteinian theories of mass: the term 'mass' is thought to refer to different quantities in the two theories, since each theory attributes different properties to what it calls 'mass'.

This frequent reference change has been seen by realists as a disadvantage of Kuhnian semantics. If there is only one world, then constantly shifting reference forces us to choose between two unattractive alternatives. Either the world happens to contain entities that satisfy all of our different theories, or we usually speak of nothing at all. The former is thought wildly implausible, not least because the ontologies of successive scientific theories often seem mutually exclusive; the latter is thought rather depressing.

The Kuhnian theory of reference is reasonable in and only in the context of a dual-world thesis, and with the assumption that the world to which we refer is the perceptually accessible, non-stable phenomenal world. We refer to different things after a revolution, but that is not surprising if we accept that there are different things after a revolution. Kuhn combines his theory of reference with the dual-world thesis in order to explain the phenomenon of linguistic incommensurability, but the relationship between the two explanatory devices is unclear. Does the theory of reference motivate the dual-world thesis, with its attendant anti-realism, or does the argument move in the opposite direction, from reference to metaphysics? Whatever the resolution of this textual puzzle, Kuhn's explanation of linguistic incommensurability requires the existence of a stable, referentially and perceptually inaccessible domain. If Hacking's metaphysics is to serve as an elucidation of Kuhn's system, it must allow for this domain, and I shall argue that it does not do so.

Hacking's world of kinds clearly does not fit the bill, since by assumption it is unstable, changing when our theories change. The world of individuals, on the other hand, seems relatively stable. Does it have the right properties of inaccessibility? For a nominalist, a kind is a collection of individuals. When nominalists use kind terms, such as 'gold' or 'water', then if they refer to anything, they must refer to collections of individuals: there is simply nothing over and above collections of individuals. Since Hacking's individuals are the things which are grouped together to form kinds, they must be the things referred to by the names of kinds. If any scientific-kind terms refer, as Kuhn believes they do, then we have referential access to individuals.

Do we have perceptual access to individuals? Given that we have referential access to individuals, Kuhn's system requires perceptual access, for two reasons. The first is the success of normal science: whatever it is we refer to, we are reasonably successful at finding out about it. Normal science is an investigation of the local phenomenal world. The second reason is Kuhn's theory of language learning. According to Kuhn, we learn how to apply concepts partly through ostension of paradigm, or exemplar, referents, and partly through the acquisition of relevant similarity relations. Without some, at least indirect, access to these referents, we would be unable to use them as exemplars, since we would be unable to recognise them when they reappeared. We must have access to these exemplars—to individuals—since it is only through this access that we learn to apply concepts, and become a part of our language community. For Kuhn, referential access implies perceptual access, and perceptual accessibility is a property of the shifting world. Hacking's individuals are accessible on both counts, and therefore cannot be the constituents of the Kuhnian stable world. There is no place within Hacking's metaphysics for the stable yet inaccessible world that Kuhn's system requires.

Many of the World Changes articles have this tangential relationship to Kuhn's writings, and are none the worse for it. The book exemplifies the lasting potential of Kuhn's philosophies to inspire new and varied work, and will itself provoke further thought and new ideas. Anyone wishing, however, to reach a fuller understanding of Kuhn's thought, both as it was expressed so vaguely in Structure, and as it is still developing today, could not do better than to take Hoyningen-Huene as a guide.

Finally, what of Hacking as an alternative to Kuhn, rather than an interpretation of his work? Despite its failure to fit into Kuhn's system, Hacking's nominalism may yet be as good an explanation of the phenomenon of linguistic incommensurability as that system itself. Linguistic incommensurability consists in the fact that the meanings of terms from an old theory often do not map one-to-one onto the meanings of terms in a new theory. Different theories are not, in general, inter-translatable in the Kuhnian sense. Kuhn sees this as evidence of a disparity in underlying taxonomies, or conceptual schemes, and this inference seems plausible. Hacking, too, invokes the different taxonomies posited by different theories. Yet this need not commit him to the existence of both a phenomenal world and a perceptually and referentially inaccessible 'object' world. Kuhn's anti-realist stance is not the only possible response to incommensurability.
Kuhn’s theory of reference makes adoption of a dual world thesis an imperative. If, however, Hacking’s nominalism is combined with a different cluster theory of reference, according to which a term refers to whatever satisfies a sizeable proportion of the most important beliefs associated with that term, then it is compatible with a realist philosophy of science. The cluster theory has two advantages for the realist. It makes reference easier to secure, since mistaken beliefs do not automatically rule out successful reference. It also makes reference more stable, since many theory changes can be interpreted as re-descriptions of a certain group of individuals, and the occasions upon which extension-change must be posited are rare. This rarity, together with the relatively weak demands upon successful reference, means that shifts can more plausibly seen as extension changes, not as changes from one failure to refer to another failure to refer.

A cluster theory of reference makes possible the combination of nominalism and successful reference to a mind-independent world, whilst allowing for the existence of linguistic incommensurability. Of course, to make nominalism the foundation of a realist philosopher of science, much further work would be required. Above all, realism would also require the other, perceptual, access to the world. Nevertheless, Hacking has provided an alternative explanation of the phenomenon of linguistic incommensurability, without thereby ruling out realism. Kuhn’s anti-realism is not a direct consequence of recognising incommensurability: it also requires a dual-world metaphysics, together with a fully-contextual theory of reference, and an assumption that the underlying world is not perceptually accessible.

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ESSAY REVIEW

Scientific Realism: Darwinian Smoke and Platonic Mirrors

Aharon Kantorovich*


About half of the book (Parts I and II) is devoted to the defence of scientific realism (SR) and to rebutting the arguments of some leading anti-realists. Brown complains that the latter (whom he calls ‘enemies of science’) blow ‘smoke’ in our eyes and he undertakes the task of dispersing that smoke. In Part III Brown presents his own realistic view. The general style of the argumentation is refreshing, but occasionally the book produces some smoke of its own.

Although the book focusses on the issue of realism, its scope is wider than that; it deals with a broad spectrum of issues from the philosophy and sociology of science. I will concentrate here on the evolutionary criticism of SR and on the attempts to defend Platonic realism.

Evolutionary Themes in the Service of Anti-realism

A central argument for SR is that it explains the success of science. Brown refers in particular to Hilary Putnam and J. J. C. Smart as advocates of this view. To spell out the argument: the truth of our theories is the best explanation for their success, therefore they are probably true (granted we accept ‘inference to the best explanation’). However, except for the ‘final’ theory, all actual scientific theories are either false or, if they are true, we cannot know it. But an untrue theory may refer to real entities (without describing correctly their properties or behaviour, for example). Thus, in their attempts to prove the