themselves can justify the inference'. I prefer to say that *logic itself* is beyond justification, neither a source of justification nor something to be justified, neither a theory nor a principle, but an ability which pervades all our thinking, even our thinking of objects.

(3) Concerning the perspective of the world and its limits, Friedlander relies on the idea of the limits of the world in his interpretation of Wittgenstein's discussions of solipsism and ethics. For Friedlander, solipsism shows that the subject must come to an intuition of the limits of the world, fixed by the objects, themselves disclosed in a fundamental showing or intuition. It is by recovering such a perspective that the subject is able to recover *meaning*, and to respond to this recovery ethically, taking up an attitude to the world as a whole. However, the implication that the world *has* limits, and that to 'see the world rightly' (*Tractatus* 6.54) is to see it *sub specie aeternitatis* ... as a limited whole' (*Tractatus* 6.45), is, I think, rejected in the deconstructive movement of the last remarks in the *Tractatus*, beginning with 6.5, '*The riddle* does not exist'. For Friedlander, nonsense is revealed by the *Tractatus* to result from the temptation to run against the limits of language. However, this temptation can be understood in two ways: as the temptation to surpass unsurpassable but real limits; or as the temptation to *think of oneself* as boxed in by imagined but unreal limits. Friedlander understands the temptation in the first way. This presupposes a view of language and the world as a whole, a view 'from sideways on' as McDowell has put it. I, however, read the concluding passages of the *Tractatus*, and indeed the overall progress of the book, as demonstrating the illusoriness of this view.

However, to substantiate such worries, I would need to develop my own comprehensive interpretation of the *Tractatus*. In doing this I would have no better model than Friedlander's *Signs of Sense*. To reiterate my initial statement, this is an extraordinary book. Anyone interested in the *Tractatus* must read it.

University of Chicago MICHAEL KREMER

Thomas Kuhn. BY ALEXANDER BIRD. (Chesham: Acumen Press, 2000. Pp. xii + 308. Price £40.00 h/b, £13.95 p/b.)

Thomas Kuhn (1922–96) was one of the leading figures of twentieth-century history and philosophy of science. His *The Structure of Scientific Revolutions* (Univ. of Chicago Press, 1962, 2nd edn 1970, 3rd edn 1996) is one of the most influential books in the field. In the present volume, Alexander Bird presents a detailed, critical examination of Kuhn's work which is broadly organized by the leading themes of *Structure*.

Kuhn's main aim in *Structure* was to propose a general model of the nature of scientific change. According to Bird, this was not so much a philosophical project as a project in 'theoretical history of science' (p. 29). For Kuhn sought to show that the development of science displays a certain general kind of pattern, and that attention to the details of this pattern enables the historian to explain episodes in the history of science. This theoretical project, however, is not without philosophical substance.

Indeed, the project of theoretical history led Kuhn both to oppose a widespread philosophical viewpoint, and to propose one of his own. The viewpoint opposed by

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Kuhn is one which Bird describes as the *old rationalism*. The old rationalists sought an account of the scientific method, which they took to be the basis of rational scientific theory acceptance and scientific progress (pp. 3–6). By contrast, Kuhn's own positive ideas fall within what Bird calls the *new paradigm* (pp. 6–8). Proponents of the new paradigm tend to be sceptical of the existence of a universal, invariant method, and raise problems about scientific rationality and progress.

A central feature of Kuhn's model of scientific change is the idea that the development of science divides into periods of normal science based on a shared paradigm. Normal science is broken at intervals by revolutionary episodes in which the reigning paradigm is overthrown following a crisis induced by anomalies. Bird argues that a sharp distinction cannot be sustained between normal and revolutionary science. Instead there is a continuum of cases between paradigm shift and normal science. Anomaly may lead a paradigm to undergo non-revolutionary revision during a period of normal science (pp. 51–3). There may even be revolutionary change in normal science without displacement of paradigm (pp. 58–9).

Bird describes Kuhn's model as a 'cyclical' one (pp. 21, 33). But 'cyclical' may be too strong a word. It suggests that the pattern of normal science followed by revolution and new normal science is destined to go on for ever relentlessly repeating itself. But nothing in Kuhn's model entails that the process could not come to a halt with a completed normal science, unlikely as such an outcome may be. Nor is there any reason why a science in a state of crisis could not pull back from the brink of revolution, returning to normal science under the old paradigm.

As for the vexed term 'paradigm', Bird dissolves much of the obscurity that shrouded Kuhn's original discussion. Bird focuses on the distinction between exemplars and disciplinary matrices, which Kuhn introduced in the postscript to the second edition of *Structure* in an attempt to explain what he really meant by 'paradigm' (p. 68). The disciplinary matrix corresponds to the original idea of a paradigm as an overarching scientific world-view. It comprises a set of symbolic generalizations, epistemic values, ontology, models and puzzle-solutions, accepted by a scientific community as the basis for research practice. Exemplars are the last item on the list. They are concrete puzzle-solutions, which serve a pedagogical function as laboratory exercises and problems in textbooks. Bird employs the notion of an exemplar in his discussion of Kuhn's views of perception and scientific judgement, drawing parallels between the latter and connectionist views of cognition (pp. 71–5).

Kuhn was a well known advocate of the theory-dependence of observation. Bird introduces an important distinction between *strong* seeing, which requires that what is seen actually exists, and *weak* seeing, which does not (pp. 102–4). Both may be understood in either an *objectual* sense (seeing x) or a *propositional* sense (seeing that p). On the basis of this distinction, Bird argues against the extreme theory-dependence thesis that scientists' perceptual experience varies with change of theory. He grants that past experience influences present experience (p. 109), and that conceptualization of experience may be theory-laden (pp. 118–9), but insists that the influence of theory on experience is at best marginal (p. 122). He argues that the extreme theory-dependence thesis runs claims about experience and concepts together (p. 119), and

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that Kuhn fails to show that observation cannot serve as neutral arbiter between theories (p. 122). Bird's rejection of extreme theory-dependence brings his approach into potential conflict (e.g., pp. 130–3) with a defence of Kuhn based on a Kantian metaphysics, since it is at odds with the theory-dependence of scientists' phenomenal world (cf. Paul Hoyningen-Huene, *Reconstructing Scientific Revolutions: Thomas S. Kuhn's Philosophy of Science*, Univ. of Chicago Press, 1993).

Kuhn was also an advocate of the thesis of semantic incommensurability. He claimed that the meaning of scientific terms undergoes change in the course of a revolution. As a result, the vocabularies of rival theories may be mutually untranslatable, and their contents may not be comparable point by point. Bird notes that Kuhn's critics tend to deny the importance of translation, and to insist that theory comparison requires only common reference, which may survive change in intensional aspects of meaning (pp. 159–60). But Kuhn held that reference is not immune to variation with theory change (p. 160). Bird points out that Kuhn's views depend on the strong intensionalist assumptions that intension depends on an entire theoretical context, and must be fully satisfied in order for a term to have a reference (p. 167). Many philosophers critical of Kuhn have espoused causal accounts of reference which sever reference from intension (pp. 179–83). Bird discusses problems with the causal theory of reference determination (pp. 184–5), which have led to the proposal of causal descriptive accounts of reference which Bird sees as a return to intensionalism (p. 185–7). He also provides useful discussion of the 'taxonomic turn' in Kuhn's later work, in which translation failure between theories is due to changes to the classificatory systems which theories impose upon the world (pp. 191ff.).

Kuhn opposed realist accounts of science, and often sailed close to the epistemological relativist wind. While he held that science progresses in an evolutionary sense, he was critical of the realist idea that progress consists in steady advance towards the whole truth about the world. He employs a historical induction against convergence on truth, which, Bird points out, rests on exaggeration of the falsity of past theories (p. 226). Kuhn also evinced doubts about correspondence between theory and reality, which fall foul of the disquotational T-scheme (pp. 228–9) and intriguingly parallel positivist reservations about correspondence truth (p. 234). As for relativism, in *Structure* Kuhn suggested that criteria of theory evaluation are paradigm-dependent, and that there are no extra-paradigmatic standards which may serve as a neutral court of appeal. Bird draws on recent reliabilist and naturalized epistemology to show that variation of scientific standards does not lead to epistemological relativism in the manner suggested by Kuhn's original treatment in *Structure* (pp. 251ff.).

In addition to detailed critical examination of philosophical aspects of Kuhn's model of scientific change, Bird discusses the intellectual context in which his work originated, as well as the broader impact of the latter. Kuhn's work arose against a backdrop of empiricism in the philosophy of science (pp. 9–13), and was influenced by *Gestalt* psychology (pp. 13–4) and Ludwik Flecks' early work in the sociology of science (pp. 14–20). *Structure* contributed to a shift in the self-image of the social sciences by altering our conception of the natural sciences and of the scientific status of the social sciences (pp. 267–8). While Kuhn sought to distance himself from

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contemporary sociology of science, he contributed to the demise of Whiggish history of science, as well as to the recognition of the social nature of scientific knowledge (pp. 269–75). On a more narrowly philosophical front, Kuhn was a transitional figure, many of whose central ideas have a Cartesian and empiricist lineage which has been rejected by more recent work in an externalist and naturalistic vein (e.g., pp. 146–7, 165, 245ff.).

Bird's *Thomas Kuhn* is a well written and incisive book which makes a major contribution to Kuhn studies. It is informed and informative both about Kuhn's own work and the critical literature on Kuhn. For those not familiar with Kuhn's views, the book will serve as a balanced and accessible introduction. For those already engaged with the literature on Kuhn, the book is an important contribution, which advances discussion of several of the leading themes in the literature. I highly recommend the book for the specialist and novice alike, as a readable, informative and critical view of Kuhn.

University of Melbourne HOWARD SANKEY

A Slim Book about Narrow Content. By GABRIEL SEGAL. (MIT Press, 2000. Pp. 177. Price £13.50.)

Segal's book presents an extended critique of externalism, the currently dominant view of mental content, according to which subjects' thought-contents are partly individuated by their respective environments. Instead, Segal argues for the internalist view that subjects' thought-contents are wholly fixed by, or supervenient on, their intrinsic microstructural properties. While the book is indeed rather 'slim', it constitutes one of the best developed internalist critiques of externalism, and is written in a lively and accessible way. I expect it to become a standard reference for both professional philosophers and graduate students.

In the first half of the book Segal considers Putnam's and Burge's arguments for the externalist claim that some concepts have broad, or environment-involving, content. In response, Segal argues that whether or not there is a type of content which is broad, there is also a type of content which is narrow, i.e., which supervenes on intrinsic microstructural properties. In ch. 4 he argues against 'two-factor' theories of content which combine narrow and broad content. While the difficulties with two-factor theories are standardly used as a problem for internalism, Segal combines them with his earlier argument for narrow content to conclude that narrow content is the only kind of content there is. He defends this internalist conclusion from a number of possible objections in ch. 5. While the overall strategy of the book is novel, the form of some of the more detailed arguments is familiar from the existing literature. But Segal presents these considerations in a persuasive manner, and ingeniously defends them against a number of externalist replies. Given limitations of space here, I shall restrict my comments to chs 2 and 3, which argue for narrow content.

In ch. 2 Segal considers whether Putnam's twin earth argument shows that natural-kind concepts have only broad content. On this view, empty natural-kind

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