Kuhn, Thomas S. (1922–96)

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Thomas Kuhn (1922–96) trained as a physicist but is best known as a historian and philosopher of science. His most famous work, *The structure of scientific revolutions* (Kuhn, 1962) was one of the most influential books in twentieth-century philosophy of science. Kuhn's work led to the term "paradigm" coming into widespread use; resulted in much of the philosophy of science coming to be closely integrated with the history of science; and inspired much work in the emergent discipline of the Sociology of Scientific Knowledge. Kuhn published four books in his lifetime: *The Copernican revolution: Planetary astronomy in the development of Western thought* (Kuhn, 1957); *The structure of scientific revolutions* (Kuhn, 1962); *The essential tension* (Kuhn, 1977); and *Black-body theory and the quantum discontinuity 1894–1912* (Kuhn, 1978). One book of essays, *The road since structure* (Kuhn, 2000), was published posthumously.

Kuhn's Life

Thomas Samuel Kuhn (1922–96) was born in Cincinnati, Ohio to liberal Jewish parents and raised in New York City. Kuhn received a progressive education and was sent to schools that emphasized independent thought over the learning of facts. At university he was first trained as a physicist, and, following his PhD, moved into history then philosophy of science. He obtained all of his degrees in physics from Harvard University taking his BS degree in physics in 1943, his MS in 1946 and his PhD in 1949. As a physics student during wartime, Kuhn's studies were heavily directed towards practical matters, and he spent parts of 1943–45 working on radar countermeasures.

While Kuhn was a graduate student in physics at Harvard he was introduced to the history of science by Harvard President James Conant. Conant played a key role in determining U.S. science policy, both during the World War II, and then heading into the Cold War, and thought that ensuring science literacy amongst the educated population (via the history and philosophy of science) was a matter of national strategic importance. Conant asked Kuhn to prepare a case study on the history of mechanics for his newly appointed general education course for nonscience students at the university. Kuhn selected Aristotle's *Physica*: the task was to prove pivotal for Kuhn's academic career. Kuhn recalled that he first approached this text from a modern perspective and was bemused by what seemed to him such conspicuously wrong ideas. He later recounted that when struggling with the text he experienced something of a "Eureka" moment that permitted intellectual empathy and enabled him to read Aristotle's work in a new way. Kuhn later encouraged students to understand historical texts by imagining how a rational person would have made sense of them: he advised students to seek to render intelligible even the very oddest claims contained within them. This was an approach that would not only influence Kuhn's historical scholarship but, more significantly, his views on the development of science.

After his PhD, Kuhn held a three-year fellowship at Harvard starting in 1948. This enabled him to work with complete freedom, without any teaching commitments, and oversaw his conversion from physicist to historian of science. Kuhn read widely, and was influenced by the works of the psychologist Jean Piaget; the School of Gestalt psychology; the sociologist of science, Robert Merton; and the biologist and

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physician Ludwik Fleck, author of *Genesis and development of a scientific fact*.

In 1951 Kuhn was invited to give the highly prestigious Lowell Lectures at Harvard, which helped clarify his ideas on the development of science. It was only after this time that Kuhn became a lecturer (and later, assistant professor) in the history of science at Harvard. In 1956 Kuhn moved to an appointment of assistant professor in history of science at Berkeley and in 1957 he published his first book *The Copernican revolution: Planetary astronomy in the development of Western thought*.

Kuhn became a full professor at Berkeley in 1961 and whilst at Berkeley familiarized himself with the works of the philosophers Paul Feyerabend and Ludwig Wittgenstein. In 1962 Kuhn published his best known and most influential book, *The structure of scientific revolutions*, first as part of the *International encyclopedia of unified science,* and then as a self-standing monograph by Chicago Press. In 1965, *Structure* was the focus of a colloquium organized by the British Society for the Philosophy of Science and the London School of Economics and Political Science. The result was the publication *Criticism and the growth of knowledge*, edited by the philosophers Imre Lakatos and Alan Musgrave (1970), which included serious criticisms of Kuhn's views by the leading philosophers of science of the day. In 1970 Kuhn published a lengthy postscript to the second edition of *Structure,* which provided a clarification and defense of his views.

From 1961–64 Kuhn worked on the Sources for the History of Quantum Physics project, which involved interviewing key participants and also copying and cataloguing key manuscripts. *The essential tension*, a collection of essays on the history and philosophy of science, was published in 1977, followed in 1978 by *Black-body theory and the quantum discontinuity 1894–1912*, a book on the emergence of quantum theory.

From 1964 to 1979 Kuhn was named the M. Taylor Pyne Professor of Philosophy and History of Science at Princeton University. In 1979 Kuhn moved to the Massachusetts Institute of Technology where, in 1983, he was named the Laurance S. Rockefeller Professor of Philosophy. He remained there until 1991. Kuhn was President of the American History of Science Society in 1968–70 and of the American Philosophy of Science Association in 1988–90.

The road since structure (Kuhn, 2000) contains an edited transcript of sections of an interview given by Kuhn just before his death. There Kuhn talks about his work and his life. Kuhn's work is discussed in greater detail below. When discussing his life, Kuhn self-presented as a complex and not altogether happy man; "I am an anxious, neurotic—I don't bite my nails but I don't know why I don't bite my nails" (Kuhn, 2000, p. 321). In the 1940s Kuhn underwent psychoanalysis, with an unnamed analyst whom he came to "hate." Kuhn claims to have had relatively few friends, and thought he drove away potential graduate students. He married twice and had three children. Kuhn died in 1996.

Kuhn's Works

The reception of Kuhn's work has varied wildly. *The structure of scientific revolutions* is one of the most important books of the twentieth century, and has been cited over 57,000 times. *The Copernican revolution* and *The essential tension* have both reached a respectable audience and have been referenced a couple of thousand times each. *Black body theory and the quantum discontinuity* and *The road since structure* are both little read and rarely cited. Here we will briefly review each work in chronological order.

Kuhn's first major historical work tracked the shift from Ptolemaic astronomy to a Copernican system of cosmology: *The Copernican revolution: Planetary astronomy in the development of Western thought* (Kuhn, 1957) emerged from his teaching on the general education science course at Harvard. The prevailing wisdom was that the Copernican revolution oversaw the emergence of a scientific cosmology for the first time. Kuhn overturned this view by emphasizing that the Ptolemaic system was a

scientific worldview, and that Copernicus owed more to the Ptolemaic system than scholars had hitherto acknowledged. The importance of this historical work was the prominence it placed on understanding episodes of science history "from within." Until that time, most history of science was undertaken by interested amateurs and exhibited a rather linear, "Whig" perspective: that is, historical accounts tended to depict science as a progressive, truth-tropic, cumulative growth of scientific facts and accounts characteristically omitted those aspects of science that did not fit this perspective. Many of the broad themes of this first book would receive a fuller explication in Kuhn's most famous work *The structure of scientific revolutions* (Kuhn, 1962).

Kuhn opens *The structure of scientific revolutions* with the (now infamous) line, "History, if viewed as a repository for more than anecdote or chronology, could produce a decisive transformation in the image of science by which we are now possessed" (Kuhn, 1962, p. 1). Kuhn contended that accurate historical accounts of science must presage philosophical questions. In *Structure,* Kuhn gave a new account of science, which was fully informed by historical case studies. He described science as a social enterprise that was characterized by adherence of groups of individuals to an overarching "paradigm." He argued that history showed that science exhibited a cyclical structure: periods of stability—what Kuhn dubbed "normal science"—would give way to periods of "crisis" when serious problems with the paradigm emerged. Eventually, Kuhn contended, a new paradigm would gain acceptance: Kuhn termed this a "scientific revolution." Significantly, Kuhn held that the new paradigm would be "incommensurable" with its predecessor: there would be no common measure for comparing the paradigms since each would "carve up" the world in different ways and each would have different claims about what constituted a problem and how to go about solving it. As a result of this purported incommensurability, Kuhn held that there could be no decisive reasons for opting for the older paradigm rather than its successor. To many commentators, Kuhn's account threatened to eliminate rationality and amounted to epistemological relativism (although Kuhn himself always resisted such readings of his work). Kuhn's paradigms and the picture of science presented in *Structure* are discussed in greater depth in the entry Kuhn's Paradigms.

The essential tension (Kuhn, 1977) collects essays written in the years leading up to, and also after, the publication of *Structure*. The first six essays in the book are concerned with historiography—that is with questions of how historians should do history. Essays consider, for example, the relations between history of science and philosophy of science, and the relationship between "internal" and "external" histories of science. The second half of the collection deals with what Kuhn terms "Metahistory," which is basically historically informed reflections on the practice of science. Papers here concern matters such as the "essential tension" between tradition and innovation in science, and the role of thought experiments in science.

Black-body theory and the quantum discontinuity 1894–1912 (Kuhn, 1978) is a technical work that is little read. In it Kuhn provides a detailed historical study on a revolutionary episode in science—the origins of quantum theory. Standard narratives had it that Max Plank played a crucial role in introducing the concept of quantum discontinuities around 1901. In researching the origins of quantum theory, Kuhn became immersed in some earlier papers by Max Plank on black-body theory. When turning again to read Planck's classic quantum papers, Kuhn found that he could no longer read them as he had been accustomed. In the context of Planck's earlier work, they no longer seemed revolutionary, but could rather be seen as continuous with classical physics. In Kuhn's account, the concept of quantum discontinuity is introduced only later, in papers written independently by Paul Ehrenfest (1880–1933) and Albert Einstein (1879–1955) in 1906. To the puzzlement of many commentators, *Black-body theory* makes

no use of the template for thinking of scientific revolutions provided by *Structure*—there is no explicit talk of paradigms, nor of incommensurability, nor of anomalies or crises. Kuhn's work on historiography (for example, in *The essential tension*) elucidates this apparent lacuna: Kuhn thought that explicit reference to philosophical notions could only distort historical work.

If the early part of Kuhn's career was devoted to showing the importance of history and psychology to understanding the nature of science—including epistemological questions—the latter part of his career (from the late 1970s onwards) took a more traditional philosophical direction. One reason for Kuhn's change of direction may have been the negative philosophical reception to *Structure*. Kuhn's training was in physics and he was a "self-taught philosopher" but throughout his career he sought professional acceptance by mainstream academic philosophy. Kuhn's later work distanced itself from the earlier use of psychological theories to understand the tacit understanding involved in "paradigms" and how scientists reason within them, and examined the nature of incommensurability from a linguistic perspective. Influenced by the philosopher of language W. V. O. Quine (1908–2000), Kuhn now interpreted incommensurable theories according to (explicit) lexicons that shared no overlapping meaning, and which were not intertranslatable: Kuhn contended that one could not make changes to parts of a theoretical network without making changes to the whole of it (a view known as "meaning holism"). From the 1980s Kuhn gave his work on paradigms and incommensurability a Kantian interpretation, which was further elucidated by philosopher Paul Hoyningen-Huene.

For the final 15 years of his life Kuhn was working on a book on rationality, relativism, realism and truth, which he never finished. Much of the work that he produced in his final decades was published in the posthumous collection of essays *The road since structure* (2000). This includes essays that, for example, develop various reworkings of his ideas about incommensurability, discuss the relevance of the newly fashionable causal theories of meaning, and attack relativist tendencies in the history and sociology of science.

Kuhn's Influence

Kuhn may be considered one the most influential philosophers of the twentieth century; undoubtedly it is his early work which remains most prominent and important. His ideas (not least his terminology) have been influential not only within history and philosophy of science but also the social sciences and humanities more broadly.

Post-Kuhn, philosophers of science have been forced to pay more attention to empirical studies by historians and sociologists of science that show how scientists actually work. The pre-Kuhnian assumption of a sharp distinction between the "context of discovery" and a "context of justification" was seriously challenged by Kuhn's insistence that philosophy pay attention to how scientific discoveries and reasoning actually occur. Similarly, Kuhn's insistence that science be viewed as an inherently social enterprise gave impetus to sociology of science.

It is his views on scientific rationality that have perhaps been most controversial and much debated, not just from an exegetical perspective. Kuhn's claims about incommensurability between paradigms and his insistence that there is no straightforward algorithm for paradigm choice were influential in shaping the tenets of the Strong Programme in the sociology of science (Barnes, 1982). The Strong Programme construed scientific beliefs as fundamentally determined by external social influences bearing on the members of the scientific community. Indeed, Kuhn's views appear to have been influential in giving rise to a tradition of "cultural relativism" within the humanities and social sciences (and even counter-culture). On this view, sets of beliefs are not only shaped by one's culture but are as epistemically legitimate as any other sets of beliefs. Whilst passages within *Structure* seem

to support such ideas Kuhn was vociferous in claiming that his work had been ill-interpreted and throughout the rest of his career sought to reassert himself as a staunch defender of science and of scientific rationality.

SEE ALSO: Epistemology; Kuhnian Paradigms

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