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RECONSTRUCTING SCIENTIFIC REVOLUTIONS: THOMAS S. KUHN'S PHILOSOPHY OF SCIENCE. By Paul Hoyningen-Huene. Translated by Alexander T. Levine. Foreword by Thomas S. Kuhn. Chicago: University of Chicago Press, 1993. pp. xx + 310. \$40.00; paper \$15.95.

WORLD CHANGES: THOMAS KUHN AND THE NATURE OF SCIENCE. Edited by Paul Horwich. Cambridge: MIT Press, 1993. pp. 356. \$45.00.

In 1962, Thomas Kuhn published *The Structure of Scientific Revolutions*. This monograph's immediate and continuing influence on philosophy of science in particular and on intellectual life in general cannot be exaggerated. The English edition alone has sold three-quarters of a million copies and at least nineteen translations exist in both Occidental and Oriental languages. Given this abiding and global interest, scholars concerned with science, its history and philosophy, and, more broadly, with the nature and structure of disciplines, including the discipline of Speech Communication, will welcome these two impressive examples of the hermeneutics of affirmation. But since the two works under review are essentially epideictic, it may be helpful, after a brief review of their contents, to redress the balance by raising explicitly three deliberative issues they raise implicitly, issues central to the self-understanding of Speech Communication: 1) What does *Structure* imply about the extent to which science is rhetorical? 2) To what extent has the rhetorical perspective endorsed in *Structure* induced historians and philosophers of science to take rhetorical theory seriously? 3) To what extent is *Structure's* framework applicable to Speech Communication as a discipline?

Hoyningen-Huene's book is a loving (but not fawning) exegesis of Kuhn's central ideas in *Structure*, based on a careful study of all of Kuhn's published work, and on extensive interviews with Kuhn over a year-long residency at the Massachusetts Institute of Technology. The reconstruction is far from uncritical—indeed, it is intellectually bracing both in criticism and in defense—but it is imminent critique, critique from inside Kuhn's intellectual world. Hoyningen-Huene shows that Kuhn's conception of science relies on a new historiography of the subject, stripped of Whiggish assumptions. It is this historiography that defines the subject of science as a phenomenal world, the world science collectively perceives. The price for this metaphysical austerity is the abandonment of any form of robust realism: truth is relative to a paradigm whose elaboration is the job of normal science. Revolutionary science, then, involves the replacement of one phenomenal world, one paradigm, with another. Strictly speaking, these different paradigms will be incommensurable. This does not mean that they are incompatible or discontinuous, only that their lexical structures will differ in fundamental ways: "there can thus be no conceptual system in which the empirical consequences of both theories can be translated without loss or change" (215). Progress from paradigm to paradigm is possible but it must be defined not as a closer approximation to the truth but as an increase in problem-solving capacity.

Given the professed aim of *Reconstructing Scientific Revolutions*, it is difficult to imagine a more conscientious result. Although Hoyningen-Huene spent over a year discussing Kuhn's philosophy of science with Kuhn himself, his book contains no quotations from these interviews and, with one well-motivated exception, no reference to them. This hermeneutic parsimony is a consequence of Hoyningen-Huene's anxiety lest his readers be unable to verify the results of his exegesis against readily available printed documents. This parsimony is accompanied by an admirable thoroughness, a desire to assemble every reference relevant to the stability of a particular interpretation. In Chapter Five, for example, the claim is made that, in Kuhnian revolutions, the phenomenal world shared by normal science changes. To anchor this one point of interpretation, Hoyningen-Huene in a single citation refers eighteen times to the first edition of *The Structure*, and twice to the second edition and *The Essential Tension*. In addition, he refers to a series of essays by Kuhn: "Second Thoughts on Paradigms" (in *Structure of Scientific Theories*, ed. F. Suppe [Urbana: University of Illinois Press, 1974] 459-482), "Metaphor in Science" (in *Metaphor and Thought*, ed. A. Ortony [Cambridge: Cambridge University Press, 1979] 409-419), "Commensurability, Comparability, Communicability" (in *PSA 1982: Proceedings of the 1982 Biennial Meeting of the Philosophy of Science Association*, ed. P.D. Asquith and T. Nickles [East Lansing MI: Philosophy of Science Association] 669-688), and "The Histories of Science: Diverse Worlds for Diverse Audiences" (*Academe: Bulletin of the American Association of University Professors* 72 [1986]: 29-33). These works span a period of twenty-four years of interpretative stability (201).

Horwich's collection, a *festschrift* published on the occasion of Kuhn's retirement from MIT, is another instance of imminent critique. The tone is appropriately epideictic. There is a personal reminiscence by Carl Hempel, followed by a series of essays whose unifying principle is their focus on the pervasive problem set for which Kuhn is largely responsible—normal and revolutionary science, paradigms, incommensurability. The collection concludes with Kuhn's own reflections on the essays written in his honor. The cast is stellar—Ernan McMullin, Noel Swerdlow, Jed Buchwald, Nancy Cartwright, and Ian Hacking are among the contributors—but the collection makes no concessions to a general audience. Every essay is aimed directly and exclusively at philosophers and historians of science. For example, Swerdlow uses an oration of Regiomontanus to make a point about a specifically Renaissance science; Buchwald distinguishes between two kinds of nineteenth-century experiments in physics, those that confirm and those that explore. A sample of the prose, from an essay by Hacking, will give the reader the flavor of the collection's intellectual style: "The relation that Kuhn himself intends is to be lexical or conceptual. But isn't 'lexical' just a way of concealing a discredited adjective? If *J* and *L* are scientific kinds, isn't *J* a kind of *L* if and only if it is analytic that all *J* are *L*?" (302) *Caveat lector*.

Having briefly reviewed the contents of these two volumes, I would like to address the three deliberative questions mentioned earlier. First, What does *Structure* imply about the extent to which

science is rhetorical? Kuhn's book acknowledges the central role of rhetoric during revolutionary periods. In the Ptolemaic paradigm, for example, the earth was at the center of the universe, a position of geometric and scientific privilege; in the Copernican paradigm that followed, the earth was just another planet, a considerable demotion. Strictly speaking, the two paradigms were incommensurable. Earth was still earth, but there was no way of equating a stationary central object with a rotating peripheral one. On the one side of an historical gap, then, we had normal Ptolemaic astronomy; on the other side, normal Copernican astronomy. The transitional period was the Copernican revolution. It is in such interim periods, though not of course in normal science, that scientists must have recourse to "techniques of persuasion, or . . . argument and counterargument in a situation in which there can be no proof" (*Structure*, 2nd edn., 152). Because the interim between Copernicus's *De Revolutionibus* and Newton's *Principia*, the first possible *terminus ad quem* of the Copernican revolution, is nearly a century and a half, the scope of rhetorical analysis ought to be considerable.

The second deliberative question concerns the extent to which the rhetorical perspective *Structure* endorses has induced historians and philosophers of science to take rhetorical theory seriously. As a rule, philosophers and historians of science have eschewed rhetorical analysis of any sort. This is true even in cases where such analysis would seem pertinent. In the Horwich collection, for example, J.L. Heilbron follows a quarrel between mathematicians in the Royal Society, a quarrel that "opened extensive rhetorical opportunities" (86); Noel Swerdlow notices that his exemplary text, an oration by Regiomontanus, is epideictic in character (141) without using the term; Jed Buchwald notes the importance of *stases*: "Arguments," he says, "may revolve about physical issues (was ether a better physical foundation than light particles?) or about analytical complexity (were Fresnel integrals less acceptable as primary apparatus than equations for particle motion?)" (180-181); in his study of eighteenth-century science, M. Norton Wise has an instrument, a calorimeter, "*mediat[ing]* between the potentially divisive interests of Laplace and Lavoisier" (212; my emphasis). But none of these scholars follows up on what seem to be intriguing lines of thought; none gives evidence of having read or been influenced by rhetorical theory or criticism.

The third deliberative question concerns the extent to which *Structure's* framework is applicable to Speech Communication as a discipline. In Kuhn's thought, from *Structure* to the present day, there persists between normal and revolutionary science a dialectical tension. There can be no revolution without normal science and, if successful, revolutionary becomes normal science, an activity that consists entirely of puzzle solving, of problems with determinate solutions. The puzzle may be very difficult indeed: to find the Higgs boson, we may need to build a supercollider. The solution may be as significant as Aspect's experiments confirming quantum indeterminacy. Given the narrowness of Kuhn's definitions, however, it is difficult to see its application beyond the physical to the other sciences, and beyond these to other disciplines, for instance, to the social sciences and the humanities. For example, *The Origin of Species* is not a revolutionary work in Kuhn's sense, since it was preceded by nothing like his normal science. It is even more difficult to see the humanities as examples of Kuhn's structure, though talk about new paradigms and revolutions is commonplace in these disciplines and, of course, in Speech Communication. In *Theories of Human Communication*, for example, Stephen Littlejohn frames his text with Kuhnian talk about theory and theory change.

What motivates this common but inappropriate use of analogical reasoning, these *misapplications* of Kuhn? In a brilliant review essay ("Being There with Thomas Kuhn: A Parable for Postmodern Times," *History and Theory* 31 [1992]: 241-275), philosopher Steve Fuller explores what others have called "physics envy," the need to measure a particular discipline against the supposed paradigm of disciplinary effort. He notices how, merely by referring to a discipline in Kuhnian terms, you automatically raise its status: "indeed, social scientists [and scholars in Speech Communication?] were attracted to Kuhn's book precisely because it seemed to provide a blueprint for how a community of inquirers can constitute themselves as a science, *regardless* of their subject matter" (269). In a stroke, you can see yourself as a Nils Bohr, revolutionizing your discipline, or as a Richard Feynmann, doing the Nobel prize winning work of normal science.

Such misappropriation creates a special problem for rhetoricians because Kuhn's account is entirely internal to science. It is as if ethics, politics, and society had no influence on science, and science no influence on them. It is a picture of science without fraud and commercialism; it is America without nuclear waste or the Human Genome Project. As Fuller says: "Kuhn stands out for having published a book that left no clear political trace, one that cloaked a desire for science to be left to the scientists in the guise of an empirically informed theory of the nature of scientific inquiry" (259). Thus Kuhn's schema leads away from just those problems of science and of Speech Communication that are central to the rhetorical tradition.

There is a final problem. Neither Fuller, nor Hoyningen-Huene, nor any of Horwich's contributors deal with what I take to be Kuhn's central and questionable presupposition: that the history of science has an interesting intellectual shape. Of course, all history has a shape of sorts: Rome rose; it declined; it fell. But no scholar worth her salt would find this shape interesting. In contrast, Kuhn's version of the Copernican revolution *would* count as an interesting intellectual structure, *if true*. But even this most clear-cut of Kuhnian exemplars is very far from clear-cut. Was *De Revolutionibus* a revolutionary work for Copernicus and most of his peers? Or was it a work *within* the Ptolemaic tradition, aberrant only in its heliocentrism? If so, it was at its publication normal science. Was *De Revolutionibus* revolutionary science for Kepler? Yes and no. It certainly persuaded, rather than convinced him to search for his planetary laws. But the discovery of the laws themselves was good normal science, wasn't it? In working these laws out, wasn't Kepler solving puzzles within the Copernican paradigm? On the other hand, didn't these laws *revolutionize* astronomical dynamics and lead to Newton's laws in the *Principia*? These questions are not merely captious; they indicate, to me at least, that Kuhn's schema may be another in a long line of attempts to impose upon history a shape alien to its essence, its essential unrepeatability. In my view this

essential unrepeatability applies also to the *social* history of science, the assumption that a Copernican and an Einsteinian revolution are sociologically enough alike for meaningful comparison.

The books presently under review are the culmination of thirty years of scholarship inaugurated by the publication of *The Structure of Scientific Revolutions*. During these three decades, in history and philosophy of science, Kuhn has to a great extent determined the set of problems scholars in the history, philosophy, and rhetoric of science have addressed. At this point in the scholarship of science, we can imagine two possible futures, one in which Kuhn's problem set continues to be explored, and another, in which a temporary moratorium is declared on citations to *Structure* and mentions of paradigms. Hoyningen-Huene, Horwich, Fuller can help us decide which of these possible futures is more conducive to intellectual growth.

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