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Charles J. Dougherty
Creighton University

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PHILOSOPHY OF SCIENCE

THE STRICTURES OF SCIENTIFIC RELATIVISM

Charles J. Dougherty
Department of Philosophy
Creighton University
Omaha, Nebraska 68178

Few recent works have generated as much intellectual discussion as Thomas S. Kuhn's *The Structure of Scientific Revolutions.* Yet given the impact this book has had on our understanding of science – its role in the demise of logical positivism, in the current outpouring of interest in the history of science, and in changes in science education – perhaps it is time now, some ten years after Kuhn's provocative *Postscript,* for still another look at his thesis. That is the purpose of this study. First, those elements of Kuhn's book which committed him to a scientific relativism are reconstructed. Secondly, this relativism is critiqued from several rather different points of view. Finally, the position is defended that Kuhn's view of science is suspect because it generates two paradoxes, one self-referential and one existential, and because his analysis is considered inadequate both from a pragmatic and a phenomenological perspective.

† † †

I.

By now Kuhn's (1970) central conceptual contribution is well-known. The history of science is a dynamic of paradigm-based normal science, progressively elaborating and confirming itself; revolutionary episodes, proliferating a consciousness of anomaly and innovative response to anomaly; and the re-establishment of normal science based on consensus around a new paradigm. Were this the whole of Kuhn's thesis, his book would have been philosophically non-controversial. Philosophers, of course, knew that science and scientific theories had developed, and that that development was not without its own peculiar paroxysms. What was (and what remains) philosophically controversial was Kuhn's understanding of paradigm.

Although *paradigm* is used throughout Kuhn's book and is re-examined critically in his *Postscript,* it defies easy translation into other words. It is what the scientists of a given tradition share, that which makes fruitful communication between them possible, and that which allows for successful elaboration of their world-view. Kuhn introduced the notion as an achievement or constellation of achievements so unprecedented as to galvanize a group of scientific adherents, and yet so open-ended as to permit these adherents to accept the task of completing its promise in painstaking and detailed scientific work. The achievements of Isaac Newton formed a paradigm in this sense. As the matrix of views within which the discipline functions, the paradigm provides laws, theories, definitions, symbolic generalizations, mathematical and logical tools, techniques, instrumentation, and shared beliefs and values for its followers. More importantly for Kuhn, the paradigm presented a concrete example or series of concrete examples for what counts as legitimate effort in that discipline. This latter sense of the paradigm as shared example also contains the crucial philosophical claim of Kuhn's work: that a paradigm defines the world of the scientists who accept it and does so in a fashion which cannot be made fully explicit.

Three dramatic consequences are entailed by Kuhn's theory of scientific paradigms. First, there are no facts independent of a given scientific theory. The paradigm defines a world, *not* a way of seeing or interpreting the world. For Kuhn there was no access to the facts directly. Rather, they are always fact-for-a-paradigm; they are always theory-laden facts. This immediately eliminates the possibility of a correspondence theory of truth since there is no reality separate from the paradigm's reality against which the paradigm itself could be compared. (Indeed, the very notion of paradigm suggests a coherence theory of truth.)

Secondly, since the paradigm is not capable of being made explicit, no rules can exhaust the import of a scientific tradition. More importantly, since the paradigm cannot be rationally articulated in full, there will always be non-rational elements in any individual's commitment or opposition to any paradigm. The decision to adopt any given paradigm at any

given point of its development is more akin to the commitment of a political revolutionary or to a religious conversion than it is to the conclusion of a deductive syllogism.

Finally, since each paradigm defines its own world, and there is no paradigm-independent world available to us, the historical movement of the scientific community from one paradigm to another is beyond rational appraisal. One can speak of progress only internal to a single paradigm; only here are there standards against which to measure progress, *viz.* the paradigm itself. Progress here becomes tautological. Again, since there is no access to the real without a paradigm, there is no way to represent meaningfully trans-paradigm progress. Progress here is empty. Furthermore, since each paradigm defines its laws, theories, and beliefs in its own terms, paradigms are not even comparable. Instead, they are radically incommensurate.

In more traditional philosophical terms, what Kuhn offered us is a scientific relativism. Scientific "truths" are relative to a given paradigm. This paradigm is not itself capable of being compared directly with the real. Nor may we assume that historical development will bring us increasingly more valid paradigms, since no two paradigms may be compared directly. Individual scientists and the community of scientists at large move from one paradigm to another for considerations not wholly rational, and where rational, not wholly explicit. If we accept this position, we shall have to relinquish the notion, in Kuhn's (1970:170) own words, that ". . . changes of paradigm carry scientists and those who learn from them closer and closer to the truth."

Two more points need to be made to complete our exposition of Kuhn's relativism. The first issue is raised in the *Postscript.* In language which is quite unexpectedly materialistic, Kuhn offered a finer-grained analysis of the epistemic roots of this relativism. Although we all may receive different sensations from a putatively similar experience, "under pain of solipsism" Kuhn held that we must posit the existence and immutability of identical stimuli. Thus, for example, three different perceptions of an orange by three different perceivers may result in three quite different sensations (say that of an orange, a peach, and a grapefruit); yet, to maintain a minimally common world we must, Kuhn asserted, say that three identical sets of orange-stimuli were present—even though stimuli are the sorts of things which can never, in principle, be known. These would-be things-in-themselves are immediately and involuntarily transformed into sensations by way of neuro-cerebral mechanisms "fully governed by physical and chemical laws" (Kuhn, 1970: 194). Scientific paradigms may therefore be regarded as this sort of neural processing writ large, the collective and involuntary physical and chemical laws of the scientific community.

The second issue moves in just the opposite direction. As Kuhn's stimulus-to-sensation model completed his relativism at the micro-level, so his rejection of any God or trans-human natural intelligence completed it at the macro-level. If one is tempted to read the cunning of Reason into this dynamic of scientific development, Kuhn scotched the temptation by an explicit espousal of Darwin's conceptual transposition. *The Structure of Scientific Revolutions,* like *Origin of Species,* "recognizes no goal set either by God or nature" (Kuhn, 1970:172). Since this is not a teleological process, we shall have to "learn to substitute evolution-from-what-we-do-know for evolution-toward-that-we-wish-to-know" (Kuhn, 1970: 171).

The world is now well lost.

II.

One of the great ironies in the history of philosophy is the paradox of the skeptic who claims to know that we can know nothing. Unless he makes no positive claim whatsoever, or is just plain evasive, his theory refutes itself. A similar conundrum faces the relativist. If his view is that all truths are relative to some perspective, one may validly counter that this is merely the relativists' perspective. If the relativists' rejoinder is that truth is relative not only from his perspective but from every conceivable perspective, he is well on his way to refuting himself by offering a non-relative claim. And to paraphrase Russell's remark on universals, if you have to admit one non-relative claim, you might as well admit all that you need. Let us apply these general observations to Kuhn's own views.

It is roughly true to say that, prior to the wide acceptance of Kuhn's thesis, the received philosophy of science in the English-speaking world was that of the Vienna Circle positivists. At least, it is accurate to say that Kuhn himself saw the situation this way. In the "Introduction," for example, Kuhn claimed to be rebelling against a theory of science on which he was himself weaned intellectually. This theory was characterized by strong separations between scientific fact and scientific theory, between sociology and epistemology, and between the context of discovery and the context of justification. This theory minimized or ignored the role of history, personal factors, and the non-rational aspects of science in general in favor of emphasis on the rational methods of science and the development-by-accumulation model. Not only was it largely ahistorical, but it was also skeptical of the social sciences, and tended to accept the ultimate reducibility of the natural sciences to physics. This received view had characteristic laws, theories, definitions, symbolic generalizations, mathematical and logical tools, techniques, and shared beliefs and values. Furthermore, there was considerable consensus on the achievements they took as their shared examples,

viz. the work of Carnap, Schlick, Russell, Ayer, the early Wittgenstein, and others.

The point I am driving at ought to be clear by now. Prior to Kuhn's theory there existed another paradigm of understanding science. That this paradigm is philosophical and not strictly scientific does not blunt my point, since the positivists clearly viewed their work as scientific in the relevant sense and so did Kuhn. At the end of the "Introduction" he said of the received view that its various elements constitute "parts of a theory, and by doing so, subjects them to the same scrutiny regularly applied to theories in other fields." It suffices to conclude this tangent to observe that the primary thrust of Kuhn's thesis is carried by empirical claims taken from the history of science. In sum, then, Kuhn's theory of science is a paradigm designed to replace the previous positivist's paradigm.

If this is the case, then the full irony of Kuhn's position is upon us. Because of his stimulus-to-sensations epistemology, and the resultant claim that a paradigm defines a world, there is no paradigm-independent fact against which we can appraise the validity or truth of Kuhn's thesis. Because paradigms cannot be compared, indeed, because critical terms like *science, explanation, justification,* and the like will literally mean different things to the positivist than they did to Kuhn, the two paradigms are strictly incommensurate. Therefore, we cannot even venture to say that Kuhn's views are truer than the positivists' views. Because there is no *telos* or macro-level progress in our developing theories of science, we cannot even say that there has been progress in understanding science. The most we can assert is that the not fully rational community of philosophers of science have become persuaded that Kuhn's approach is somehow a preferable paradigm, and that those who have resisted the paradigm change are getting older and dying out.

This is Kuhn's version of the self-referential paradox of the relativist. If his view is correct, it is only correct from his own perspective and that of his followers. We cannot meaningly say it is correct (or incorrect) in itself. In fact we have Kuhn's own affirmation of this. He told us (Kuhn, 1970: 208) that his theory ". . . need not be right, any more than any other theory. . . ."

III.

As the philosophical formulation of the relativists' paradox is merely the abstract expression of what in its concrete manifestation is the lived inconsistency of a person's life, so the paradox of Kuhn's thought expresses logically what is an existential contradiction for the scientist. To illustrate this point, let us consider from Kuhn's own point of view what it is that makes a person a scientist.

There is, Kuhn told us, a set of personal commitments without which no man can be a scientist. "The scientist must, for example, be concerned to understand the world and to extend the precision and scope with which it has been ordered" (Kuhn, 1970:42). This concern to know the world must be sufficiently strong to support what to an outsider appears to be rather tedious and painstaking detailed investigations, what Kuhn called the puzzle-solving of normal science. Further, this drive must be strong enough to bind the individual and his researches to the larger scientific community and its rigorous standards of professional conduct. These are among the considerations which set the project of science apart from other activities, in spite of the overall tendency of Kuhn's thesis to emphasize the similarities between science and politics, art, history, religion, etc.

This commitment to know the world as it is accounts in part for the resistence within scientific communities to paradigm change. The normal scientists of every paradigm period believe their paradigm provides direct access to the real. When faced with a continued awareness of anomaly, and the prospects of a radical change to a new paradigm, scientists experience acute personal crisis. This experience is similar, in a quite literal fashion, to the anxiety experienced by one wearing goggles which turn his world upside-down. Consequently, scientists are loathe to face paradigm change. Nevertheless they will if, according to Kuhn, they become convinced that the new paradigm (the new world, if you will) solves the outstanding anomalies and presumably is a better tool for satisfying the scientists' overarching commitment to understand the world.

Now let us insert Kuhn's own paradigm into this situation. According to Kuhn, no scientist at any time can know that his paradigm is aiding him to see the world as the world is. In micro-terms, no scientist can ever break out of his sensations to compare them with his stimuli. On the macro-level, no scientist is justified in the belief in scientific progress across paradigm changes. Now, unless we assume the unlikely hypothesis that what scientists really mean by understanding the world is understanding the paradigm-dependent world, we must conclude that if Kuhn was correct in his analysis (ignoring the difficulties of that judgment itself), then scientists are doomed to be disappointed. Not only must each scientist continue to face the personal anxiety of various individual paradigm changes, but now he must do so without the illusion that something truer is in the offing, or for that matter, is even available in an infinite run of scientific efforts.

If Kuhn's views about the nature of the scientist's commitment are accurate, then his position generates an existential paradox. One simply cannot assume what one must assume in order to make the existential choice to become a scientist.

IV.

Having taxed Kuhn with two paradoxes, I want to continue this critical analysis in two other directions. I will claim that Kuhn's work is inadequate from the perspective of any philosophy which takes human *praxis* to be a central focus and a primary vehicle for human self-understanding. Finally, I will offer some considerations designed to establish the inadequacy of his epistemological analysis from a phenomenological perspective.

The philosophy of science paradigm, which Kuhn's views challenged, was largely that of the Vienna Circle, as has been pointed out above. Positivism, in spite of its animus toward metaphysics, was a highly rationalistic doctrine, relying ultimately on *a priori* arguments concerning the meaningfulness of propositions, the structure of scientific explanation, the roles of reason and emotions, and the like. Against this background Kuhn's work can be seen as a return to a much more empirical and human-centered approach to understanding science. Science, for Kuhn, was no ideal structure but the work of real persons with their real historical prejudices and failings. One might expect, then, that his views would be more compatible with philosophies like Marxism and Pragmatism, which emphasize the centrality of real human activity in historical change. This expectation, however, is quite unwarranted since Kuhn's work remains essentially a history of theory.

From a Marxist perspective, *The Structure of Scientific Revolutions* may be considered a step in the right direction, but the absence of any attempt to uncover systematically the political and societal context of the rise of various paradigms or the relationship between political and scientific revolutions vitiates Kuhn's conclusions. The lack of any discussion of the role of concrete human needs, and the resultant demand for technologies to satisfy those needs, leaves the history of science divorced from human history; it is as though a scientific paradigm were literally a different world that the scientist enters when he approaches the laboratory. Further, Kuhn's discussion of the tedium of the puzzle-solving activity of normal science seems profoundly incomplete without some discussion of professionalization and its relation to class structures. Finally, given Kuhn's frankness about the real-world motivations of scientists, his work is remarkably free of any discussion of the role of economics in the development of science.

A pragmatic critique cuts deeper than merely charging incompleteness. With the Marxist this perspective would also see the absence of a discussion of technological development as a critical lacuna in Kuhn's views, but, unlike the Marxist, the pragmatist is likely to see this lack as symptomatic of the more debilitating aspects of Kuhn's relativism. Quite simply, a pragmatist is likely to see a scientific theory which produces effective technologies not only as humanly better but truer as well. Kuhn's central error, from this perspective, is the assumption of a spectator or intellectualist view of knowing. By contrast, for a pragmatist, scientific theories are not merely cognitive achievements but, if correct, are also instruments allowing us to adapt better to our human environment. Systemic coherence is insufficient of itself to appraise the truth of a theory. The theory must also work. Effective technologies are indicative then of true theories. An increasing range of predictive and manipulative power over our environment and its scourges means increasing truth in our scientific theories as a whole. Otherwise it remains a mystery why some theories work and some do not; why, for example, the germ theory led to vaccines and the theory of humors did not. A pragmatist would surely find it odd for Kuhn to say that he is incapable of claiming scientific progress toward the truth while at the same time mankind is converting matter into energy, penetrating outer space, vanquishing smallpox, creating synthetic fabrics, and the like.

Not only does a pragmatic perspective afford a means of recognizing progress at the macro-level of human history, but it also blunts the edge of Kuhn's incommensurability thesis, thus allowing for a sense in which two paradigms can be compared directly. The thesis that two paradigms are incommensurate follows from the view that the meanings of the various terms of a paradigm take their significance from their place in the nexus of other terms composing the paradigm. These terms cannot derive their meaning from direct reference to the world since we have no access to a paradigm-independent world with which to compare them. For an intellectualist there is no alternative but to hold that they derive their meanings from their cognitive role in the system of terms composing the paradigm itself. Since each paradigm will be different to some extent from all others, the various relationships of terms are thereby altered, and no direct comparison of paradigms is possible. A term like *mass,* for example, is necessarily and radically different when used by a Newtonian and an Einsteinian.

If, however, we follow the pragmatic insight that terms, at least in part, are tools for action, we will have another alternative. A greater continuity can be recognized between two historically contiguous paradigms when the use of the term as an instrument for action maintains a large core of identity in both paradigms; this in spite of the admitted cognitive changes. Thus, we can say that though *mass* for a Newtonian and an Einsteinian is not identical, the great bulk of active uses of the term has remained sufficiently similar to be compared. And since we can do more at the sub-atomic and intergalactic levels with the Einsteinian notion, that one is truer. The pragmatist is unabashed: progress has been made.

V.

My final critical perspective on Kuhn's *The Structure of Scientific Revolutions* is that of the phenomenological tradition. Apparently by way of Polanyi, Kuhn has appropriated what has long been commonplace within that tradition, *viz.* the idea of implicit or horizonal knowledge. The insight here, in brief, is that any act of knowledge takes place within or against a background context which itself is not made explicit and perhaps is incapable of being made explicit. Kuhn, with Polyanyi, called this horizonal consciousness, *tacit knowing,* and it constitutes one of his major innovative claims, *viz.* that the content of a paradigm is not capable of being exhausted by any set of explicit rules. Thus, while a community of scientists is united in a world, it is a world of which none of them is wholly conscious, and one which allows for much divergence in explicit interpretation. Physicists of the eighteenth century, for example, would all recognize and respond positively to the achievements of Isaac Newton; yet, if they were asked to state what it was Newton had achieved, Kuhn would have expected a wide range—perhaps even a contradictory range—of responses. (A more commonplace example might be the recognition of a friend's face by three other mutual friends, who thereafter disagreed dramatically in their various descriptions of the first friend's face.)

Kuhn shared this position with as diverse a group as Polanyi, Merleau-Ponty, and the later Wittgenstein. It represents common coin among those who reject the positivist's goal of a completed system of wholly explicit knowledge claims.

Thus, from a phenomenological point of view, Kuhn's idea of a paradigm has much to recommend it on this score. The difficulty that would arise is that Kuhn was not consistent enough in drawing out the implications of his rejection of the positivist's goal. A case in point is Kuhn's apparent loss of the world. Kuhn spoke time and again of the scientist's paradigm as defining a world for the scientist. Yet surely it is mistaken to say that scientists of one paradigm live in a different world than those of another paradigm. Kuhn's point, of course, is well taken: a scientific paradigm does focus on certain aspects of our common world; it does call us to attend to experience *as though* we were seeing a different world. Still there is a common lived-world that forms the implicit horizon beyond all scientific worlds. As difficult or impossible as it may be to make explicit the connections between the scientist's several worlds and the *Lebenswelt* we all share, surely we *know* in some quite valid sense of that word that the scientist eats dinner, sleeps, enjoys our common culture, ages, and dies in a fashion which puts a lie to the notion of a private scientific world. Making this same point in other terms altogether, scientists do not have a wholly private language. The challenge which eluded Kuhn is to describe the scientific language game in such a way as to fit it into our common form of life. Perhaps this is due to an unconscious assumption that such a fit, such a connection between the scientific world-view and that of the non-scientist, must be an explicit one. Rather it may have the implicit connection of a family resemblance.

Carrying this same point in another direction, Kuhn's book seems to try to make just this connection in its first edition. Kuhn here was moving away from the positivist's reduction-to-physics model and into the more human flux of history and the social sciences. If this was a positive sign to those seeking to unite science and the *Lebenswelt,* the *Postscript* is a giant step backwards. Kuhn's neuro-cerebral analysis of knowing and his reduction of these processes to fully determined physical and chemical laws departed dramatically from the realm of the lived-world and embraced again the reductivist chimera of a wholly explicit physical interpretation of experience.

Finally, from a phenomenological perspective, one must say that Kuhn's truncated dismissal of the teleological character of science must be inadequate if scientific knowing is at all co-extensive with knowing in its more ordinary versions. Our common experience reveals an irreducible telic component—a drive into the future, a project for tomorrow. If this is the case, then we simply cannot substitute the non-teleological evolution *from*—what-we-do-know for the teleological evolution *to*—what-we-wish-to-know. What-we-wish-to-know is too central a part of the given transcendence of each moment's experience, and as such, is hardly to be eliminated from science, mankind's best hope for continued and organized understanding of the world.

In conclusion, it has not been my purpose to present a balanced view of Kuhn's *The Structure of Scientific Revolutions.* A balanced view would have to acknowledge Kuhn's achievements: the corrective his book supplied to the then-dominant positivist views of science, his emphasis on the central importance history plays in our understanding of science, his uncovering of the misleading view of science conveyed in science textbooks, and other accomplishments too widely known to need enumeration. Instead, my purpose here has been that of offering a critical re-appraisal in the hope that the time is now right to go beyond Kuhn's relativism and its strictures.

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