UCLouvain

FIAL
Un éventail de formations, une multitude d'horizons

Kuhn 2

LFILO2602 – Philosophy of Science
Session 4

Summing Up

> Yet one standard product of the scientific enterprise is missing. Normal science does not aim at novelties of fact or theory and, when successful, finds none. (52)

Anomalies

> Discovery commences with the awareness of anomaly, i.e., with the recognition that nature has somehow violated the paradigm-induced expectations that govern normal science (52–53)

Anomalies

> . . . normal science leads to a detail of information and to a precision of the observation-theory match that could be achieved in no other way. [. . .] Without the special apparatus that is constructed mainly for anticipated functions, the results that lead ultimately to novelty could not occur. And even when the apparatus exists, novelty ordinarily emerges only for the man who, knowing *with precision* what he should expect, is able to recognize that something has gone wrong. Anomaly appears only against the background provided by the paradigm. (65)

Anomalies and Scientific Facts

> [After the discovery of an anomaly, normal science] then continues with a more or less extended exploration of the area of the anomaly. And it closes only when the paradigm theory has been adjusted so that the anomalous has become the expected. Assimilating a new sort of fact demands a more than additive adjustment of theory, and until that adjustment is completed…the new fact is not quite a scientific fact at all. (53)

Resolution of Anomalies

> …the previous awareness of anomaly, the gradual and simultaneous emergence of both observation and conceptual recognition, and the consequent change of paradigm categories and procedures often accompanied by resistance. (62)

Crisis

> It follows that if an anomaly is to evoke crisis, it must usually be more than just an anomaly. There are always difficulties somewhere in the paradigm-nature fit; most of them are set right sooner or later, often by processes that could not have been foreseen. (82)

Crisis

> …the solution to each of them had been at least partially anticipated during a period when there was no crisis in the corresponding science; and in the absence of crisis those anticipations had been ignored. (75)

Crisis

1. “The anomaly itself now comes to be more generally recognized as such by the profession.” (82)
2. “…many of them may come to view its resolution as *the* subject matter of their discipline.” (82-83)
3. “…more and more of the attacks upon it will have involved some minor or not so minor articulation of the paradigm, no two of them quite alike, each partially successful, but none sufficiently so to be accepted as paradigm by the group.” (83)

Crisis

4. “…the rules of normal science become blurred.” (83)
5. “…research during crisis very much resembles research during the pre-paradigm period…” (84)
6. “It is, I think, particularly in periods of acknowledged crisis that scientists have turned to philosophical analysis as a device for unlocking the riddles of their field.” (88)

Three Possible Resolutions

- “Sometimes normal science ultimately proves able to handle the crisis-provoking problem…”
- …the problem resists even apparently radical new approaches. Then scientists may conclude that no solution will be forthcoming in the present state of their field. The problem is labelled and set aside for a future generation with more developed tools.”
- “…a crisis may end with the emergence of a new candidate for a paradigm and with the ensuing battle over its acceptance.” (84)

Revolutions: Why?

You might ask yourself: why are scientific revolutions interesting? Can't we just use our normal scientific procedures for evaluating theories and data, comparing the two paradigms to see which is better supported, and then change (or not)?

The main claim of the book: revolutions are **completely different** from normal science. The rules of normal science **cannot** apply.

Revolution

> …the choice is not and cannot be determined merely by the evaluative procedures characteristic of normal science, for these depend in part upon a particular paradigm, and that paradigm is at issue. When paradigms enter, as they must, into a debate about paradigm choice, their role is necessarily circular. Each group uses its own paradigm to argue in that paradigm's defense. (94)

Revolution

> Yet, whatever its force, the status of the circular argument is only that of persuasion. It cannot be made logically or even probabilistically compelling for those who refuse to step into the circle. The premises and values shared by the two parties to a debate over paradigms are not sufficiently extensive for that. (94)

Revolution

> The man who premises a paradigm when arguing in its defense can nonetheless provide a clear exhibit of what scientific practice will be like for those who adopt the new view of nature. That exhibit can be immensely persuasive, often compellingly so. (94)

Incommensurability

> Of course, science (or some other enterprise, perhaps less effective) might have developed in that fully cumulative manner. Many people have believed that it did so, and most still seem to suppose that cumulation is at least the ideal… (95–96)

Incommensurability

> Can Newtonian dynamics really be *derived* from relativistic dynamics? […] > [By adding expressions like $(v/c)^2 \ll 1$, we can] yield a new set, $N_1, N_2, \ldots, N_m$, which is identical in form with Newton's laws of motion, the law of gravity, and so on. Apparently Newtonian dynamics has been derived from Einsteinian, subject to a few limiting conditions. (101)

Incommensurability

> Yet the derivation is spurious, at least to this point. Though the N_i's are a special case of the laws of relativistic mechanics, they are not Newton's laws. [...] The variables and parameters that in the Einsteinian E_i's represented spatial position, time, mass, etc., still occur in the N_i's; and they there still represent Einsteinian space, time, and mass. But the physical referents of these Einsteinian concepts are by no means identical with those of the Newtonian concepts that bear the same name. (101–102)