What Lakatos Overlooked: A Metaphysical "Hard Core" of Unity for Science
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Abstract
Lakatos held that science proceeds by means of competing research programme, each with its own "hard core" or paradigm. He intended this view to reconcile the competing views of Kuhn and Popper. But what Lakatos overlooked is that science needs to be construed to be one gigantic research programme with, as its "hard core", a metaphysical thesis that asserts that the universe is such that there is an inherent unity in the laws that govern the way physical phenomena occur. The conception of science that emerges from this insight succeeds in doing what Lakatos's own view fails to do; it has fruitful implications for science itself, and solves the problem of induction.

Karl Popper (1959) held that scientists should try to falsify empirically an accepted theory. Thomas Kuhn (1970), by contrast, held that an accepted theory, or "paradigm" should most of the time be preserved from refutation. In engaging in "normal science", scientists struggle to fit recalcitrant phenomena into the framework of the accepted paradigm. Only when refutations become overwhelming, does crisis set in; a new paradigm is sought for and found, a revolution occurs, and scientists return to doing "normal science" with the new paradigm. Imre Lakatos (1970) sought to reconcile Popper and Kuhn by arguing that science consists of competing fragments of Kuhnian normal science, or "research programmes" (each with its own paradigm or "hard core"), to be assessed, eventually, in terms of their relative empirical success and failure. Instead of research programmes running in series, one after the other, as Kuhn thought, research programmes run in parallel, in competition, this doing justice to Popper's demand that there should be competition between theories – a point emphasized especially by Paul Feyerabend (1965).

Lakatos also emphasized that "science as a whole can be regarded as a huge research programme with Popper's supreme heuristic rule: 'devise conjectures with more empirical content than their predecessors'" (1970, p. 132). The research programme of science as a whole has, for Lakatos, no hard core; to this extent, Lakatos's view is a variant of Popper's.

But here Lakatos overlooked an important argument that leads to a conception of science that depicts the whole enterprise of science, in somewhat Lakatosian terms, as a huge research programme with something like a hard core. A new fundamental theory in physics must satisfy two requirements, as Popper (1963, p. 241) recognized, and Lakatos and Kuhn would have recognised too. It must be sufficiently (a) unified and (b) empirically successful (or corroborated). Clarify what it is for a physical theory to be unified, and it becomes clear that this demand for unification commits physics to accepting a metaphysical thesis, a sort of "hard core" for science. That in turn implies that we should adopt a new conception of science.

Einstein (1982, pp. 21-25) recognized, but could not solve, the problem of what it means to say a physical theory is "unified". Many others have tried, and failed, to solve the problem.[1] Here, in a nutshell, in three steps, is the solution. First, we need to consider, not the *formulation* of the theory or its axiomatic structure, but rather what the theory *asserts* about the possible phenomena to which it applies. Second, we need to transform the problem, and consider the diverse ways in which a theory can be *disunified*. $F = Gm_1m_2/d^2$ before 2050, and Gm_1m_2/d^3 after 2050 is an example of a disunified theory (what is asserted here being what matters). And third, we now have the solution to what it means to say a physical theory,

T, is disunified: T is disunified to degree N if, what it asserts about the possible phenomena to which it applies divides up into N distinct regions such that what T asserts about phenomena in any one region is the same throughout, but differs from what T asserts in all the other regions. We can now declare: T is unified if N = 1. (For details see Maxwell, 2017a, chapter 5).

Given any accepted fundamental physical theory, there will always be infinitely many disunified rivals that fit all available phenomena just as well. To concoct such a disunified rival, all we need do is take the accepted theory, T, and modify it to make any prediction we please for possible phenomena not yet observed, either because the phenomena lie in the future, or because they consist of bodies or states of affairs not yet brought into existence (gold spheres, for example, of 10^8 tons).

In persistently rejecting (or ignoring) all such disunified rivals that fit the facts even better than,[2] or just as well as, accepted theories, physics thereby – granted it seeks truth – persistently assumes: the universe is such that all disunified theories, however successfully they predict known phenomena, are false. But this substantial, influential, untestable (and therefore metaphysical) assumption, presupposed by physics, is just a *conjecture*. We do not know it is true. Intellectual rigour requires that we make it explicit within physics, so that we can critically assess diverse versions of the assumption, and try to improve it as physics proceeds. That in turn requires that physics adopts a new meta-methodology, one that represents the metaphysical assumption of physics in the form of a hierarchy, assumptions becoming increasingly insubstantial as one goes up the hierarchy, and so increasingly likely to be true, and increasingly such that the truth of the assumption in question is required for science, or the pursuit of knowledge to be possible at all. The hierarchical character of the view is designed to concentrate critical exploration of metaphysical possibilities where this is most likely to be fruitful for progress of physics – low down in the hierarchy of assumptions, where error is most likely to be found. Furthermore, the hierarchical structure helpfully constrains candidate metaphysical conjectures, in demanding that an acceptable conjecture be compatible with both what is above in the hierarchy, and what is below, namely accepted fundamental physical theory (Maxwell, 2017a).

What emerges is a conception of science that is in some respects similar to Lakatos's research programme, with a metaphysical hard core for physics, and for the whole of natural science. Lakatos just might have approved, as this view does what his view fails to do: it has fruitful implications for science (Maxwell, 2017b, chapter 5), and solves the problem of induction (Maxwell, 2017a, chapter 9).

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Notes

[1] For criticisms of accounts of theory unity put forward by Jeffreys and Wrinch (1921), Popper (1959, pp. 62-70 & 126-145), Friedman (1974), Kitcher (1981; 1989) and Watkins (1984, pp. 203-213), see Maxwell (1998, pp. 56-68). For criticisms of more recent proposals, including those of Bartelborth (2002), McAllister (1996), Weber (1999) and Schurz (1999), see Maxwell (2004b).

[2] For an account of how endlessly many disunified rivals to an accepted physical theory can be concocted to fit available data even better than the accepted theory, see Maxwell (2017a, pp. 24-9).