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Rediscovering Einstein's legacy: How Einstein anticipates Kuhn and Feyerabend on the nature of science

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ABSTRACT

Thomas Kuhn and Paul Feyerabend promote incommensurability as a central component of their conflicting accounts of the nature of science. This paper argues that in so doing, they both develop Albert Einstein's views, albeit in different directions. Einstein describes scientific revolutions as conceptual replacements, not mere revisions, endorsing 'Kant-on-wheels' metaphysics in light of 'world change'. Einstein emphasizes underdetermination of theory by evidence, rational disagreement in theory choice, and the non-neutrality of empirical evidence. Einstein even uses the term 'incommensurable' specifically to apply to challenges posed to comparatively evaluating scientific theories in 1949, more than a decade before Kuhn and Feyerabend. This analysis shows how Einstein anticipates substantial components of Kuhn and Feyerabend's views, and suggests that there are strong reasons to suspect that Kuhn and Feyerabend were directly inspired by Einstein's use of the term 'incommensurable', as well as his more general methodological and philosophical reflections.

1. Introduction

In influential 1962 publications, Thomas Kuhn and Paul Feyerabend provocatively propose that successive scientific theories are sometimes incommensurable.[1] They can have *no common measure* that can unequivocally force a rational decision between them, so that scientific advance cannot correctly be characterized as progress towards truth—as many contemporary scientific realists would have it.[2] Incommensurability is a central component of Kuhn and Feyerabend's respective views on the nature of science, both of which were contentiously received as radical proposals at odds with well-established views in the field.[3] Incommensurability in science continues to be widely discussed across a range of interrelated disciplines, primarily in history, philosophy and sociology of the sciences.[4]

This paper argues that with respect to incommensurability and the nature of science, Kuhn and Feyerabend were developing and

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[1] See Feyerabend (1962), revised in Feyerabend (1981a), and Kuhn (1962a, 1962b), second enlarged edition published with a new postscript in 1970, see Kuhn (1996 [1962]), pp. 174-210.

[2] To be more precise, in 1962 Feyerabend applies "incommensurable" to specific sets of inter-defined "concepts", as delineated by successive (but once competing) "theories", while Kuhn's more historical and sociological approach initially applies "incommensurable" explicitly to "paradigms", "world views", "worlds of research", successive "scientific traditions", and their "standards" for what counts as good science—but never directly to "theories" (Kuhn only begins applying "incommensurable" explicitly to "theories" in post-*Structure* publications); see and compare Feyerabend (1962), pp. 31, 58, 59, 74-76, 78, 83, 90 and 92-94 to Kuhn (1996 [1962]), pp. 4, 103, 112, 148-150, 157, 165, 175 and 198-204.

[3] Feyerabend and Kuhn are called "the worst enemies of science" in *Nature*, see Theocharis & Psimopoulos (1987), p. 596. Compare Preston, Munévar, & Lamb (2000). The ongoing transition in the status of the idea of incommensurability in science, from incoherent nonsense to potentially important insight, is nicely illustrated by a comparison of the forewords to the first and second editions of Chalmers's popular introductory textbook *What is this Thing Called Science?* In 1976, Chalmers has "no time for obscurantist nonsense about the incommensurability of frameworks" (Chalmers, 1976, p. xii). In 1982, Chalmers admits that he has, "been obliged to separate the important sense from the 'obscurantist nonsense about the incommensurability of frameworks'" (Chalmers, 1982, p. iv).

[4] For an annotated bibliography on incommensurability in science, see Oberheim & Hoyningen-Huene (2012).

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popularizing ideas set out by Albert Einstein.[5] As we shall see, Einstein had already proposed many substantial components of Kuhn and Feyerabend's controversial views, even using the term 'incommensurable' to apply specifically to challenges posed to comparatively evaluating scientific theories more than a decade before Kuhn and Feyerabend.[6] This analysis suggests that there are strong reasons to suspect that Kuhn and Feyerabend were directly inspired by Einstein's earlier use of the term, as well as more generally, by Einstein's methodological and philosophical reflections.

The paper has four parts. The first part sketches Kuhn's views on incommensurability as set into his account of science. The second part sketches Feyerabend's views on incommensurability as set into his account of science, comparing Feyerabend and Kuhn's ideas. The third part shows how Einstein anticipates many substantial components of both Kuhn and Feyerabend's accounts. All three emphasize that scientific revolutions involve conceptual replacements, and not mere revisions. All three emphasize underdetermination of theory by evidence, the non-neutrality of empirical evidence, and even 'world change' (i.e. the controversial suggestion that scientific revolutions transform empirical reality itself). Moreover, they all do so on the basis of a 'Kant-on-wheels' metaphysics.[7] Einstein also anticipates Kuhn's conception of scientific progress as an 'evolutionary' process, including 'crises' as precursor to evolution through revolution. In Feyerabend's case, his 'anything goes', 'epistemological anarchism' is explicitly modeled on Einstein's 'unscrupulous opportunism' and scientific approach to philosophy. Part four concludes that Kuhn and Feyerabend develop specific aspects of Einstein's views on incommensurability and the nature of science.

2. Kuhn

In *The Structure of Scientific Revolutions* (1996 [1962]), Kuhn dramatically claims that history reveals competing paradigms failing to make complete contact with each other's views. They are always talking at least slightly at cross-purposes. Kuhn characterizes the collective reasons for these limits to communication as the incommensurability of pre and post-revolutionary scientific traditions.[8] According to Kuhn, paradigm choice is holistic. Competing paradigms can lack a common measure that could force a rational decision between them, because their members may address overlapping sets of problems with different, interrelated (incommensurable) sets of concepts, methods, and epistemic values. This promotes talk at cross-purposes across revolutionary divides. Kuhn's historical investigations lead him to suggest: "As in political revolutions, so in paradigm choice — there is no standard higher than the assent of the relevant community […] paradigm choice can never be unequivocally settled by logic and experiment alone" (Kuhn, 1996 [1962], p. 93).[9]

Kuhn challenges the traditional view of scientific method, contending that theory comparison is based on epistemic values, such as simplicity, accuracy, consistency, scope and fruitfulness, which do not function as rules that determine rational theory choice, but as values that merely guide it (Kuhn, 1977, p. 331). Moreover, epistemic values guiding theory choice depend on, and vary with, the currently dominant paradigm (Kuhn, 1977, p. 322). This leads Kuhn to conclude that there is "no neutral algorithm for theory choice, no systematic decision procedure which, properly applied, must lead each individual in the group to the same decision" (Kuhn, 1996 [1962], p. 200). As scientists weigh and apply these values differently, they may pull in opposing directions making room for *rational disagreement*. Different scientists may support conflicting theories because they weigh and apply epistemic values in different ways. While Kuhn's account of scientific revolutions is holistic, in that epistemic values change together with concepts, problems and methods, Kuhn's claim that paradigms can lack a common measure with respect to epistemic values is sometimes called "methodological incommensurability" as distinguished from his claim that paradigms can lack a common measure with respect to the basic concepts used to state laws and theories, which is sometimes called "taxonomic incommensurability".[10]

Kuhn develops taxonomic incommensurability on the basis of the 'no-overlap principle', according to which "no two kind terms, no two terms with the kind label, may overlap in their referents unless they are related as species to genus. There are no dogs that are also cats, there are no gold rings that are also silver

[5] Einstein is not the only precursor to Kuhn and Feyerabend on incommensurability in science. Kuhn acknowledges his general debt to Fleck (1979 [1935]), which is "an essay that anticipates many of [his] own ideas" Kuhn (1996 [1962], pp. viii-ix), and many contemporary views about the social construction of knowledge. Ludwik Fleck applies the German term "inkommensurabel" to an antiquated concept of disease that became incommensurable with a newer concept of disease, which was not a completely adequate substitute for it (Fleck, 1979 [1935]), p. 62. Fleck also applies "inkommensurabel" to different styles of thinking, suggesting that "medical thinking", which addresses irregular, temporally dynamic phenomena such as an illness, is incommensurable with "scientific thinking", which addresses uniform phenomena (Fleck, 1986 [1927], pp. 44-45). In developing incommensurability, Feyerabend also draws on Duhem, Bohr and Köhler, see Oberheim (2005) and Oberheim & Hoyningen-Huene (2009).

[6] As an anonymous referee pointed out, Popper also uses the term "inkommensurabel" in the context of comparing theories prior to Kuhn and Feyerabend. In the English edition, the term "inkommensurabel" is translated as "noncomparable": "The subclass relation corresponds very well to the intuitive 'more' and 'fewer', but it suffers from the disadvantage that this relation can only be used to compare the two classes if one includes the other. If therefore two classes of potential falsifiers intersect, without one being included in the other, or if they have no common elements, then the degree of falsifiability of the corresponding theories cannot be compared with the help of the subclass relation: they are noncomparable [*inkommensurabel*] with respect to this relation" (Popper, 2005 [1959], p. 98). Compare Popper (1989 [1935]), pp. 79-80; [1935], pp. 69-70. However, Popper does not suggest that theories can be incommensurable. Popper's point is that technically the sizes of the classes of potential falsifiers of two theories can only be quantitatively compared if one class is a subclass of the other—otherwise the two classes have 'no common measure' with respect to how falsifiable they are. This is not some version of the thesis that *theories* can be incommensurable. It is the claim that their degrees of falsifiability (as measured by the sizes of their classes of potential falsifiers) can be incommensurable.

[7] Peter Lipton coins the phrase 'Kant-on-wheels' to describe Kuhn's metaphysical position in a review, see Lipton (2001), p. 30. 'Kant-on-wheels' metaphysics recognizes that basic concepts make a constructive contribution to empirical reality, while emphasizing that empirical reality is dynamic (not fixed), as basic concepts can be replaced through scientific revolutions, resulting in new empirical realities.

[8] See Kuhn (1996 [1962]), pp. 147-150. For explicit attempts to untangle some aspects of Kuhn and Feyerabend's contributions to the development of the idea of incommensurability in science, see for example Hoyningen-Huene (2000, 2005) and Oberheim & Hoyningen-Huene (2009). According to Kuhn: "I believe that Feyerabend's and my resort to 'incommensurability' was *independent*, and I have an uncertain memory of Paul's [Feyerabend] finding it in a draft manuscript of mine and telling me he too had been using it" (Kuhn, 2000 [1983], p. 33, fn. 1, italics inserted). At the time (1959–1962), Kuhn and Feyerabend were close, collaborating colleagues at Berkeley, as evidenced for example by two sets of letters that Feyerabend sent Kuhn about '*Proto-Structure*', a draft of what was to become *The Structure of Scientific Revolutions* (1996 [1962]) that Kuhn had circulated for comments and suggestions. For the letters and more background, see Hoyningen-Huene (1995, 2006). See also Hickey (2013).

[9] Compare Duhem (1954 [1906]), especially chapter seven, 'Experiment and Physics', pp. 180f., where Duhem argues that strictly speaking "A 'crucial experiment' is impossible in physics" (Duhem, 1954 [1906], p. 188).

[10] See Sankey & Hoyningen-Huene (2001), p. xiii. Methodological incommensurability is sometimes also called "Kuhn-underdetermination", see Carrier (2008), p. 278. Taxonomic incommensurability is sometimes also called "semantic incommensurability", see for example Bird (2000, 2013) and Sankey (2009).