**Incommensurability[[1]](#footnote-1)**

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In the philosophy of science, the term ‘incommensurable’ describes a relation of incomparability, or limited comparability, purported to obtain between some pairs of successive or competing scientific theories. The thesis that scientific theories may be incommensurable was proposed by Paul Feyerabend and Thomas Kuhn in separate publications in 1962. Due to perceived negative consequences of incommensurability, the thesis has been the focus of considerable controversy. Before considering objections to incommensurability, the thesis of incommensurability will first be examined.

**Feyerabend on incommensurability**

Feyerabend’s claim that some theories are incommensurable derives from his critique of the empiricist idea of a theory-neutral observation language. Neither experience nor pragmatic conditions of use determine the meaning of observational terms. Instead, “the interpretation of an observation language is determined by the theories which we use to explain what we observe, and it changes as soon as those theories change” (‘An Attempt at a Realistic Interpretation of Experience’, p. 31). By contrast with the empiricist view that the meaning of observational terms is independent of theory, Feyerabend holds that the meaning of such terms varies with theory.

 Feyerabend introduced the concept of incommensurability in the context of a discussion of the empiricist account of inter-theory reduction by means of deductive subsumption. Against reduction, Feyerabend argues that:

What happens ... when a transition is made from a theory T’ to a wider theory T (which ... is capable of covering all the phenomena that have been covered by T’) is something much more radical than incorporation of the *unchanged* theory T’ (unchanged, that is, with respect to the meanings of its main descriptive terms as well as to the meanings of the terms of its observation language) into the context of T. What does happen is, rather, a *replacement* of the ontology (and perhaps even of the formalism) of T’ by the ontology (and formalism) of T, and a corresponding change of the meanings of the descriptive elements of the formalism of T’ (provided these elements and this formalism are still used). This replacement affects not only the theoretical terms of T’ but also at least some of the observational terms which occurred in its test statements. (‘Explanation, Reduction and Empiricism’, pp. 44-5)

For Feyerabend, change in theoretical ontology leads to variation in the meaning of the vocabulary employed by theories. One theory cannot be deductively subsumed by the other, given the meaning variance of the terminology employed by the theories.

 According to Feyerabend, reduction fails because of incommensurability. Theories are incommensurable due to lack of semantic equivalence between terms employed by the theories. On the one hand, the concepts of one theory cannot be defined on the basis of concepts of the other. On the other hand, no empirical statement may be formulated which correlates terms of one theory with terms of the other theory. Because no neutral observation language exists in which to express the empirical consequences of such theories, Feyerabend concludes that “incommensurable theories may not possess any comparable consequences, observational or otherwise” (‘Explanation, Reduction and Empiricism’, p. 93). The content of incommensurable theories is unable to be compared because no consequence of one theory may either assert or deny the same thing as any consequence of a theory with which it is incommensurable.

**Incommensurability in Kuhn’s *The Structure of Scientific Revolutions***

In *The Structure of Scientific Revolutions*, Kuhn proposed a model of the development of science, on which science divides into periods of normal science grounded in consensus on a shared scientific paradigm. Normal science is broken at intervals by periods of extraordinary science, brought on by anomaly and crisis, which may ultimately result in revolutionary displacement of paradigm. Once a new candidate for paradigm emerges in the midst of a crisis, debate ensues between defenders of the reigning paradigm and advocates of the candidate paradigm. Paradigm debate is characterized by failure of communication which arises because of the incommensurability of the paradigm and candidate paradigm. As a result of incommensurability, paradigm debate is unable to be brought to closure by purely rational means.

 According to Kuhn, the incommensurability of competing paradigms is due to differences which arise at three levels between paradigms. By contrast with Feyerabend, Kuhn’s original concept of incommensurability has non-semantic components. The first difference involves variation at the methodological level. Paradigms address different problem-solving agendas and employ different standards of theory appraisal:

...proponents of competing paradigms will often disagree about the list of problems that any candidate for paradigm must resolve. Their standards or their definitions of science are not the same. (*Structure*, p. 148)

The second difference is at the semantic level. There is variation in the concepts employed by paradigms, which leads to change in the meanings of the terms which express key scientific concepts:

Within the new paradigm, old terms, concepts, and experiments fall into new relationships one with the other ... To make the transition to Einstein’s universe, the whole conceptual web whose strands are space, time, matter, force, and so on, had to be shifted and laid down again on nature whole ... (*Structure*, p. 149)

The third difference relates to the theory-dependence of observation. Not only may scientists observe different things, but the content of their perceptual experience when they observe the same thing depends upon the paradigm in which they work:

... proponents of competing paradigms practice their trades in different worlds ... practicing in different worlds, the two groups of scientists see different things when they look from the same point in the same direction. (*Structure*, p. 150)

Kuhn’s claim that scientists work in different worlds may be taken to suggest a stronger thesis than the thesis that scientists’ perceptual experience depends on paradigm. In his book, *Reconstructing Scientific Revolutions*, Paul Hoyningen-Huene has argued that Kuhn’s position is best understood as a Kantian position on which the phenomenal world of scientists varies with paradigm, while the unknowable noumenal world remains constant.

**Taxonomic incommensurability**

In the decades following publication of *The Structure of Scientific Revolutions*, Kuhn continued to refine his concept of incommensurability. He came to view incommensurability as a semantic issue distinct from the issue of variation of standards of theory appraisal. Semantic issues relating to translation failure are the focus of Kuhn’s later work on incommensurability, in which he proposes a taxonomic version of incommensurability which involves localized translation failure between subsets of the special terminology employed by theories.

 In *The Road Since Structure*, Kuhn claims that scientific revolutions are characterized by changes in the taxonomic schemes by means of which theories classify entities in their domain (p. 30). In the transition between theories, both criteria of classification and membership of taxonomic categories undergo change. At the semantic level, taxonomic change gives rise to variation in meaning of preserved vocabulary, as well as introduction of vocabulary with new meaning. Because taxonomic change involves change of interconnected categories, the meanings of the terms affected by such change are related in a holistic manner. Each theory possesses a central set of interdefined terms, which cannot be translated in piecemeal fashion into the vocabulary of a theory with a different taxonomic structure (*ibid*. pp. 43-4). Translation failure between theories is localized to such central sets of interdefined terms.

**Objections to incommensurability**

As indicated above, the incommensurability thesis is controversial because of negative outcomes to which it gives rise. If, as Kuhn initially suggested, there are no neutral standards of theory appraisal, and communication is obstructed, it is unclear how choice between theories may proceed on a rational basis. If, as Kuhn and Feyerabend both suggest, the content of theories may not be compared due to semantic variance, it is unclear how to conduct crucial tests between rival theories or to determine whether one theory marks an advance over another. Indeed, Dudley Shapere raises the question of whether incommensurable theories may constitute rivals at all (‘Meaning and Scientific Change’, p. 73). But the two objections which have proven the most telling have been Davidson’s critique of untranslatability and Scheffler’s referential objection to incomparability.

**The incoherence of untranslatability**

In his paper, ‘On the Very Idea of a Conceptual Scheme’, Donald Davidson raises serious doubts regarding the coherence of the idea of an untranslatable language. He notes that there is an air of paradox about incommensurability: “Kuhn is brilliant at saying what things were like before the revolution using – what else? – our post-revolutionary idiom” (p. 184). If one provides an example of an untranslatable concept in the language into which translation fails, the example belies the untranslatability. It is also puzzling how one might understand an untranslatable concept in the first place, if it cannot be translated into a language that one understands. It is not, moreover, clear what would count as evidence of untranslatability. Failure to translate a language is indeterminate between being evidence that the language is untranslatable and evidence that it is not a language at all. Davidson suggests that the idea of an untranslatable language depends on a distinction between conceptual scheme and content, which gives substance to the idea of a language independent of translation. But, he argues, no intelligible sense can be made of the distinction between scheme and content.

 Davidson’s objections can in part be defused by noting two ways in which the incommensurability thesis is less extreme than he supposes. First, failure of translation between incommensurable theories is restricted to the vocabulary employed by theories, and even to a subset of such vocabulary, rather than extending to the entirety of a natural language. Second, incommensurability need only entail failure to translate rather than failure to understand; one might understand what is said in another language even if it cannot be translated.

**The referential objection**

In his book, *Science and Subjectivity*, Israel Scheffler notes that discussion of meaning variance in relation to incommensurability runs foul of the distinction between sense and reference. Variation in theoretical context may lead to variation in the sense of a scientific term. But it does not follow that the term’s reference is thereby similarly affected. Terms which differ in sense may refer to the same thing. Co-reference is all that is needed for claims about the world to enter into conflict. Hence, the content of meaning variant theories may be compared if the terms employed by the theories share common reference, regardless of variation in sense.

 Scheffler’s referential objection is not entirely successful. Meaning variance in science need not be restricted to variation in the sense of scientific terms. There are also cases in which the reference of scientific terms may be subject to variation as well.

**The causal theory of reference**

Since the 1970's, the referential objection has been based on the causal theory of reference. Causal theorists argue that the reference of a term is not determined by an associated description which specifies the term’s sense. Rather, reference is determined in a direct manner by ostensive introduction of a term in the presence of the referent. What determines reference is the causal relation (e.g., perception) between term-introducer and referent. Subsequent use of the term by later speakers is connected by means of a causal-historical chain to the original term-introduction.

 If reference is determined independently of description, then terms employed by one theory may be employed in the context of a later theory to refer to the same things as they referred to in the earlier theory. Terms employed by successive theories may continue to refer to the same things despite variation in descriptive content associated with the terms in different theories. The claims made by such theories may be compared directly on the basis of the shared referents of the terms which the theories employ.

 Application of the causal theory of reference in the context of scientific theory change is not without difficulties. First, to secure reference to a kind, the kind must be specified by description rather than by ostension. Second, to permit reference failure of theoretical terms, minimal descriptive characterization is required of the entities to which terms purportedly refer. Third, to allow reference change, reference must be sensitive to use of terms subsequent to initial introduction.

 In light of the need for a descriptive element in the determination of reference, recent authors propose causal descriptive accounts of reference on which either causal relation combines with description to fix reference or else reference-fixing description is cast in causal terms. While causal descriptive accounts allow descriptive content of scientific theories to affect reference, they provide little scope for incommensurability due to radical divergence of reference. Thus, so far as reference is concerned, the prospects for incommensurability are greatly diminished.

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