INCOMMENSURABILITY: THE CURRENT STATE OF PLAY

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ABSTRACT: The incommensurability thesis is the thesis that the content of some alternative scientific theories is incomparable due to translation failure between the vocabulary the theories employ. This paper presents an overview of the main issues which have arisen in the debate about incommensurability. It also briefly outlines a response to the thesis based on a modified causal theory of reference which allows change of reference subsequent to initial baptism, as well as a role to description in the determination of reference. On such a view, the content of theories may be compared on the basis of shared reference, despite failure of translation. Two recent developments involving the incommensurability thesis are also examined: (i) the taxonomic version of the incommensurability thesis found in Kuhn's later writings, (ii) Hoyningen-Huene's neo-Kantian interpretation of Kuhn's metaphysics.

Keywords: incommensurability, meaning variance, taxonomic change, theory comparison, causal theory of reference, Kuhn, Feyerabend, Hoyningen-Huene.

1. Introduction

During the first half of the twentieth century, philosophy of science was dominated by empiricist models of science, such as logical positivism and Popperian falsificationism. By the end of the 1950s, however, a new 'historical' or 'post-positivist' movement in philosophy of science had begun to emerge. Instead of formal analysis of confirmation and the structure of theories, post-positivists emphasized developmental and contextual features of the sciences. Where neutral observation and universal method were once seen as guarantors of scientific objectivity, claims of theory-dependent observation and methodological variation raised the spectre of an epistemic relativism haunting the very citadel of objectivity, science itself.

The year 1962 marks a particularly significant point in the emergence of post-positivist philosophy of science. That is the year in which both Paul Feyerabend's 'Explanation, Reduction and Empiricism' (1981b) and Thomas Kuhn's *The Structure of Scientific Revolutions* (1970a) were first published. These two texts introduced the thesis of the

incommensurability of scientific theories into the post-positivist arsenal. More than perhaps any other single aspect of post-positivism, the possibility of alternative incommensurable theories points up the contrast between the empiricist presumption of objectivity and the relativist tendency of post-positivism. For if alternative theories are unable to be compared by common standards, then no objective basis exists for rational choice between theories. Rather than objective grounds for theory choice, scientists' grounds for accepting a theory can at most reside in standards which the theory satisfies, but which are unable to be used to compare it with its rivals.

At the present day, however, matters appear in a strikingly different light. On the one hand, the aspects of the thesis of incommensurability which involve variation of methodological standards have been disarmed by recent naturalist and pluralist approaches to the rationality of science.[1] On the other hand, semantic aspects of incommensurability have broken down under analysis, so that few of the dire consequences which originally appeared to flow from the thesis may be sustained. In this paper, I seek to illustrate the latter claim about the semantic incommensurability thesis. Save for a few incidental remarks, I shall leave methodological aspects of incommensurability out of the picture.[2]

2. 'Incommensurability' revisited

While Kuhn and Feyerabend began to use the term 'incommensurability' at the same time, they did not initially use it to express the same idea. Kuhn originally used the term to describe methodological, semantic and perceptual differences which impede communication between the advocates of rival paradigms (1970a, pp. 148-50). By contrast, Feyerabend introduced the term in the context of an attack on the empiricist model of reduction, specifically to express the point that reduction of one theory to another by deductive means may fail due to meaning variance of the terms used by theories (1981b, p. 67).

In subsequent work, Kuhn restricted incommensurability to semantic relations between theories, though his use of the term continued to evolve. At one point, he drew a close connection between incommensurability and Quinean indeterminacy of translation (1970b, pp. 268-9). Later, however, Kuhn distanced his view from Quine's, and argued instead for localized failure of exact translation between clusters of terms within the special vocabulary of theories (1983, pp. 670-1). His final position was that natural kind terms from the taxonomic structure of one theory may not be introduced into the taxonomic structure of

another, because of a relation of non-overlap between the extensions of natural kind terms (1991, p. 4, 1993, pp. 318-9).

With few exceptions, Feyerabend's use of the term 'incommensurability' was limited to semantic issues.[3] His idea of incommensurability grew out of a critique of the empiricist idea of a neutral observation language (1981a). He argued that the meaning of observation terms depends on the theory in which they occur. Since the basic ontology and conceptual apparatus of theories may differ, the terms employed by one theory may fail to be definable in the context of another theory (1981b, pp. 65-7). Given the inability to interdefine terms, such theories may not share statements in common. Hence, Feyerabend concluded that such theories are incommensurable in the sense that they do "not possess any comparable consequences, observational or otherwise" (1981b, p. 93).

3. The incommensurability thesis

The incommensurability thesis may be characterized without undue simplification by means of three semantic relations between alternative theories: meaning variance, translation failure and content incomparability. The basic idea is that the content of theories is unable to be compared due to translation failure arising from the meaning variance of their vocabulary.

The claim of meaning variance stems from rejection of the empiricist idea that observation terms receive fixed empirical meaning in the absence of theory. Feyerabend and Kuhn both argued that the meaning of observational vocabulary derives from the theoretical context in which it occurs.[4] Rather than acquire meaning directly from experience or application conditions, an observation term obtains meaning from the theory which explains the items to which it applies. Consequently, the meaning of observational vocabulary varies with respect to theoretical context. Such variation of meaning extends as well to theoretical terms, since such terms are defined on the basis of fundamental theoretical laws or principles, which are themselves subject to variation with theory.

But mere variation of meaning does not suffice for incomparability of content. What is needed is that claims made by one theory not be expressible using the vocabulary of another theory. In other words, variation of meaning must result in failure to translate from the vocabulary of one theory into that of another. To the extent that claims of one theory may not be translated into the language of another theory, the content of one theory may not be compared with the content of the other. For, in the absence of translation, no claim from one

theory may either assert or deny the same thing as any assertion deriving from the other theory.

The incommensurability thesis may now be stated in a clear form. Two alternative scientific theories are incommensurable if, and only if:

(i) there is variation of meaning between the vocabulary of the theories;
(ii) translation fails between the theories;
(iii) as a result of (i) and (ii), the content of such theories may not be compared.

A number of troublesome consequences follow immediately from the claim that alternative scientific theories may be incommensurable. For one thing, if the content of theories is incomparable, it is unclear how they may constitute *alternative* or *rival* theories between which a choice must be made. For another thing, if claims made by one theory neither assert nor deny claims made by the other, it is unclear how the transition between such theories may lead to progress in the sense of an advance on truth.

4. Two objections to incommensurability

Two specific objections have proven particularly fruitful in the analysis of the problem of incommensurability. The first turns on an apparent equivocation in the inference from meaning variance to content incomparability. For while it may be the case that the *sense* of a term varies with theoretical context, it need not follow that the term's *reference* must also vary with context. But, since sameness of reference is all that is needed for content comparison, incomparability of content does not follow from variation in the sense of the terms employed by theories.[5]

The second objection involves the apparent incoherence of the idea of untranslatability. Suppose it is claimed that an outmoded scientific term is untranslatable by any current scientific term. The very fact that the old term may be understood by contemporary speakers suggests that it may in fact be translated into modern language. Otherwise it is difficult to see how the term might be recognized to be untranslatable by any modern term. Yet ability to understand the old term paradoxically suggests that one may translate what cannot be translated.[6]

As it happens, Kuhn and Feyerabend offered similar replies to each objection. With regard to the objection that reference may survive change of meaning, Kuhn and Feyerabend replied that in the cases of interest reference is subject to variation as well as

sense (Feyerabend 1981c, p. 98; Kuhn 1970b, p. 269). As for translating the untranslatable, both authors responded by arguing that failure of translation need not preclude understanding, so that one might understand terms without being able to translate them (Feyerabend 1987, p. 266; Kuhn 1983, pp. 671-3). In addition, Kuhn argued that translation failure is localized to narrow subsets of terms, which enables the semantic differences responsible for untranslatability to be the subject of discussion within an encompassing background language. A similar response may be given on behalf of Feyerabend (see my 1994, pp. 107-8).

5. The causal theory of reference

The claim that change of sense is accompanied by change of reference raises the question of the relation between meaning and reference. For if reference is determined by sense, then change in the description which gives the sense of a term may result in change in the term's reference. More generally, where changes in the concepts employed by theories lead to substantial variation in the descriptive content associated with terms used by the theories, there may be discontinuity of reference in the transition between theories.[7]

By contrast, advocates of a causal theory of reference have argued that reference is determined in a more direct manner. Rather than by satisfaction of description, reference is determined independently of descriptive content, by means of broadly causal relations between speakers and the objects and kinds in their environment. As argued, for example, by Saul Kripke, reference is established at an initial naming ceremony or baptism, typically by ostensive means (e.g., Kripke 1980, p. 96).[8] Later speakers acquire the ability to refer with a term by a causal chain which links their use to the initial baptism, rather than from a reference-determining description which they associate with the term. Given such non-descriptive determination of reference, the reference of terms used by scientific theories is unaffected by change in conceptual content brought about in the course of theoretical change.

But if reference is stable through conceptual change, the terms employed by alternative scientific theories may share reference despite variation of concepts. Given shared reference, statements from meaning variant theories may enter into conflict or agreement, since their component terms refer to the same things. Hence such theories may be compared for content, and are not therefore incommensurable.

However, such a swift dismissal of the thesis of incommensurability cannot be sustained. For the causal theory of reference itself faces a number of severe problems, which are of particular relevance in the present context. For example, trouble arises for the idea that reference may only be fixed at an initial baptism. For if reference were established once and for all at an initial baptism, without subsequently being able to be altered, the possibility of reference change would be eliminated altogether. Yet there are cases in the history of science in which reference appears to have changed. In light of this, the causal theory must be modified to allow for the possibility that reference may change, for example, by allowing usage subsequent to initial baptism to affect reference.[9]

Trouble also arises with the manner in which reference is secured to a given natural kind. In the case of ostensive introduction of a term for an observable natural kind, the question arises how the kind may be individuated by ostension. Kim Sterelny describes the case of a visitor to Mars, who encounters a catlike animal, for which he introduces the term 'schmat':

> Schmats are animals bearing a certain relation to this paradigm local schmat (...) But what determines which relationship this is? For the schmat will be a member of many kinds. A non-exhaustive list would include: physical object, animate object, animate object of a certain biochemical kind, animate object with certain structural properties, schmats, schmats of a certain sex, schmats of a certain maturational state. (Sterelny 1983, p. 121)

The problem is that the relations of pointing and perceiving, on which ostension is based, fail to discriminate between the various kinds to which the schmat belongs. To specify the kind to which 'schmat' refers, some descriptive apparatus is needed, for example, a verbal stipulation that 'schmat' is the name of a genus or species.

Related to this is the issue of how to secure reference for theoretical terms. Since unobservable entities are incapable of ostension, one suggestion is that reference may be secured by a causal description which specifies the referents as the entities causally responsible for certain observed effects (see Kripke 1980, p. 132; Putnam 1975, p. 200). For example, one might introduce the term 'phlogiston' to refer to the substance, whatever it is, which causes *that* phenomenon, pointing to a fire. But, if in fact it is the presence of oxygen which causes fire, then 'phlogiston' would refer to oxygen (as argued by Enç 1976, p. 267). Yet such a result is surely mistaken. For there is no substance which possesses the properties, or behaves in the manner, which were thought characteristic of phlogiston. Thus, rather than mistakenly refer to oxygen, the term 'phlogiston' fails to refer to anything at all. To deliver such a result, however, the causal description must be expanded to include

information about the referent, such as the causal role it plays in producing the observed phenomena.[10]

6. Causal descriptivism, post-baptismal use and translation failure

The problems just highlighted spell the end for a pure causal response to incommensurability. For if reference may change, and description plays a role in reference, no dismissal of referential discontinuity of the kind previously sketched may be upheld. However, the causal theory may be revised in light of these problems to permit a more nuanced referential response to the incommensurability thesis. In particular, a modified causal theory may be used to defend referential comparison, while retaining key semantic insights on which the incommensurability thesis is based.

In this section, I will briefly summarize the approach to incommensurability which I have developed at length in my (1991) and (1994, Chapter 3). The modified causal theory which I favour is a form of *causal descriptivism*, according to which the causal relations on which reference is based must be supplemented by description. In the case of introduction of a kind term by ostension of a sample, reference is determined by the causal relation of perception supplemented by a descriptive specification of the kind (e.g., species, genus) to which the sample belongs. In the case of reference to unobservable theoretical entities, the causal relation which determines reference must be specified by description. Thus, the reference of theoretical terms is determined by description of the causal mechanism, whereby the action of unobservable referents is thought to produce certain independently specified (e.g., by ostension) observable phenomena.

A causal descriptive model of reference determination resolves the problems of indeterminacy of ostension and reference failure of theoretical terms. But it leaves the issue of reference change untouched. To meet the latter problem, the causal theory must grant post-baptismal use a role in reference determination.

Rather than being inalterably fixed at an initial baptism, reference may shift as a result of subsequent use of a term. After a term is introduced, speakers continue to apply the term to various items to which they take it to refer. In this way, to borrow a phrase from Michael Devitt, terms become *multiply grounded* in their referents (Devitt 1981, pp. 56-7, 191-5).[11] Reference change may occur due to shift in the *pattern of groundings* which a term has in its referents. For example, a term may be introduced to refer to a given kind, yet subsequently be applied to members of another kind. Because of the shift in the items in

which it is grounded, the term comes to refer to the kind to which it was subsequently applied, rather than the kind for which it was introduced.

A further implication of the role of post-baptismal use in reference determination is that a term may be associated with multiple ways of fixing reference. As has been shown by Philip Kitcher, different tokens of a scientific term-type may have their reference fixed in different ways (e.g., 1978, p. 535). For example, the reference of some tokens of a term may be fixed by ostension of samples of a given substance, while the reference of other tokens may be fixed by a description which specifies the role played by the substance in producing certain effects. Such diversity of reference determination may seem unified from the point of view of scientists, for whom the different means of fixing reference are merely alternative ways of picking out the same thing.

A modified causal theory of the kind just outlined serves as the basis for my approach to incommensurability. I defend a version of the referential response to the incommensurability thesis, roughly along the lines of Scheffler (1967). More specifically, I argue that the content of theories may be compared by means of shared reference, despite translation failure due to semantic variance. Suitably modified, therefore, the causal theory of reference has the resources both to reveal what is correct about the incommensurability thesis and to remove it as a threat to rational theory choice and scientific progress.

My argument for translation failure assumes that the way in which the reference of a term is determined is a semantic property which must be preserved in translation. There are two principal ways in which expressions employed by one theory may fail to be translatable into the vocabulary of another. First, it may not be possible to determine reference within one theory in a manner permitted by the other. For example, the causal role description required to fix reference for a theoretical term may be incompatible with the basic laws of the theory. Second, it may not be possible to determine reference within a theory in the same set of ways as in another. For example, within one theory the reference of a term may be fixed both by ostension and by theoretical description, while from the point of view of the other theory the two reference-fixing procedures fail to pick out the same kind. In either of these two ways, translation fails because the way reference is determined in one theory is unavailable in, or is precluded by, the other. (For details of how ontological and causal-explanatory commitments impose limits on reference determination, see my (1991, pp. 229-34) and (1994, pp. 81-95).)

Thus, it may be argued on the basis of a modified causal theory that translation fails between theories due to limits on reference determination in the context of a theory. Such

translation failure is entirely consistent with comparison of the content of theories, which may proceed by means of shared reference. The question remains, however, of the extent to which such comparison is assured, given that reference may vary subsequent to initial baptism.

The answer, in short, is that while reference may vary with theory, it need not do so in wholesale fashion. On my view, reference changes in a piecemeal manner, dependent on the facts relating to the use of a given term. As such, reference is not necessarily subject to variation with overall shift in the way theories describe the entities which populate a common domain of application. Rather, it may remain stable through major alteration of the descriptive content which speakers associate with terms.

While reference may change through shift in the pattern of groundings of a term, this does not mean that all post-baptismal use affects reference. Rather, speakers typically acquire reference via a chain of communication from earlier use, despite reference not being inalterably fixed at the original introduction of a term. Hence, reference may remain stable even though later speakers do not associate the same descriptions with terms as earlier speakers. Thus, while reference may vary due to post-baptismal shift in the pattern of groundings, in a great many cases reference is determined by deference to earlier use.

In any event, the threat of reference change due to variation in descriptions which determine reference is much reduced on the present account. On a classic description theory of reference, substantial variation in the concepts employed by successive theories may result in radical discontinuity of reference, since the descriptions associated with the terms used by theories may not be satisfied by the same things. By contrast, description plays less of a role on my account. In the case of terms introduced by ostension to refer to observable natural kinds, the associated descriptive content is minimal (e.g., a categorial expression such as 'liquid' or 'species'). Thus, the reference of such terms may withstand considerable variation of associated descriptive content in the transition between theories. As for theoretical terms, whose reference is determined by description of causal role, significant scope exists for variation in descriptive content without change of reference, since the latter may vary without affecting the former.

To sum up, on the view I propose, translation may fail due to limits on reference determination within theories, yet the content of theories is comparable by means of reference. This approach allows for significant conceptual change in the transition between theories, while enabling the choice between such theories to be made on a rational basis.

Given the possibility of common reference, moreover, it is possible for theories to advance on the truth about a shared domain of entities, in the manner suggested by scientific realism.

7. Taxonomic incommensurability

Apart from allowing rational theory choice, the chief attraction of the present approach is that it permits analysis of the semantic issues relating to incommensurability within a realist framework. For it reveals how theories, which are untranslatable due to conceptual variance, may nonetheless entail comparable consequences about a shared, mind-independent reality. In the final two sections of this paper, I will discuss two recent developments which raise questions about the realist commitments of this approach.

The first of these involves the formulation in Kuhn's later writings of a new, *taxonomic* version of the incommensurability thesis. According to Kuhn's later view, scientific revolutions are characterized by changes in the taxonomic schemes by means of which theories classify the entities in their domains of application (1987, pp. 19-20). Such changes include redistribution of members among existing taxonomic categories, modification of criteria of category membership, and introduction of new categories. At the semantic level, taxonomic change gives rise to change in the meaning of preserved vocabulary, which in some cases involves change of reference. In the case of new categories, it may also result in introduction of new vocabulary which differs semantically from previous vocabulary.

According to Kuhn, the taxonomic scheme of a theory is represented linguistically by a *lexicon*, which is a structured vocabulary of natural kind terms (1983, pp. 682-3). Kuhn argues that terms from one lexicon fail to be translatable into another due to a restriction on relations between natural kinds, which derives from what he calls the *no-overlap principle* (1991, pp. 4-5, 1993, pp. 318-9). According to the no-overlap principle, members of one natural kind may only be members of another kind if one of the kinds is contained in the other (e.g., as species is contained in genus; see Kuhn 1991, p. 4). Thus, a term cannot be translated from one lexicon into another if its extension includes items which belong to distinct kinds within the rival taxonomy, since that would result in violation of the no-overlap principle (1993, p. 319).[12]

Translation failure due to inability to transfer a kind from one taxonomy to another is entirely consonant with the reference-based approach outlined in the previous section.[13] However, Kuhn sought to base a number of anti-realist claims on taxonomic

incommensurability. I will sketch these claims, and then point out why such anti-realism does not follow from translation failure between lexicons.

Where scientific realists tend to see scientific progress in terms of convergence on truth, Kuhn was critical of both the idea of convergent progress and the realist view of truth. That science is not convergent, he took to follow directly from incommensurability (cf. 1993, p. 330). Speaking of propositions from Aristotelian physics, Kuhn wrote that:

> Using our conceptual lexicon, these Aristotelian propositions cannot be expressed -they are simply ineffable- and we are barred by the no-overlap principle from access to the concepts required to express them. It follows that no shared metric is available to compare our assertions about force and motion with Aristotle's and thus to provide a basis for a claim that ours (or, for that matter, his) are closer to the truth. (1993, p. 330)

Thus, according to Kuhn, science does not converge on truth because claims from rival theories cannot be expressed in a common lexicon, with the result that they cannot be compared for closeness to truth.

Kuhn's objection, though, was not simply to the idea of advance on truth, but to the very idea of truth as correspondence to reality. For he says that 'the subject of truth claims cannot be a relation between beliefs and a putatively mind-independent or "external" world' (1993, p. 330). His objection to the correspondence theory seems to turn on the relation between lexicon and reality:

> (...) lexicons are not (...) the sorts of things that can be true or false. A lexicon or lexical structure is the long-term product of tribal experience in the natural and social worlds, but its logical status, like that of word-meanings in general, is that of convention. Each lexicon makes possible a corresponding form of life within which the truth or falsity of propositions may be both claimed and rationally justified, but the justification of lexicons or of lexical change can only be pragmatic. With the Aristotelian lexicon in place it does make sense to speak of the truth or falsity of Aristotelian assertions in which terms like 'force' or 'void' play an essential role, but the truth values arrived at need have no bearing on the truth or falsity of apparently similar assertions made with the Newtonian lexicon. (1993, pp. 330-1)

Thus, Kuhn was prepared to grant a role to truth within the context of a given lexicon. But it is a limited role. Neither is the truth of claims made in one lexicon relevant to that of claims made in another, nor may the concept of truth be applied to a lexicon itself. On the concept of truth which emerges, truth is internal to lexicon in the sense that a claim may be true in a lexicon without corresponding to reality.

But Kuhn seems simply to have been mistaken in taking these anti-realist claims about truth and convergence to follow either from taxonomic incommensurability or from the

nature of lexicons. It is a mistake to suppose that inability to translate between lexicons entails either that theories cannot converge on truth or that they may not be judged to do so. For, even if two theories are not fully intertranslatable, it remains possible for terms used by such theories to refer to some of the same things. To the extent that there is co-reference, such theories may assert true or false claims about a common domain of entities. Indeed, one theory may even assert a greater number of truths than the other about such entities.

Nor does untranslatability preclude comparative judgement of truth. For a lexicon is a special vocabulary, embedded in a background natural language. Given this, it is possible to employ a fragment of the natural language as metalanguage with respect to alternative lexicons, which may be treated as object languages. Within such a metalanguage one may assert the truth or falsity of object-linguistic sentences from alternative lexicons. Therefore, it is at least in principle possible to arrive at a judgement of comparative closeness to truth of theories expressed in non-intertranslatable lexicons.

As for the realist idea of truth, Kuhn appears to reject the idea of correspondence between theory and reality on the basis of the conventional status of lexicons. He is right, of course, about the conventionality of lexicons, since the words which make up a lexicon are conventionally associated with their meanings. But nothing follows from this about the nature of truth. Statements may be true because what they say corresponds to the way things stand in reality, regardless of the conventional status of lexicons.

In any event, to assume that the status of a lexicon, in relation to truth, is entirely a matter of convention is to overlook the factual nature of claims which may be made on the basis of a lexicon. For it is possible to use the terms of a given lexicon to formulate substantive claims about the world regarding what kinds of things there are, as well as the properties that such things possess. To assume that such claims are lacking in truth-value is to assume that there is no fact of the matter relating to the structure or constitution of reality. But such an extreme metaphysical thesis is certainly not entailed by the conventionality of lexicons.

My point, though, is not just that the anti-realist claims specifically based by Kuhn on taxonomic incommensurability are unfounded. Rather, at a more general level, the thesis of taxonomic incommensurability poses no threat to scientific realism. The phenomenon of conceptual change between theories is consistent with a commitment to the reality of theoretical entities, which is characteristic of scientific realism. Moreover, variation of the taxonomic schemes whereby theories classify the world does not by itself have any bearing on metaphysical matters. The translation failure between theories, to which it gives rise, is a semantic relation between alternative theories of the same world.[14]

8. Meta-incommensurability?

In the last section, I mentioned fit with realism as an attraction of my approach. But not all readers may take such fit as a positive feature. Some will see it as a drawback. I will conclude this paper by commenting on a recent suggestion that realism is in fact positively inimical to understanding incommensurability.

The suggestion is due to Hoyningen-Huene, Oberheim and Andersen (1996) -HHOA, for short- in a critical study of my (1994) book. The main impetus behind the suggestion derives from the proposal by Paul Hoyningen-Huene (1993) of a novel interpretation of Kuhn's philosophy of science, which presents the latter within a neo-Kantian anti-realist framework. On this reading of Kuhn, the incommensurability thesis involves anti-realist assumptions, which problematize a realist critique of incommensurability.

Hoyningen-Huene takes seriously Kuhn's talk of the world changing with change of paradigm. To make sense of such talk, he proposes a distinction between the variant *phenomenal world* of the scientist and the invariant *world-in-itself* (1993, pp. 33-5). The phenomenal world is a world of appearances, jointly constituted by perceptual input from external reality and the conceptual contribution of an epistemic subject. By contrast, the world-in-itself is a fixed, independent reality, not subject to the influence of human conceptual activity. Thus, in the transition between paradigms it is the phenomenal world which varies, while the world-in-itself remains constant.

The metaphysical divide between phenomenal and real corresponds to an epistemological divide between the knowable and the unknowable, reminiscent of Kant. On Hoyningen-Huene's interpretation of Kuhn, scientific knowledge is knowledge of a phenomenal world, since the world-in-itself is unknowable and epistemic access is limited to the phenomena. However, the chief novelty of such an interpretation lies not in its Kantian underpinning, but in the analysis it proposes of Kuhn's theory of the constitution of phenomenal worlds.

Drawing mainly on Kuhn's (1974) account of empirical concept-acquisition, Hoyningen-Huene argues that subjects enter the phenomenal world of a scientific community as they acquire the community's conceptual system (1993, pp. 70-111). A major part is played in concept-acquisition by ostension, whereby a subject is taught a set of similarity relations by direct exposure to members and non-members of a given similarity class or kind. For concepts at the more theoretical end of the spectrum, exposure to sets of similar problem situations takes the place of ostension. The network of similarity relations acquired by these

processes is what provides the conceptual ordering of the phenomenal world, which the subject acquires on initiation into a given scientific community.

Such a reading of Kuhn suggests that incommensurability is also to be taken in anti-realist vein, as a relation between theories about different phenomenal worlds rather than objective reality. That incommensurability is an essentially anti-realist idea is the basic assumption of HHOA in their (1996). HHOA write, for example, that for Kuhn and Feyerabend "incommensurability is one form of expressing a critical attitude toward naive realism" (1996, p. 133). "Realism", they say, "is just the issue of the dispute" (1996, p. 135).

By contrast, my approach makes "realist assumptions that lead [me] to misconstrue Feyerabend and Kuhn's intentions in establishing the incommensurability thesis" (1996, p. 131). This results in misunderstanding, perhaps due to a "*meta-incommensurability* between the realist and the non-realist" (1996, p. 138), which involves meaning change, communication difficulty and circular argument (1996, pp. 139-40). Thus, HHOA suggest, debate about incommensurability is vitiated by a meta-level incommensurability arising from "the different metaphysical commitments realists and non-realists bring to the debate" (1996, p. 141).

The claim of meta-level semantic variance is not, of course, implausible, as may be illustrated by comparison of my use of the term 'realism' with that of HHOA. By 'realism' I mean *scientific realism*, which is a doctrine typically committed to correspondence truth, reality of theoretical entities and advance on truth about mind-independent reality. In contrast, for HHOA 'realism' refers to the view that scientists' epistemic access extends to objective reality, rather than being limited to a changing phenomenal world, as it is for what they call 'non-realism' (cf. 1996, p. 139). While such discrepancy of use may create temporary confusion, the semantic adjustment required is routine: adopting a metalinguistic mode of discourse, one either explicates the meaning of a mentioned term or else specifies its reference, as I have just done. In short, I can see no basis in the semantic variation of philosophical terms for a crippling meta-level incommensurability between realist and non-realist.

HHOA make much of the supposed intentions of Kuhn and Feyerabend. The incommensurability thesis was "originally intended", they say, "as a challenge to realism" (1996, p. 138). Now, it would undoubtedly be an important *historical* discovery, if it were shown that Kuhn and Feyerabend meant all along for incommensurability to be understood in the context of an anti-realist position of the kind described by Hoyningen-Huene.[15] But such a discovery would not detract in the least from the *philosophical* importance of the

semantic incommensurability thesis standardly discussed in the literature on the topic. For, as we have seen, semantic incommensurability spells trouble for scientific rationality and progress -to say nothing of the problems it raises for traditional views of methodology.

Setting aside the question of authorial intent, the claim that incommensurable theories relate to different phenomenal worlds is a distinct thesis from the thesis of semantic incommensurability. Let us call it the Φ-incommensurability thesis. I will close this discussion by briefly outlining why, in my view, the Φ-incommensurability thesis fares no better than the more standard semantic version of the thesis.

In the first place, while Hoyningen-Huene (1993) proposes a very plausible interpretation of Kuhn's metaphysics, the plausibility of the position thereby ascribed to Kuhn is itself somewhat doubtful. Indeed, the claim that there is a world-in-itself, which is itself unknowable, appears to be fundamentally incoherent. For how can it coherently be said *of* an unknowable reality that *it* is unknowable?

In order to know that such a reality cannot be known, it must be possible to enter into *some* sort of epistemic relation with it, namely, the epistemic relation of knowing that it cannot be known. At the very least, this suggests that it is possible for a cognitive agent to enter into an intentional or referential relation with reality itself, on the basis of which it is possible to bear an epistemic relation to it. This, in turn, raises the question of why more extensive knowledge of reality itself should be precluded, given that it is possible to enter *some* epistemic relation to it.[16]

The problem may be brought into focus by consideration of Kuhnian anomalies. Failure of theory-data fit, characteristic of anomaly, requires that the world-in-itself be capable of impact on the phenomenal world of the scientist. To account for the existence of anomalies, Hoyningen-Huene speaks of the "proprietary resistance of the world-in-itself" (1993, p. 270). "The world-in-itself", he writes, "offers resistance, resistance which makes it impossible to impose just any network of similarity relations" (1993, p. 269). Such resistance "reveals itself when (...) significant anomalies appear"; "resistance of the world-in-itself must be a participant in the production of significant anomalies" (1993, p. 270).

The trouble with such talk of resistance is that it is irreducibly *causal*.[17] For in order for the world-in-itself to resist, and thereby induce change in phenomenal world, it must interact causally with the phenomenal world. Anomaly is *caused* by unpredicted behaviour of mind-independent entities, just as recalcitrant experience is *caused* by impact of such entities on our sensory receptors. But given the existence of causal relations between world-in-itself and phenomenal world, there is no basis on which to deny that there may be causally

grounded referential relations linking scientists' linguistic tokenings to mind-independent objects. In short, Hoyningen-Huene would seem to have no reason to deny that terms of semantically variant theories may refer to common entities in the world-in-itself.

Hoyningen-Huene is not, in any case, opposed in principle to intertheoretic co-reference. Indeed, in his discussion of comparison of Φ-incommensurable theories, he explicitly allows for such co-reference (1993, pp. 219-20). In some cases, such comparison proceeds on the basis of shared, semantically stable vocabulary:

> (...) some of the empirical predictions of incommensurable theories can be compared *immediately*, namely those unaffected by the (merely local) incommensurability of the lexica. (1993, p. 219)

For more complex cases, Hoyningen-Huene follows Kitcher in admitting theory comparison on the basis of the co-reference of tokens of semantically variant term-types:

> (...) there may be *particular situations* in which the referents of the new concepts may be identified by means of the concepts of the old lexicon. (1993, p. 220)

In either case, comparison of the content of theories proceeds by means of common reference. But if terms from Φ-incommensurable theories co-refer across phenomenal worlds, they must refer to the same items in the world-in-itself. Given this, Hoyningen-Huene would appear to be committed to shared reference by the terms of Φ-incommensurable theories to common elements of an objective reality.

Nor is there any reason for Hoyningen-Huene to demur. For why should he not allow co-reference to mind-independent objects across phenomenal worlds? After all, as Hoyningen-Huene notes, "a phenomenal world is constituted both by the object-sided world-in-itself and by subject-sided moments" (1993, p. 36).[18] Given this, the elements which constitute the phenomenal worlds of Φ-incommensurable theories must include items drawn from the *same* domain of objects in the world-in-itself.[19] For where such phenomenal worlds differ is not in their objective constituents, but in the conceptual ordering overlaid by theories on such constituents.

The upshot is that the phenomenal worlds of Φ-incommensurable theories contain phenomenal items, the constitutive parts of which include the same mind-independent elements of the world-in-itself. But, given that phenomena in different phenomenal worlds may be constituted of the very same objective elements, scientists working in such different worlds may nevertheless refer to the same objective entities. For, while they employ terms which refer to items in their phenomenal world, they thereby refer to the objective entities

which partly constitute those phenomenal items. As a result, there may be co-reference across Φ-incommensurable theories to common entities in the world-in-itself.

The possibility of co-reference across phenomenal worlds combines with the causal nature of resistance to yield an unexpected result. Given both co-reference and resistance, little substantive difference remains between Hoyningen-Huene's position and my own. Rather than speak of phenomenal worlds and an inaccessible world-in-itself, one may simply say that there is one world about which different folks believe different things. Far better to say, as I do, that the vocabulary of semantically variant theories may refer, by way of causal links, to the *same* mind-independent objects, though these *same* objects may be categorized in different ways by different theories.

Notes

1 Particularly influential in this regard has been the work of Larry Laudan, especially (1984) and the papers contained in his (1996).

2 I discuss the relevant methodological issues in several recent papers (1995, 1996a, 1996b), all of which are due to appear in my collection of essays (forthcoming (b)).

3 The chief exception is Feyerabend (1975, Chapter 17).

4 See, for example, Feyerabend (1981a, pp. 29-31, 1981b, pp. 51-3, 76-83) and Kuhn (1970a, pp. 125-9).

5 The *locus classicus* for the argument that the incommensurability thesis is undermined by failure to take into account the distinction between sense and reference is Scheffler (1967, Chapter 3). To simplify matters, I will largely ignore complications involving semantic relations other than strict co-reference, such as extensional overlap, partial co-reference, co-reference of term-tokens.

6 The incoherence objection to the untranslatability of incommensurable theories is due to Davidson (1984) and Putnam (1981). I provide a detailed analysis of various aspects of this argument in my (1994, Chapter 4).

7 I say that change of reference *may* occur because rather special conditions must obtain for such change to occur. For reference change to occur as a result of change of associated descriptive content, the descriptions must be incapable of being jointly satisfied by the same thing or set of things. Change of description need not result in change of reference, if, for example, the descriptions may be true of the same things.

8 For convenience, I pass over Kripke's claim that reference may also be fixed by means of a description which fixes the reference rather than one which gives the meaning of a term.

9 The objection that the causal theory rules out reference change in science is due to Fine (1975). As an example of reference change, Fine mentions the shift of 'electron' from referring to the unit charge of electricity to a specific kind of particle (Fine 1975, p. 25). Other plausible examples are given by Kuhn: e.g., 'compound' (1970b, p. 269) and 'planet' (1987, p. 8).

10 In this I follow Robert Nola, who speaks of scientists introducing theoretical terms by means of the causal powers by which phenomena are produced (Nola 1980, pp. 524-6).

11 By 'grounding', Devitt means perception of an object by virtue of which a name designates its bearer (1981, p. 278). For present purposes, grounding may be understood more generally as a relation between term and object(s) by means of which the term refers to the object(s).

12 How no-overlap leads to translation failure may be illustrated by one of Kuhn's own examples. Apart from planets other than the earth which are classified as planets by Copernican astronomy, the Ptolemaic kind *planet* includes the sun and the moon. Thus, to translate the Ptolemaic term 'planet' into the Copernican lexicon would require introduction into the Copernican taxonomy of a kind which contains items belonging to three distinct Copernican kinds, viz., *planet*, *sun* and *satellite*. But such a kind cannot be introduced into the Copernican scheme, since it treats entities which behave according to different laws as belonging to a uniform natural kind.

13 My requirement that reference determination be preserved in translation insures that reference to kind is preserved in translation. This in turn insures that no kind term may be translated into a taxonomic scheme which precludes the relevant kind (for details, see my 1994, pp. 96-7).

14 For more detailed discussion of the matters dealt with in this section, see my (forthcoming (a)).

15 This is not the place to challenge the claim about Kuhn and Feyerabend's intentions in detail. With respect to Kuhn, suffice to say that while Hoyningen-Huene's neo-Kantian interpretation makes sense of Kuhn's early talk of world-change, it hardly follows that Kuhn *intended* such talk to have exactly that interpretation. As for Feyerabend, the claim about original intentions will prove difficult to reconcile with the sustained polemic against positivism in the name of realism, which Feyerabend conducted in the late 1950s and early 1960s. More generally, the claim about intentions misidentifies the opposition: at the time of the introduction of the incommensurability thesis in the early 1960s, logical empiricism was the target, rather than scientific realism.

16 An analogous problem arises for Kuhn, who writes that: 'Underlying all these processes of differentiation and change, there must, of course, be something permanent, fixed, and stable. But, like Kant's *Ding an sich*, it is ineffable, undescribable, undiscussible. Located outside of space and time, this Kantian source of stability is the whole from which have been fabricated both creatures and their niches, both the "internal" and the "external" worlds' (1991, p. 12). Yet for something that cannot be described, Kuhn manages to say rather a lot about it.

17 Indeed, this is evident from the causal idiom which Hoyningen-Huene adopts in discussing resistance: e.g., resistance "makes itself felt", and it is "a participant in the production of significant anomalies" (1993, p. 270); we even "feel the effects" of "concrete properties of the world-in-itself" (1993, p. 271). The point is made explicitly by Hoyningen-Huene (1993, p. 34), where he talks of the "causal efficacy" of the world in "codetermin[ing] a given phenomenal world".

18 The terms 'object-sided' and 'subject-sided' are introduced by Hoyningen-Huene (1993, pp. 33 ff) to distinguish between that which is independent of human cognition (e.g., objective reality) and that which derives from the epistemic subject (e.g., concepts, ideas).

19 The strain inherent in Hoyningen-Huene's position is particularly evident at this point. In an attempt to explain how incommensurable theories differ from theories which really are about different domains, he writes that: "incommensurable theories, by contrast [with such theories], target *roughly the same* object domain, *as far as the world-in-itself is concerned*" (1993, p. 219). Such appeal to the world-in-itself to individuate a common object domain illegitimately trades on

facts about the world-in-itself which Hoyningen-Huene otherwise treats as inaccessible. Quick to correct the slip, however, he adds: 'Such talk of "object domains" obviously can't be taken literally, as this notion properly applies only to regions of the phenomenal world' (1993, p. 219, note 119). The problem is, of course, that there is no way to individuate a common domain for theories without appeal to a shared set of objects, such as may be provided by the world-in-itself.

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