

Semantic Incommensurability and Scientific Realism

Howard Sankey

University of Melbourne

1. Background

Perhaps the most controversial claim to emerge from the historical turn in the philosophy of science was the thesis proposed by Paul Feyerabend and Thomas Kuhn that some alternative scientific theories are incommensurable. The controversy surrounding the incommensurability thesis remains one of the enduring legacies of the historical turn. While some may regard the matter as closed, this is not a view taken by all parties to the discussion.

It is widely recognized that Kuhn and Feyerabend did not mean the same thing when they originally spoke of the incommensurability of competing theories. Feyerabend employed the term ‘incommensurability’ to refer to the absence of logical relations between theories due to semantic variance of the terms employed by theories. Kuhn employed the term to describe the obstacles to communication between advocates of rival paradigms which result from perceptual, methodological and semantic differences between paradigms. While Feyerabend’s use of the term remained constant throughout much of his writing on the topic, in his later work Kuhn developed a refined version of the notion of incommensurability which involved the inability to translate between holistically interdefined subsets of terms within the vocabulary of alternative theories.

The incommensurability thesis has been controversial for two main reasons. On the one hand, the claim that scientific theories are incommensurable suggests that the content of theories may not be directly compared. But if the content of theories may not be compared, no

comparative test of predictive consequences may be undertaken. Moreover, if there are no shared standards of theory appraisal, then there may be no neutral basis for theory choice. On the other hand, if semantic variance between theories entails variation of reference, later theories may fail to refer to the same entities as earlier theories. But if there is discontinuity of reference between theories, there may be no scientific progress in the sense of increase of truth about a common domain of entities. In sum, the incommensurability thesis is controversial because it throws doubt upon the rationality of scientific theory choice, as well as the progressive character of scientific theory change.

2. Incommensurability: two distinctions

To set the terms for the discussion, I will introduce two key distinctions. The first distinction is between semantic and methodological forms of incommensurability. The second is between two sources of semantic incommensurability: variation of sense and referential discontinuity.

The first distinction may be traced back to the difference in original use between Kuhn and Feyerabend. Semantic incommensurability arises due to semantic variation between scientific theories. By contrast, methodological incommensurability arises due to variation in evaluative standards between theories. In this paper, I will focus on semantic incommensurability as a problem for scientific realism. Methodological incommensurability poses a threat to rational theory choice, which is a distinct issue from the question of scientific realism. As such, methodological incommensurability does not present a problem specifically for scientific realism.

The second distinction is between two sources of semantic incommensurability. In their initial treatment of the topic, Kuhn and Feyerabend tended to ignore the distinction between sense and reference. But ever since Israel Scheffler's *Science and Subjectivity* (1967), the

distinction has been central to discussion of the topic. It enables a distinction to be drawn between two sources of semantic incommensurability. The first is due to variation of sense. The second is due to discontinuity of reference. As I will now explain, semantic incommensurability is a problem for realism insofar as it is understood in terms of discontinuity of reference rather than variation of sense.

3. Realism, variation of sense and discontinuity of reference

According to scientific realism, the aim of science is to arrive at the truth about the world. Scientific progress consists in progress toward that aim. The world which we inhabit, and which science investigates, is an objective reality. It exists independently of human cognitive activity. The result of successful scientific investigation is knowledge of both observable and unobservable aspects of the world. Scientists discover facts about unobservable entities whose behaviour is responsible for the behaviour of observable entities. Scientists propose theories which refer to unobservable entities in order to explain observed phenomena. As science progresses, theories approach the truth by providing increasingly accurate descriptions of entities identified by earlier scientists. Truth, for the realist, is a relation of correspondence between language and reality. Whether a claim about the world is true is an objective matter. It depends on how things are in the mind-independent world, rather than on what scientists believe to be the case.

The thesis of semantic incommensurability has been perceived as a challenge to scientific realism. But to the extent that semantic variance is restricted to variation of sense, semantic incommensurability poses no threat to realism. In order to determine whether successive theories approach truth, the content of theories must be compared. But comparison of the content of theories requires that the terms employed by theories refer to the same objects. It

does not require that the terms share sense. Thus, variation in the sense of the terms employed by theories does not cast doubt on approach to truth. Nor does variation of sense call continuity of reference between theories into question. In order for there to be an increase in truth known about a shared field of investigation, successive theories must refer to a common domain of entities. Thus, progress requires continuity of reference between theories. But successive theories may continue to refer to the same entities whether or not sense is subject to variation. In sum, provided that reference is constant between theories, no problem arises for the realist account of progress with respect to the variation of sense between theories.

However, the same is not true with respect to variation at the level of reference. The threat to realism posed by semantic incommensurability arises in relation to the discontinuity of reference between theories. For to the extent that semantic variation entails discontinuity of reference, the realist account of scientific progress as increase in truth about a common domain of entities seems untenable. If later theories do not refer to the same entities that earlier theories in the same domain referred to, then it is not possible for later theories to increase the truth known about the same entities as those referred to by earlier theories. Under such circumstances, progress in the realist sense is impossible. For the replacement of one theory by another is unable to constitute progress toward the truth about a common domain of entities.

4. Incommensurability and the theory of reference

The point of Scheffler's appeal to the sense/reference distinction was that semantic variance does not entail incomparability of content. Theories whose terms share reference may agree or disagree with respect to specific assertions even if the terms differ in sense. Terms which co-refer may differ in sense. Co-reference of constituent terms is all that is needed for assertions to agree or disagree. Indeed, even full co-reference is unnecessary, since overlap of extension

suffices for comparability.¹ Scientific theories may be compared with respect to content, provided only that the terms employed by the theories have the same or overlapping reference.

Scheffler's point that co-reference suffices for the comparability of content has not been seriously contested. What has been contested is whether semantic variation is limited to variation of sense. Both Kuhn and Feyerabend took change of meaning between theories to include variation of reference as well as sense. Indeed, both Kuhn and Feyerabend initially appeared to take theory change to involve wholesale change of reference, though Kuhn later restricted reference change to "redistribution" of members among central "taxonomic categories" (Kuhn, 2001: 30).² But if reference is not preserved between theories, then it cannot be assumed either that the content of theories may be compared or that the transition between theories is progressive in the realist sense.

The issue of reference change raises the question of the nature of reference determination. For the extent to which reference is taken to change depends upon considerations about the way in which reference is determined. Analysis of the reasoning employed by Kuhn and Feyerabend when they argue for failure of co-reference and reference change reveals that they assume that reference is determined by description. Kuhn and Feyerabend routinely argue from difference in the descriptive content associated with terms to difference in the reference of such terms. Thus, when they argue that reference is subject to variation between theories, Kuhn and Feyerabend employ a description theory of reference, according to which the reference of a term is determined by the descriptive content associated with the term.³

On the basis of the description theory of reference, reference change would appear to be widespread in science. As theories undergo modification, or are replaced by alternative theories, the descriptions which theories provide of the objects in their domain of application likewise undergo modification or are replaced. The descriptions which a theory proposes of the entities

in its domain may be replaced by new descriptions that are incompatible with earlier descriptions. Indeed, an entirely different set of putative entities might even be introduced and described by a new theory. On the assumption that reference is determined by description, variation of reference would regularly occur in such circumstances.

As is well-known, however, the description theory of reference is problematic. It is possible to refer to items despite the fact that the items have been incorrectly described. Conversely, a term may fail to refer to items even though the items satisfy the description associated with the term. Satisfaction of description is neither necessary nor sufficient for reference. As has been argued by advocates of the causal theory of reference, pragmatic relations between a speaker and their environment play a crucial role in the determination of reference. Causal theorists emphasize the role played by ostensive definition in the context of naming ceremonies, in which terms are applied directly to the objects to which the terms refer. Because reference is independent of description, and may be established at an initial naming ceremony, causal theorists have argued that reference is not sensitive to variation in descriptive content in the way that it is on the description theory.

On the assumption that reference is independent of description, it may be denied that reference varies with theory. Once reference is established at the original introduction of a term, subsequent variation of associated descriptive content has no effect on reference. As a result, successive theories are not incommensurable due to discontinuity of reference.

But such an outright dismissal of referential discontinuity has proven to be unsustainable. For the causal theory of reference does not admit of straightforward application to the problem of reference change in science. In the first place, there appear to be genuine cases of reference change in the history of science, so that post-introductory use of terms must be accorded a role in reference determination. Second, in the case of observational natural kind terms, ostensive

term-introduction is indeterminate unless it is supplemented by at least minimal descriptive apparatus. Third, to allow for the possibility of reference failure for theoretical terms, description of at least the causal role of the entities referred to must be employed in the determination of reference.⁴ Thus, in order to apply to the problem of reference change in science, the causal theory of reference must be modified to allow for post-introductory change of reference, as well as to allow descriptive apparatus to play a role in the determination of reference. The modified theory which results from these changes is a version of what is usually known as a causal-descriptive theory of reference.

While outright dismissal of referential discontinuity cannot be sustained on the basis of a pure causal theory of reference, a moderate position consistent with the realist view of progress may be defended on the basis of a causal-descriptive theory of reference. In the first place, the threat of wholesale referential discontinuity between theories has been removed by rejecting the description theory of reference. For if reference is not fully determined by descriptive content, then it is not subject to wholesale variation with change in the descriptive content of theories.

This leaves variation in the reference of specific terms that may occur in incidental cases. Where reference is fixed at an initial term-introduction, it remains constant throughout subsequent variation of the descriptive content associated with the term. Even if the reference of a term changes in post-introductory use, there may still be referential overlap between original and post-introductory uses of a term. Where reference is established by means of causal role description, subsequent variation of descriptive content not affecting description of causal role will likewise leave reference unaffected. In sum, rejection of full descriptive determination of reference, combined with an emphasis on the aspects of reference determination highlighted by the causal-descriptive theory of reference, leads to significant reduction in the potential for variation of reference between theories.

Thus, while allowing for the possibility of some shift of reference, there is in general sufficient continuity of reference between theories to allow for comparability of content. Indeed, only in exceptional cases of wholesale ontological error is there any serious prospect of total incomparability of content due to failure of referential overlap between theories.⁵ For if theories are genuinely applied to the same domain, then, given the role of pragmatic factors in reference determination, there will always be at least some overlap in the reference of the terms employed by theories in relation to the common domain.

A similar point holds with respect to the question of scientific progress. In order for there to be an increase in truth about a common domain, later theories must refer to the same entities as earlier theories referred to. Given that reference is not fully determined by description, it is not subject to variation with descriptive content in the transition between theories. If reference is fixed at the initial introduction of a term, then the term may continue to refer to the same entities across theory change. Where reference is fixed by causal role description, use of a term in a later theory may refer to the same thing as it referred to in the context of an earlier theory, provided that the causal role description remains fundamentally unaltered. Except for rare cases of wholesale ontological error, successive theories whose terms refer to items in a common domain refer to at least some of the same entities. Thus, later theories may lead to an increase in truths known about the same entities that were referred to by earlier theories in the same domain.

5. Incommensurability and anti-realism

The position I have just described represents a common assessment of the challenge presented to scientific realism by semantic incommensurability. We might sum it up by saying that

semantic variance is real but of little import for scientific realism, since reference by and large persists through theory change.

However, this assessment of the situation is not shared by all parties to the discussion. Some commentators understand the idea of incommensurability as an intrinsically anti-realist idea. Any attempt to resolve the problem of incommensurability that fails to address the anti-realist nature of the idea of incommensurability obscures the intentions of the original advocates of the incommensurability thesis. Moreover, any attempt to show that successive theories refer to a common domain of mind-independent entities begs the question, since advocates of semantic incommensurability reject the very idea of a mind-independent reality to which successive theories may refer.

As I will later argue, however, this response does not invite further discussion specifically with respect to semantic incommensurability. Rather, it elevates the issue into a general dispute between realism and anti-realism in the philosophy of science. Such a dispute is not to be resolved simply by semantic considerations relating to continuity of reference. It is instead to be conducted at the level of arguments presented on behalf of scientific realism and its anti-realist adversaries. I will now examine this issue as it arises in the writing of Paul Hoyningen-Huene, especially in work that he has undertaken with two co-authors, Eric Oberheim and Hanne Andersen.

6. The neo-Kantian challenge

Paul Hoyningen-Huene's book, *Reconstructing Scientific Revolutions*, is one of the most authoritative treatments that has been written of Thomas Kuhn's philosophy of science. One aspect of *The Structure of Scientific Revolutions* that has perplexed numerous commentators was Kuhn's repeated claim that the world changes with change of paradigm. Where some authors

have interpreted Kuhn's world-change image as a metaphor, Hoyningen-Huene adopts a more literal interpretation of the image.

At the heart of Kuhn's philosophy of science, according to Hoyningen-Huene, is a metaphysical position that is neo-Kantian in character.⁶ Kuhn's world-change image is to be understood in terms of a distinction that Hoyningen-Huene proposes between a fixed and unknowable *world-in-itself* and a variable but knowable *phenomenal world*. The world-in-itself is the objective reality that exists independently of human cognition, whereas the phenomenal world is jointly "co-constituted" out of sensory input from the world-in-itself and the conceptual contribution of the epistemic subject. When Kuhn says that the world changes with paradigm, it is, according to Hoyningen-Huene, the phenomenal world of scientists that changes, while the world-in-itself is unaffected by such change (Hoyningen-Huene, 1993: 36).

Hoyningen-Huene and his co-authors adopt the distinction between an unknowable world-in-itself and a knowable phenomenal world as the basis for their interpretation of the idea of incommensurability. Scientists who work in incommensurable theories or paradigms inhabit different phenomenal worlds. Because they fail to have epistemic access to the world-in-itself, reference to objects in the world-in-itself may not be employed for the purposes of theory comparison. On the basis of this anti-realist interpretation of incommensurability, Hoyningen-Huene, Oberheim and Andersen assert that the thesis of incommensurability forms part of an attack on realism. They extend this anti-realist interpretation of incommensurability to include Feyerabend's version of of incommensurability, as well as Kuhn's.

According to Hoyningen-Huene, Oberheim and Andersen, failure to recognize that incommensurability is an anti-realist idea undermines the referential approach to incommensurability, which they regard as resting on realist presuppositions. In their review of my book on the topic, they claim that "incommensurability is one form of expressing a critical

attitude toward naive realism” (1996: 133).⁷ They go on to say that, “understood as a challenge to realism, as Feyerabend and Kuhn originally intended, the incommensurability thesis raises a debate between realism and those who wish to moderately distance themselves from realism” (1996: 138). They argue that my “referential approach” to incommensurability “presupposes a number of realist assumptions that lead [me] to misconstrue Feyerabend and Kuhn’s intentions in establishing the incommensurability thesis” (1996: 131).

Hoyningen-Huene, Oberheim and Andersen suggest that such misunderstanding of the idea of incommensurability is due to difference in metaphysical assumptions. They conjecture that “the debate ... is permeated by a *meta-incommensurability* between the realist and the non-realist which promotes local communication difficulties” (1996: 138).⁸ Such meta-incommensurability is characterized by variation in the meaning of key philosophical terms, such as ‘reality’, ‘world’, ‘fact’ and ‘reference’ (1996: 139-40). It also leads to circular argumentation, which consists “in the presupposition of a particular conception of reality or theory comparison, which may make arguments for realism ineffective to the non-realist and vice versa” (1996: 140).

In a later paper, Oberheim and Hoyningen-Huene explain how application of the causal theory of reference to incommensurability is beset by meta-incommensurability. They argue that such use of the causal theory “begs the question against a proponent of incommensurability within a non-realist context” (1997: 451). They articulate their argument as follows:

Our argument has three steps. First, any causal theory of reference must involve *both* linguistic and metaphysical considerations because it is about the relationship between the terms used in science *and* the objects picked out by those terms: reference is the connection between language and the world. Second, the claim that incommensurability is only a semantic issue restricted to problems within language ... can only be defended if issues about the metaphysical status of the object being referred to have already been settled, i.e., if realist metaphysical commitments have already been established. And third, as these metaphysical issues are also a point of dispute between the proponents of a non-realist incommensurability and those of realist causal theory of reference, those who adopt the strategy of treating incommensurability as a semantic issue and thereafter disarm it with a causal theory of reference clearly beg the question from the perspective

of the non-realist proponent of incommensurability. This argumentative strategy begs the question from the perspective of the proponent of incommensurability *exactly because* it treats incommensurability as a semantic issue which *only* concerns problems of language. (1997: 451)

In this passage, Oberheim and Hoyningen-Huene draw attention to the existence of realist metaphysical assumptions which they take to underlie application of the causal theory of reference to the problem of incommensurability. Such assumptions, they claim, are not shared by proponents of the incommensurability thesis. Thus, the attempt to resolve the problem of incommensurability on the basis of the causal theory of reference begs the question against those who advocate incommensurability.

In sum, the Kantian objection to the referential response turns on the question of the status of the objects to which theories refer. The referential response is based on the assumption that it is possible for semantically variant theories to refer to a common domain of mind-independent objects. This assumption is not shared by proponents of the incommensurability thesis, for whom such mind-independent objects are the epistemically inaccessible contents of the world-in-itself. Because of this, use of the theory of reference as the basis for a response to the problem of incommensurability rests on realist presuppositions that are impugned by proponents of incommensurability. It therefore begs the question against proponents of the incommensurability thesis. As such, it can have no persuasive force against the thesis.

7. A realist *tu quoque*

Setting aside questions of an exegetical nature, there are a number of points that may be made on behalf of the realist.⁹ The first point turns on the claim that the thesis of incommensurability was meant as a challenge to realism. Hoyningen-Huene *et al.* object that the referential response is based on realist metaphysical assumptions which are themselves called into question by incommensurability. This objection has the immediate effect of converting the debate about

incommensurability into a debate between realism and anti-realism. For it is now a matter of determining whether legitimate use may be made in relation to the problem of incommensurability of the realist idea that theories may refer to a mind-independent domain of objects.

Hoyningen-Huene *et al.* object that the assumption that theories may refer to mind-independent objects begs the question against anti-realist proponents of incommensurability. The trouble with framing the debate in these terms, however, is that it invites the realist to respond in kind to the anti-realist proponent of incommensurability. For the realist has the basis for a *tu quoque* rejoinder to the anti-realist, which may be set out in the form of the following dilemma. *Either* the incommensurability thesis is based on Kantian anti-realist metaphysical assumptions, *or* it is not based on Kantian anti-realist metaphysical assumptions. In the former case, it is not possible for incommensurability to pose a challenge to realism, since it rests on anti-realist assumptions of a kind rejected by realism. In the latter case, the referential response may be upheld, since theories may refer to mind-independent objects. Thus, either proponents of incommensurability beg the question against realism, or incommensurability fails to pose a threat to realism.

In light of such a realist *tu quoque*, there is a risk that the debate may degenerate into mutual charges of question-begging. But even if questions are begged in relation to incommensurability, there remains considerable scope for argument at the level of the debate between realism and anti-realism. As I will now proceed to show, there is good reason to think that the balance of argument weighs in favour of the referential response, since a strong case may be made against the Kantian alternative proposed by Hoyningen-Huene *et al.*

8. The incoherence of the Kantian position

As we have seen, Hoyningen-Huene *et al.* take the incommensurability thesis to rest on a Kantian metaphysics which is at odds with realism. It is important to bear this in mind as we turn our attention to the dispute between scientific realism and anti-realism. For the Kantian anti-realism favoured by Hoyningen-Huene *et al.* differs significantly from other forms of anti-realism in the philosophy of science, such as van Fraassen's constructive empiricism. The point at issue between the realist and the Kantian is not the same as the point at issue between the realist and the constructive empiricist. The realist differs from the constructive empiricist with respect to the truth as opposed to the empirical adequacy of theories, whereas the realist differs from the Kantian with respect to access to the independent reality that underlies the phenomenal world. As a result, the dispute between the realist and the Kantian turns on the issue of access to mind-independent reality rather than to a merely phenomenal world.

Indeed, the issue of access to mind-independent reality is a matter on which the Kantian adopts a highly unstable position. For consider the distinction that Hoyningen-Huene draws between the unknowable world-in-itself and the knowable phenomenal world of the scientist. Such a distinction cannot be coherently maintained. For in order to maintain the distinction, it must be possible to know something about the world-in-itself. In particular, one must be able to know *of* the world-in-itself that *it* is unknowable. But this requires both that the world-in-itself exist and that it be known to exist. The latter implies that the world-in-itself is not unknowable. For at least something can be known about it, namely, that it exists.

The Kantian position is therefore subject to a fundamental incoherence with regard to the world-in-itself. As I have argued elsewhere, the matter is made all the worse by the fact that Hoyningen-Huene attributes a causal role to the world-in-itself in the production of both Kuhnian anomalies and the sensory component of phenomenal worlds (1993: 34, 269-71). For

quite apart from the fact that such attribution requires knowledge of the causal role of the world-in-itself, any such causal interaction between ourselves and the world-in-itself would provide a basis for us to enter into epistemic and intentional relations with that world.¹⁰

Hoyningen-Huene *et al.* describe the Kantian position as a metaphysical position. But this is only half true. The thesis that the world-in-itself exists is a metaphysical thesis. But what about the phenomenal world? The claim that phenomenal worlds exist is a psychological hypothesis about the nature of human mental experience, rather than a metaphysical thesis. For phenomenal worlds are “co-constituted” out of the conceptual contribution of the human mind and sensory input from the world-in-itself. The claim that phenomenal worlds exist is only a metaphysical thesis in the minimal sense that it postulates the existence of phenomenal worlds. But nothing that is jointly constituted out of concepts and sensory input may exist outside of the human mind in the world-in-itself. For human sensory input and conceptual apparatus may only come into contact with each other within the human mind. *If* phenomenal worlds exist, they must be located in the human mind.¹¹

But, given their location within the mind, it is entirely mysterious how phenomenal worlds may be shared between individual scientists. Since a phenomenal world is a psychological entity that only exists within the mind of an individual person, it is not possible for different minds to occupy the very same phenomenal world. Phenomenal worlds come into being as a result of the interaction between the specific sensory input and conceptual apparatus which are the unique possession of an individual mind. Thus, they are the subjective possession of individual human minds. The only way to avoid the irreducible subjectivity of phenomenal worlds is to appeal to the role of the world-in-itself as an external factor that imposes constraints on the formation of phenomenal worlds. But, while this is precisely what Hoyningen-Huene proposes, as we have seen previously it lapses into incoherence.¹²

The underlying problem with the Kantian position derives from its relation to epistemological scepticism. In the attempt to avoid the sceptical denial of knowledge, the Kantian postulates the existence of a world that is epistemically accessible because it is constituted of conceptual and sensory elements that reside within or are directly available to the human mind. But while postulating the existence of a knowable world, the Kantian relegates the world-in-itself to the status of an inaccessible somewhat lying behind the appearances. The world-in-itself is something that we cannot know and about which we are unable to speak. And yet its existence is required to explain the most basic features of human experience.

By contrast with such an incoherent position, the realist occupies a readily defensible epistemological position. For the challenge of scepticism is not to be met by conceding that the mind-independent world is unknowable, but rather by rejecting scepticism. This is the chief lesson of naturalized epistemology. The sceptic adopts standards of certainty and rational justification that are inappropriately high, since they exceed the operative epistemic norms of both science and common sense. Contrary to scepticism, we do have knowledge of an external world. This is brought home to us every day in the course of practical interaction with our environment. To think otherwise is to do such violence to our commonsense conception of ourselves and our relation to the world around us that it is unclear that anything substantive would remain of it. As supporters of common sense have long maintained, realism about the external world is the default position which we should only consider relinquishing in the face of absolutely overwhelming arguments against it.

Before concluding, I will quote from a comment offered by Michael Devitt in relation to the present topic:

Speculations about what and how we can know and refer have led to disaster: a bizarre metaphysics. But why should we have any confidence in these speculations? In particular, why should we have such confidence in them that they can undermine a view as commonsensical as Realism? A Moorean point is appropriate: Realism is much more

firmly based than these speculations that are thought to undermine it. We have started the argument in the wrong place: rather than using the speculations as evidence against Realism, we should use Realism as evidence against the speculations. We should ... “put metaphysics first”. (Devitt, 2001: 149)

If Devitt is right, we are well-advised not just to adopt realism, but to employ realism as a touchstone in the evaluation of philosophical positions, such as the anti-realist metaphysics of the Kantian proponents of incommensurability. For realism is grounded in common sense. And we have far more reason to trust common sense than any philosophical argument that might be raised against it. Given this, we may assume realism when we appeal to considerations in the theory of reference as the basis of a response to the incommensurability thesis.

9. Concluding summary

In this paper, I have reconsidered the challenge that semantic incommensurability poses to scientific realism. The challenge arises from the claim that there is discontinuity of reference between theories, rather than from the claim that there is variation of sense. Considerations deriving from the causal and causal-descriptive theories of reference suggest that there is reduced scope for variation in reference between theories. In some cases, the reference of a specific term may undergo change subsequent to introduction of the term. But the prospects for wholesale variation of reference have been for the most part eliminated with rejection of the description theory of reference. Substantial overlap of reference obtains between the terms of theories which are applied to a common domain of entities. Only in exceptional circumstances is there any risk of the incomparability of the content of such theories.

As we have seen, though, the referential response I have just summarized has been taken to beg the question against anti-realist proponents of incommensurability. As Hoyningen-Huene *et al.* have argued, the referential approach rests on realist assumptions about the relation between language and reality of a kind that are under dispute in the present context. This

objection transforms the debate from one about semantic issues into a debate between the realist and a Kantian version of anti-realism. As I have argued, not only is the Kantian anti-realist position subject to fundamental incoherence in relation to the world-in-itself, but it leads to the overthrow of our commonsense view of the world. Yet the rejection of common sense rests on an ill-considered response to the challenge of epistemological scepticism. Such dramatic measures are entirely unnecessary. For we may respond to the anti-realist in the same manner that we respond to the sceptic. To the extent that the anti-realist throws doubt on our knowledge of an external world, to that extent we may be sure that the anti-realist is mistaken.

We inhabit an objective reality, of which we have knowledge, and to which the words of our language refer. It is the same reality that was inhabited by our ancestors. Though our beliefs about this reality have changed, and our concepts have undergone modification, we continue to interact on an ongoing basis with the same world that our ancestors dealt with. There is no need, therefore, to say that earlier scientists referred to items in a different world from present science. Quite the contrary, they applied their different beliefs and concepts within the same reality to which we apply our own beliefs and concepts. For this reason, we may reject the claim of incommensurability on the basis of the position of realism.

Notes

1. For extension of Scheffler's ideas about co-reference and comparability to relations of extensional overlap, see Martin (1971). Further relations of referential overlap which increase scope for content comparison include Field's idea of partial denotation (Field, 1973) and Kitcher's idea of the variable reference of tokens of term-types (Kitcher, 1978).
2. Cf. Kuhn (1996: 102) and Feyerabend (1981: 98). For general discussion, see my (1994: 44).
3. For detailed analysis of Kuhn and Feyerabend's reliance on the description theory of reference, see my (1994: Ch. 5).
4. Recent work on the reference of theoretical terms has tended to emphasize Ramsey-sentences. However, such approaches can still appeal to causal role descriptions. For a sophisticated recent treatment of the topic that employs considerations of causal role within the context of a Ramsey-sentence approach, see Nola (2008).
5. Wholesale ontological error occurs if none of the theoretical entities postulated by a theory exist, in which case none of the theoretical terms employed by the theory have reference. While there are well-known cases in which central theoretical entities fail to exist (e.g., the aether, celestial spheres), it is not clear to what extent complete ontological error occurs. One possible case is that of the phlogiston theory. But even this case is problematic. For according to Kitcher, some tokens of phlogistic vocabulary genuinely referred, e.g., some uses of 'dephlogisticated air' referred to samples of oxygen (Kitcher, 1978: 696).
6. The position is *neo*-Kantian because it allows variation in phenomenal world relative to shift in conceptual and linguistic apparatus. From here on, I shall say 'Kantian' instead of 'neo-Kantian'.
7. Hoyningen-Huene, Oberheim and Andersen tend to speak of "naive realism", a position which they do not explicitly define. However, it seems clear in context that any position which holds that there is a mind-independent world, and that we have epistemic access to such a world, is a naive realist position in their sense. Presumably, scientific realism qualifies as a naive realist position, since it is committed both to mind-independence and epistemic access.
8. Hoyningen-Huene, Oberheim and Andersen employ the expression 'non-realism', rather than 'anti-realism'. While they do not define 'non-realism', it is clear that the Kantian position they attribute to Kuhn is an example of a non-realist position.
9. As I have indicated elsewhere, I am not persuaded that incommensurability was originally intended as part of a challenge to realism (see my 1997: 442 n.15). My reservation relates to the philosophical context *circa* 1962 when the idea of incommensurability was first introduced. It is far from clear that realism – naive or scientific – was a suitable object for challenge during that time period. Logical positivism and empiricism were the dominant positions in the philosophy of science at that time, though scientific realism had begun to receive favourable attention. Leading figures in the logical positivist and empiricist movements were on record as taking the issue of realism to be a meaningless pseudo-question of the sort to be eliminated with the rest of metaphysics. It is entirely unclear why Kuhn and Feyerabend would have launched an anti-realist challenge to realism within such a positivist climate. Nor is it clear which contemporary

philosophical realist position they sought to challenge by proposing the purportedly “non-realist” thesis of incommensurability in such an environment.

10. For detailed discussion of the incoherence of the Kantian position which Hoyningen-Huene attributes to Kuhn, see my (1997: 439-40), as well as Devitt (2001: 147-8).

11. Hoyningen-Huene says that phenomenal worlds consist of “genetically subject-sided moments” and “genetically object-sided moments”, meaning by this that the phenomenal world consists of elements that originate both from within the subject and from the world-in-itself (1993: 31-5, 64ff). But there is nothing that exists outside the human mind that can possibly be jointly constituted of such things. The phenomenal world is either a chimera or a hypothetical psychological entity. If the latter, then the existence of phenomenal worlds is an empirical hypothesis for which no evidence has been proposed.

12. According to Hoyningen-Huene, a significant role is played in the constitution of phenomenal worlds by the social process of language-acquisition within the context of a scientific community (1993: 70-82). But interaction with other human beings in the process of language-acquisition involves causal interaction with entities (viz., other human beings) that reside outside the mind. Other human beings do not exist within the phenomenal world of an individual person (only their phenomenal presentation exists within a given phenomenal world). Other human beings inhabit the world-in-itself. Hence, the fact that phenomenal worlds are constituted within the context of a scientific community does not reduce the need for interaction with the world-in-itself in order for there to be shared phenomenal worlds.

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