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KUHN'S CONCEPTION OF INCOMMENSURABILITY†

Abstract — In this paper, I try to reconstruct Kuhn's conception of incommensurability and its development. First, Kuhn's presentation of incommensurability in his *Structure of Scientific Revolutions* of 1962 is analyzed. The problems involved in this conception lead to further developments of Kuhn's theory, mainly a theory of world constitution. By means of this theory, Kuhn is able to reformulate his incommensurability concept in his publications from the seventies and the eighties, and to answer some of the objections raised against it. In particular, some of the criticisms of Kuhnian incommensurability seem to rest on misunderstanding. Finally, I discuss a serious problem that Kuhn's incommensurability conception is faced with.

1. Introduction

THOMAS KUHN's theory marks a turning point in the history of philosophy of science. This is well-known and practically undisputed. No doubt: since Kuhn's *Structure of Scientific Revolutions (SSR)* of 1962 terms like 'scientific revolution', 'paradigm', 'paradigm shift' and others are widely used. But this already seems to be the end of the general agreement on Kuhn's theory. There is no consensus at all about what the essential statements of the Kuhnian theory are, let alone any agreement about their validity. It does not even seem to be clear what the subject matter of the Kuhnian theses is: do they belong to epistemology, to philosophy or to sociology or to history of science, or to a philosophy of history or even to a philosophy of historiography?

One of the concepts that holds a key position in the controversial discussion about Kuhn is the concept of incommensurability. While the initially heated debate about the concept of a paradigm has considerably cooled down —

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partly due to substantial corrections on Kuhn's part — incommensurability remains a topical subject. There are still articles and even books being published, and there are still conference sections or even whole conferences devoted to the problems connected with this concept. But we are far from clarity with respect to these problems, let alone agreement on their solutions. In a sense this is not astonishing since incommensurability seems to indicate a philosophical problem — and when can peaceful agreement be found among philosophers about philosophical problems or their solutions? But in this case, three clearly identifiable sources of the disagreement can be traced.

First, the term 'incommensurability' was introduced by two authors into the philosophy of science, at the same time, and not in complete independence from one another, but still with some differences. I'm talking, of course, about Kuhn in his *SSR* and about Paul Feyerabend. Since then, more variants of the incommensurability concept have been invented. Some confusion is due to a neglect of these differences in the concept invoked. Furthermore, Kuhn's and Feyerabend's conceptions of incommensurability have evolved over the course of time. A discussion of incommensurability that aims at clarity must take these differences and developments into account.

A second reason for the disagreement about incommensurability consists in the fact that in a particular conception of incommensurability all the essential elements of the respective philosophical position are present in concentrated form. This holds at least for Kuhn and Feyerabend. Therefore, an understanding of a certain conception of incommensurability presupposes an overall understanding of the respective philosophical position. But different people differ widely on their interpretation of the Kuhnian theory as I mentioned earlier.

But as in most other cases of philosophical disagreement, conceptual confusions and differences in interpretation are not its only causes. Additionally, and this is the third source for the disagreement about incommensurability, there are deep problems in the background of the incommensurability issue that are already incapable of a consensual articulation — let alone a generally accepted treatment — which contribute to the disagreement.

In this paper I will address only the Kuhnian conception of incommensurability. In the following section, I will discuss the introduction of the idea of incommensurability in Kuhn's *SSR*, together with some essential problems this conception faces. Then I will reconstruct a theory Kuhn began to develop in the late sixties — apparently without connection to our subject: the theory of world constitution. By means of this theory, the problems mentioned earlier can be treated, which in turn will lead us to Kuhn's conception of incommensurability in the seventies and eighties. Finally, I will discuss three misunderstandings and a serious methodological problem that Kuhn's view of incommensurability faces.

2. Incommensurability in *SSR*

Let us start by considering the concept of incommensurability as it is developed in *SSR*. Incommensurability is a relational concept: it holds (or does not hold) between an *A* and a *B*. In *SSR*, *A* and *B* mainly are consecutive traditions of normal science. Now, the concept of a tradition of normal science is controversial, but here I cannot address the complications involved. Think of the Ptolemaic, geocentric system of the planets and the Copernican, heliocentric system. In both conceptions, there was a relatively unanimous research tradition dealing mainly with the prediction of planetary positions. Between such traditions that are separated by a scientific revolution, incommensurability prevails, according to the 1962 Kuhn. This kind of incommensurability has three different aspects (*SSR*, pp. 148–150).

First, through a scientific revolution, there is a change in the field of scientific problems that have to be addressed by any theory of that domain, and also a change in the field of problems that are legitimately addressed. Problems whose solution was vitally important to the older tradition may disappear as obsolete or even unscientific; problems that did not exist, or whose solution was considered trivial, may gain extraordinary significance to the new tradition. With the problems, quite often the standards imposed upon scientifically admissible solutions change. Think of the problem of the weight of phlogiston that disappears with the chemical revolution, or think of the requirement of classical mechanics, that explanations must be deterministic, which vanishes with the quantum-mechanical revolution.

A second aspect of Kuhn's 1962 incommensurability concerns scientific methods and concepts. After a revolution, many of the older concepts and methods are still used, but in slightly modified ways. Of prime importance is the change of concepts. The change of concepts discussed in *SSR* has an extensional and an intensional aspect. The extensional aspect consists in the movement of objects belonging to the extension of one concept into the extension of another concept, the two concepts being mutually exclusive. The striking example Kuhn uses in *SSR* (and still uses even now) is the change of the concept of a planet in the Copernican revolution. After the revolution the earth, for instance, is a planet, whereas the sun and the moon are not planets anymore. The intensional aspect of the change of concepts consists in a change of meaning of the respective concepts. This is the case since the properties of the objects that are subsumed under these concepts change.

As the third and most fundamental aspect of incommensurability, in addition to the change of problem fields and of concepts, Kuhn claims in *SSR* that "the proponents of different paradigms practice their trades in different worlds" (*SSR*, p. 150). But this statement — that the world changes with a revolution — is the least intelligible of all aspects of Kuhn's 1962 incommensurability. What does it mean to say that the world changes with a revolution?

Is the use of the term 'world' here only metaphorical? Or does 'world' here mean indeed reality, in the sense of *objective* reality? But how could reality change with and by something that happens exclusively in the heads of a group of scientists? These questions are not answered in *SSR*, but Kuhn has clearly seen their urgency there. He states explicitly that he is unable to explicate the sense of the statement that after a revolution scientists practice their trade in a different world (*SSR*, p. 150), but he urges "that we must learn to make sense of statements that at least resemble these" (*SSR*, p. 121).

Kuhn has further developed his conception of incommensurability. In addition to the problematic change of the world as a result of a revolution, another aspect of his 1962 view of incommensurability has been severely criticized: the meaning change. Is it really appropriate to speak of the Kuhnian cases as examples of meaning change? Isn't it that the respective concepts themselves remain constant and are only used differently? Additionally, one may pose the question: what is the relationship among the three aspects of the 1962 incommensurability? Are these three heterogeneous aspects of scientific revolutions that are arbitrarily packed into one single box with a fashionable name? Or are these aspects somehow intrinsically connected? It is mainly these questions and problems that have led Kuhn from the late sixties on to develop further his theory and his conception of incommensurability.

3. The Theory of World Constitution

In my opinion, the most important development of Kuhn's thought in the late sixties concerns a theory of world constitution. Before I can explain what I mean by that I must return to *SSR* once more.

In *SSR* an ambiguity in the use of the term 'world' can be found that Kuhn does not notice. In the first sense, the term 'world' means a world that is "already perceptually and conceptually subdivided in a certain way" (*SSR*, p. 129). It is such a world to which we actually have access, be it in everyday life or in science. We can perceive and describe such a world, and in such a world there are ducks, lecture halls and electrons, for example. Such a world has a certain conceptual structure, for instance the categories just mentioned: ducks, lecture halls, electrons. Now Kuhn got the impression — in the course of his research in the history of science — that these concepts are of human origin, i.e. *we* impose a structure on the world by means of these concepts, and that we do *not* read off these concepts from the world itself, as a more familiar story wants us to believe. Although it is not possible to impose any and every

structure on the world, clearly more than just one is possible. This is shown by the historical change of these conceptual structures. Therefore, as Kuhn puts it in *SSR*, paradigms — whatever they are — are constitutive of a perceptually and conceptually subdivided world (*SSR*, pp. 110, 125). Expressed in more traditional terminology: the subjects of knowledge contribute to the constitution of the objects of knowledge (by means of paradigms — whatever they are), insofar as they structure the world of these objects.

The second sense of the term 'world' in *SSR* is obtained by asking what is left if one subtracts all these human contributions, all this perceptual and conceptual structuring from the world in the first sense. Then one is left with a world that is completely independent of our perceptions and conceptions, a world — as one might say — that is purely object-sided, whereas the world in the first sense is also subject-sided by its origin. But we have, according to Kuhn, no access whatsoever to this purely object-sided world. This world bears, of course, great similarity to Kant's 'thing in itself' although it is not identical with it. Correspondingly, the other world that is conceptually subdivided has great similarity to Kant's 'totality of appearances', the 'object of all possible experience'. I will call it a 'world of appearances'.

As I have said, Kuhn does not notice the ambiguity in his use of the term 'world' in *SSR*, and this impairs his own understanding of his theory. As long as the concept of a purely object-sided world and the concept of a world of appearances are conflated, one can indeed not understand what it would mean to say that the world changes through a revolution, let alone how to argue for this assertion. This assertion can be understood only when it consciously refers to a world of appearances. Additionally, one should at least know in principle how the subjects of knowledge contribute (in a potentially variable manner) to the constitution of a world of appearances.

Kuhn's theory of world constitution aims exactly at answering this last question: how do the subjects of knowledge constitute their world of appearances? I hasten to add that this theory cannot really be found explicitly and fully worked out in Kuhn's writings. In fact, it is a reconstruction that I am presenting, a reconstruction that uses various hints from Kuhn and tries to construct from them a reasonably clear and coherent theory (these hints can mainly be found in Kuhn, 1970a, 1970b, 1970c, 1979, 1981, 1983a, and 1983b). I can present this theory here only in outline.

Kuhn investigates world constitution by considering the process by which a member of a certain culture gains access to the world of appearances that is characteristic for that culture. This culture may be a certain tradition of normal science, for example. In other words the question is: how is a historically contingent structure of a world of appearances learned? The core element to be learned for world constitution consists in similarity relations that hold in the respective world between objects or situations that are classified as

similar. These similarity relations are learned by pointing at exemplars of the respective similarity class, and by assigning them to the respective class. Additionally, members of neighboring similarity classes must be pointed at, and their membership in the original class be denied. (The exemplary objects of those acts of ostension, by the way, are what the concept of a paradigm was originally meant to denote.)

Such similarity relations are at once constitutive for perception, constitutive for some empirical concepts, and constitutive for the respective region of the world of appearances. To use a Kuhnian example: when one has learned the similarity and dissimilarity relations that hold between ducks, geese and swans, three things have happened at once. First, one has trained one's perception in a way so that in the presence of the respective beasts one really sees ducks, geese and swans, and not just unidentified water fowl. If one has simultaneously learned the designators of the respective similarity classes, that is the terms 'duck', 'goose' and 'swan' (in English), one has also learned the use of those concepts. Finally, this region of the world of appearances — the water fowl — has gained a certain structure, namely the said classification. Similarity relations hold a central position in Kuhn's theory of world constitution because of their threefold function.

The situation of the more theoretical concepts, like the fundamental concepts of the sciences, is strongly analogous to the situation just mentioned. Those concepts are also learned via certain similarity relations, typically between problem situations, and also in this case the respective region of the world of appearances gains its structure by the similarity relations.

One point deserves special emphasis. Kuhn very often describes the similarity relations just mentioned as *immediate* relations, and by this he means that they are not learned with the help of *definitions* of the respective similarity class. It is this feature of ostension to paradigmatic examples and their assignment to a certain similarity class that is of prime importance: the respective similarity class can be learned simply by example, *without any use of defining criteria for that class*. This is plausible for many of the empirical concepts that we can handle unproblematically. In order to be able to teach children concepts like duck, swan and goose, one does not have to have a definition of these terms. People who are in complete agreement on paradigmatic examples for some empirical concept may argue extensively about its definition. Since the learning process of empirical concepts via immediate similarity relations does not make use of definitions, one has difficulty in finding or inventing appropriate definitions for these concepts afterwards. In general, we are not concerned with this fact at all. Why invent definitions if no problems arise in the actual use of those concepts? Correspondingly, empirical scientists often find the quest for definitions for their fundamental concepts odd when confronted with it by mathematicians or philosophers.

The fact that empirical concepts can be, and mostly are, learned empirically, without any definitions, has an important consequence for incommensurability. In the unproblematic use of such concepts in a certain language community, implicit knowledge about the respective world of appearances can accumulate. To explain this somewhat strange statement, take the concepts 'man' and 'woman' that we have certainly not learned by definitions in our youth, but via immediate similarity relations. Many different criteria may be used to distinguish men from women. How different these criteria can be may be seen from the joke that Johnny was unable to identify Adam as Adam and Eve as Eve on an old painting since they weren't wearing any clothes. Many different criteria by which we pick out the referents of a term can and do coexist in everyday language, as well as in scientific languages. But the unproblematic coexistence of these criteria contains implicit knowledge about the world. This knowledge consists in implications between the different criteria: if an object has *one* of the features that are used to identify it, it has also the other ones. With the example just mentioned: let us counter-factually assume that men and women can *either* be distinguished by their hair-style *or* by their clothing. The coexistence of these criteria implies the knowledge about the world that, for example, people wearing men's clothes have a masculine hair-style, and people with feminine hair-style wear women's clothes. This knowledge about the world is not explicitly articulated but is embedded in the actual use of language.

4. Incommensurability after *SSR*

Now I can finally come back to incommensurability. First one has to note that from the late sixties on Kuhn uses a narrower domain for the incommensurability relation. In *SSR*, traditions of normal science were the principal items between which incommensurability could exist. Now it is consecutive theories or their vocabulary, respectively, that are or are not incommensurable (e.g. Kuhn, 1970b, pp. 266–268; 1970c, p. 198; 1983a, pp. 670–671). Two theories are incommensurable if and only if they are articulated in languages that are not mutually translatable. But the concept of translation that is used in this definition is emphatically not the everyday concept of translation. Rather, a mechanically feasible translation is meant in which, according to fixed rules, words or groups of words from the source language are replaced by words or groups of words of the target language (see mainly Kuhn, 1983a and 1983b). Such a translation has to conserve the meaning of the text (whatever that is), and also truth values and reference.

Under which circumstances is it the case that two consecutive theories are not mutually translatable in the sense just given? This happens to be the case exactly for scientific revolutions. It is a characteristic feature of scientific

revolutions that some similarity and dissimilarity relations, which are constitutive of the relevant vocabularies, change. Think, for example, of the Copernican revolution in which the Ptolemaic similarity between Mars and the sun — both are planets circling the earth — is replaced by a massive dissimilarity between them. Or the formerly extremely dissimilar Earth and Jupiter now belong to the same similarity class: Copernican planets. Correlated to a change of immediate similarity relations is a change of the extensions of some concepts and, consequently, a change in the basic classification of objects. Furthermore, the implicit knowledge about the world which is contained in the use of those concepts is changed. The latter change takes place so that the earlier knowledge about the world is incompatible with the more recent knowledge claims. But then it is clear why the two languages cannot be translated mechanically into each other. Each of these languages already carries with itself classifications of the objects and other knowledge claims about the world which are mutually incompatible. Clearly, such languages cannot be translated into one another mechanically.

By means of this analysis, the three questions posed earlier about the 1962 view of incommensurability can be answered. First, in which sense and why does the world change with a revolution? The world, in the sense of a world of appearances, changes in a scientific revolution since the similarity relations change that are constitutive for that world and some of the concepts used to describe that world. Second, does the meaning of certain concepts really change in a revolution? This is indeed the case. It is possible to develop the constitutive role of similarity relations for empirical concepts into a plausible theory of meaning (Kuhn 1983a and 1983b). From this theory of meaning one gets criteria for deciding which of all the possible theoretical changes that somehow affect concepts actually must be described as meaning changes and which not. Third, what is the relation among the three aspects of the '62 idea of incommensurability: problem field change, meaning change, and change of the world? The intrinsic connection among these phenomena consists in their common root: the change of fundamental similarity and dissimilarity relations. This change leads to a change of the world and of some concepts. The shift of the problem field is mainly a consequence of the latter changes: with respect to a different world different questions are asked, and different standards for acceptable answers are applied.

5. Three Misunderstandings

In this section, I want to discuss briefly three misunderstandings with which the Kuhnian conception of incommensurability is very often confronted.

First, Kuhn has very often been understood as endorsing the thesis of 'radical meaning change', or 'total' or 'radical' incommensurability. This thesis

assumes that in a scientific revolution *all* concepts used in the two theories have changed their meaning. But Kuhn has never subscribed to this extreme thesis. To use an expression from the eighties, Kuhn has only asserted 'local incommensurability': only a small group of usually interlinked concepts changes meaning in a revolution (Kuhn, 1983a).

The second misunderstanding of Kuhnian incommensurability is closely connected with the previous one. It states that according to Kuhn there are no continuities between incommensurable theories: a revolution is an abrupt and total change that takes place between them. But already in *SSR* Kuhn states repeatedly that there are many continuities between succeeding traditions of normal science, experimental continuities as well as theoretical ones. One of the reasons for these continuities is that the new theory must conserve much of the problem-solving ability of its predecessor, otherwise it does not stand the slightest chance of being accepted in the respective scientific community (*SSR*, p. 169).

This brings me to a third misunderstanding, which is a close relative of the two previous ones. It is that incommensurable theories cannot rationally be compared at all, that is that they cannot objectively be compared with respect to their scientific merits. At first sight, this seems to be a compelling consequence of incommensurability. Since incommensurable theories deal with different worlds, they seem to stand in the same relationship as theories about the unconscious stand to theories about the stability of galaxies: these theories clearly describe different domains with mutually untranslatable vocabularies. Because there cannot be any empirical friction between such theories, there cannot be any real competition between them, and consequently the question of a rational choice between them cannot arise either. The same seems to hold for incommensurable theories.

But according to Kuhn, incommensurable theories can be compared rationally. First of all, because of the *local* nature of incommensurability, *some* of the empirical consequences of the two theories can be compared *immediately*, namely, those in which the mutually incommensurable terms are not involved. Take again the Ptolemaic and the Copernican theory as a case in point. Although these theories are incommensurable, their predictions of the position of Mars in the sky, for example, can immediately be compared; thus their respective accuracy can be compared without problems of principle.

Second, further possibilities of theory comparison arise if the conceptual changes between the two theories are taken into account. A proponent of the old theory has to identify and learn those parts of the new conceptual vocabulary that are different from his own. Note that *learning* the new conceptual vocabulary is different from the ability to *mechanically translate* into the old vocabulary, which is impossible for incommensurable theories by definition. But even before a *full* mastery of the new conceptual vocabulary,

new possibilities of theory comparison may arise. This is the case if for *some* specific classes of situations, one has learned to identify the referents of the new or changed concepts by means of the old concepts. (Being able to identify the referents of the new or changed concepts for *all* the situations in which the natives do, and to understand somehow why all referents of one concept are referents of just one concept, amounts to full mastery of the new conceptual vocabulary: Kuhn, 1983b, p. 712). Think of a proponent of the phlogiston theory who is about to learn the conceptual vocabulary of oxygen chemistry. Let us assume that he or she has not yet fully understood the concepts of oxygen and of hydrogen. In *some* situations, however, he or she may be able to identify the referents of oxygen and hydrogen by means of the old vocabulary, namely as 'dephlogisticated air' and as 'phlogiston', respectively. It is for those situations that the two theories can now be compared.

A third stage of theory comparison is reached after full mastery of the new conceptual vocabularly. But it is still not the case that the two theories can now be compared point by point, that is, that each (general) statement of one theory can be confronted with the corresponding statement of the other theory. This holds since with the new conceptual vocabulary statements can be formulated that are incapable of articulation with the old one. Additionally, even corresponding empirical statements may carry different weights in the two theories so that the merits of one theory may be depreciated from the viewpoint of the other. Yet, the two theories can be compared globally, with respect to their simplicity, accuracy, fruitfulness, predictive power, etc. But two scientists in agreement on the list of such cognitive values may still disagree on which theory should be preferred; this is indeed the case during the phase of extraordinary science. Therefore, theory comparison and theory choice do not resemble an algorithmic procedure in which all applicants of the algorithm must get the same result since they have to follow fixed rules mechanically (Kuhn 1977b). Yet, this form of theory comparison is far from being irrational, at least if one supposes that the kind of cognitive values mentioned forms a reasonable ground for theory choice.

Thus, I have the impression that no fundamental problem exists — in the sense of paradox or *aporia* — with respect to the comparison of incommensurable theories, although a more detailed picture than the one just given is highly desirable. A far deeper problem with Kuhn's version of incommensurability, however, seems to arise at a different point.

6. The Problem of the Position of the Analyst

The problem arises in the course of the Kuhnian theory of world constitution. It can be called 'the problem of the position of the analyst', and it has important parallels to similar problems that have repeatedly surfaced in the history of philosophy.

A theory of world constitution is called for, I have argued, if one wants to make sense of the thesis that the world changes in a scientific revolution, and if one attempts to produce arguments for that thesis. But what has brought Kuhn to this strange talk about world changes in revolutions? His motive is his experience as a historian of science, from which most of his philosophical intuitions derive. If one scrutinizes the scientific practices of the past, one finds that in many cases these practices make much more sense if one assumes these scientists did indeed work in a world substantially different from ours. Yet this other world is not totally different from ours and therefore not totally foreign to us, but at some characteristic points it differs from ours. For example, there was phlogiston in the world of chemistry before the chemical revolution, the Ptolemaic planets revolved around the the earth, and so on. But in which sense 'was there' phlogiston in the world of pre-revolutionary chemistry? Well, it was there in the same sense as there are electrons in the world of today's physics, or there is evolution in the world of today's biology. That means, roughly speaking, that there are theories that describe and explain these entities and processes, that — to different degrees — these entities and processes are subject to experimentation, that they play an essential role in the explanation of diverse phenomena, and so forth. But such a role in a given science, even if played extremely successfully, does not guarantee that later generations of scientists will believe in the same entities and processes, and this holds for past science as well as for present science.

The obvious consequence is this: if one sets out to discover the scientific past in as undistorted a way as possible, then one is well advised not only to 'bracket' one's own idea of reality (Husserl) but to question it, and to open oneself up for different ideas of reality. Otherwise, there is the danger of projecting one's own idea of reality into the past, thereby blocking access to possibly different ideas of reality. The situation is analogous to ethnocentric anthropology or to presentist historiography, which miss the essentially foreign. In particular, the abandonment of one's own idea of reality seems to be an indispensable methodological postulate for even entertaining a *general* theory of world constitution. The reason is that the theory of world constitution aims to understand the constitution of worlds in general and impartially, that is, unbiased by any particular idea of reality. Therefore, no elements whatsoever may enter this theory that originate from the specific world of the analyst: they would destroy the theory's intended generality and impartiality that must prevail with respect to various ideas about reality.

But this postulate apparently cannot be fulfilled. At least in the Kuhnian theory of world constitution, a host of assumptions are used that can be justified only with recourse to the specific world of the analyst. Many of these assumptions are of an anthropological nature, namely, assumptions concerning cognitive abilities of human beings. In particular, assumptions are

made with respect to the abilities to perceive, to understand ostensions, to form concepts, to communicate, and many more. These assumptions are a necessary part of the general theory of world constitution, since this theory must assume that the subjects of world constitution *have the abilities necessary to constitute a world.* But to gain knowledge about the subjects of world constitution means to treat them *as objects belonging to one's own world,* and this implies the use of substantial parts of one's own idea of reality.

As a result, the attempt to construct a general theory of world constitution leads to the uncomfortable situation that the means needed to reach that goal also render its attainment impossible. The attempt to analyze the constitution of reality in a general and unbiased way, independently of one's own idea of reality, seems predestined to fail because one has to use one's own idea of reality — otherwise one never gets started. Once one gets started, one must necessarily fail.

I must admit that I don't know what to do in this methodological situation. We may have learned with difficulty how to live with that fact that the one true religion or the one true culture — one's own, of course — does not exist. It may be — I am not saying that it is the case — it may be that also the idea of the one reality — the one we are used to, of course — must be abandoned. But the learning process required here will not be an easy one.

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