On Kuhn's Post-Kantianism

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Abstract

In last part of his life, Kuhn claimed that he is a post¬Kantian in many aspects. This paper aims to inquire the post-Kantian thesis of Kuhn from two paths. One is metaphors in science, and the other is Kuhn's theory of concepts. Following Andersen, Barker and Chen , who apply the new results of cognitive psychology (particularly, the frame model of concept representation), I propose a reinterpretation of Kuhn' s latest philosophy of science.

Keywords

post-Kantianism, metaphor in science, representation of concepts, frame model

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In his later writings, Kuhn has repeatedly claimed to be a Kantian. For example, "I am a Kantian without a 'thing-self', and the categories of the mind can change according to language and experience". "In a relative sense, my structured thesaurus resembles Kant's a priori concepts, but the categories can change according to time, place and culture."

If we are to understand Kuhn's post-Kantianism, we can start in two ways. One is metaphor in science; Kuhn argues that true metaphor is important to science and that metaphor plays an important role in the connection between scientific language and the world. Changes in theory have been accompanied by changes in related metaphors and networks of approximation. The second is Kuhn's theory of concepts. Kuhn once said: "I am a Kantian who thinks that categories are mutable".[1] Kuhn's later philosophy of science was increasingly

concerned with the nature of scientific concepts, and his conceptual theory gradually became the basis for his earlier claims of proofs for the change and development of scientific knowledge. This paper hopes to explore this post-Kantian thesis of Kuhn based on Andersen, Barker, and Chen's (hereafter ABC) reading of Kuhn's later philosophy of science using recent results from cognitive psychology (especially the framework model of conceptual representation).

I. Metaphors in Science

At the beginning of the 20th century, Einstein, through his own practice of scientific invention, put forward the proposition that basic concepts and basic assumptions are the "free creation" of thought and the "free invention of reason". He clearly pointed out that "the whole of science is but a distillation of everyday thought" and that "all our thinking is a free play of concepts; the reasonableness of this play depends on the extent to which we can generalise sensory experience by means of it". He goes on to argue that "in order for thinking not to degenerate into 'metaphysics' or empty talk, it is sufficient that there be enough propositions in the system of concepts to have a sufficiently solid connection with sense experience, and that beyond this, the 'system' (in logical terms) is no more than a 'system'. (logically speaking) is nothing more than a free play with symbols according to (logically) arbitrary rules of play." [2] Einstein's words are not unreasonable; science as a system of knowledge is itself a linguistic system, science is a linguistic grasp of the world, and scientific invention is a fundamental grasp of the world through the invention of new concepts. By what means, then, do scientific inventions reach new concepts or new terms? They do so by means of metaphor, model and analogy.

This peculiar creation, language, is by its very nature metaphorical. It does not describe things directly, but indirectly by recourse to vague and polysemous words. Abstract concepts, in particular, are always defined by a system of related metaphors, to the extent that human language cannot express abstract ideas except by virtue of metaphor. Even in languages where precision, acuity and clarity are required, the 'crutch' of metaphor is inseparable. Kuhn answers quite positively to the question of whether ambiguous and inexhaustible metaphors are adapted to a rationalised and logical scientific language: "Students of literature

have long taken for granted that metaphor, and with it the method (which alters the interrelationship between words), provides access to a population of new worlds of all kinds and makes such practices untranslatable. Political life and, in the eyes of some, the entire field of the human sciences, are also widely given this character. However, the natural sciences, which deal objectively with the real world, are generally considered unaffected. Scientific truths (and fallacies) are considered to be beyond the ravages of transient, cultural and linguistic change. I would caution that the natural sciences cannot do this. Neither the descriptive nor the theoretical language of the natural sciences can provide the bedrock for such an idea." (Kuhn 1993, p.75)

The magic of metaphor in science is pervasive and indispensable. Especially in times of scientific revolutions, metaphorical descriptions are often central to the transformation of scientific theories and the birth of scientific concepts. New metaphors do not merely provide answers to old questions, but largely determine the nature of empirical results as they fundamentally change our perceptions, thus forming new questions, conditions of observation, and experimental protocols. In terms of interactions, metaphors can fruitfully create parallels, suggest possible analogies and models, and in turn lead to the introduction of new concepts or new terminology. Paradigm shifts or terminological changes in scientific revolutions are also preceded by fundamental modifications of metaphors, models and analogies. Moreover, the analysis of metaphors is useful for how to speak about the unobservable and for understanding the substance of changes in the meaning of basic concepts, or theoretical terms. So useful are metaphors, models and analogies that Kuhn sees them as concrete manifestations of paradigms in different contexts, and again as midwives to the introduction of new concepts or new terms. Kuhn even sees the development of science as a 'metaphor-like process'.

Kuhn uses the example of movement to illustrate the important role of metaphor. In Aristotle, "motion is a special case of change, so that a falling stone is like a growing oak tree, or like a man going from illness to recovery, and it is this pattern of similarity that puts these phenomena in the same natural family, thus placing them all in the same taxonomic category, and necessarily superseded in the development of Newtonian physics ". (Kuhn 1993, p. 19) And the concepts of matter waves, gravitational waves, black holes, etc. in modern science are all metaphorical in nature. Metaphors, models and analogies

originate from the experience of people's scientific practice and cultural beliefs, and can only become comprehensible if they rely on this empirical basis; once they leave this empirical basis, they are impossible to understand. For example, people without experience of Aristotelian physics cannot understand that "the falling stone resembles a man who has gone from illness to recovery". The revolutionary change in science lies in this change in the foundations of experience, and this change in the foundations of experience inevitably causes a fundamental change in the corresponding models, metaphors and analogies. This metaphorical relationship, which changes from time to time with the scientific revolution, is important, Kuhn argues, for the acquisition of scientific language and other languages. And it is only after this metaphorical relationship is constantly experienced and a certain level of learning and acquisition of scientific and other languages is reached that new scientific practice can begin.

In Kuhn, language is a coin that looks outwards at the world on one side and inwards at the reflection of the world that exists within the associative structure of language on the other. It is also through different scientific vocabularies or dictionaries that different cuts of the world are made, and thus different possible worlds are shaped. These possible worlds, although very different, are after all homologous structures of the same objective world. The meaning that the mind or thought gives to the terms of the glossary or dictionary begins and ends with the confrontation with the natural world and its attachment to it.

Kuhn argues that it is impossible to imagine a theory that uses metaphor without presupposing a theory of literal meanings. Science, to whatever extent it has developed, has had to confront a linguistic world in which metaphor is the inner subject and outer feature, and it has had to use analogies and models as scaffolding for the construction of new conceptual systems or as bridges to new lexicons with very different structures. Kuhn also makes a metaphor, calling himself a Kantian without a material autopoiesis, arguing that the categories of the mind as pre-existing language and experience can change over time.

II. Kuhn's conceptual theory

While metaphors can certainly help us understand the connections between

the language of science and the world, the perception of metaphor remains elusive in its ambiguity. In science, conceptual ambiguity can immediately raise questions and become a source of crisis, but Kuhn points out that metaphor is not the subject of his thesis (Kuhn 1983, pp. 714 -716). And Kuhn also suggests that the changes in analogies and models evoked by metaphor are also changes in the categorical categories that characterise certain relations of similarity and difference. Are the changes in categories then arbitrary or restricted? Is there a mechanism for category change? This paper argues that a better understanding of Kuhn's post-Kantianism has to be understood in terms of the nature of concepts and their evolution.

The learning of concepts consists in the learning of concepts of things, activities and states. This learning process is the process of assigning the corresponding concepts to the corresponding things or features of things. Only once this learning process has reached a certain level can description begin. Once description has begun, however, one learns not only the language used to describe, but also the world that is described in that language. That is, on the one hand one learns how to describe, and on the other hand one perceives the world being described, acquiring concepts and perceiving the world at the same time. Kuhn considers the dictionary to be the most perfect tool for describing the world. One can describe the world once one has acquired a dictionary. Kuhn points out that, like Kant's 'categories', the lexical structure provides the preconditions for possible experience. Of course, if Kant's category is an a priori thing, Kuhn's category has an empirical content.

In the late 1980s and early 1990s, Kuhn introduced the concept of 'local incommensurability', which confined the change of meaning to a limited number of class terms. For Kuhn, what characterises a revolution is a change in the taxonomic categories that are a prerequisite for scientific description and generalisation. And, according to Kuhn, 'this change is not only concerned with adjusting the criteria of classification, but also gives rise to a redistribution of particular objects (environments) within the antecedent category (i. e. the taxonomic category before the change took place). The redistribution, the combination of natural members, involves both a transformation of the antecedent categories and the new categories (those reconstructed after the change) and a change in the norms defining these categories. And because the categories define each other, this change is necessarily holistic." (Kuhn 1993, p.

30) If, on the other hand, changes in meaning occur only in a very limited set of terms, invariant concepts and common problem-solving criteria will always exist, and they can be seen as the basis for rational evaluation between competing paradigms in a scientific revolution.

Kuhn argues that the phenomenon of incommensurability is directly caused by changes in the structure of concepts. "The practice of conventional science depends on the ability to form similar sets of objects as well as phenomena obtained from examples ..... so that an important aspect of any revolution is that certain similarity relations have changed." (Kuhn 1970, p. 200) However, how does such a change in conceptual structure occur? This depends on how we define concepts. The traditional view is that concepts can be defined in terms of sets of sufficient conditions. Kuhn does not accept this view. Indeed, work in modern psychology and cognitive science clearly shows that Kuhn's view is correct and that human concepts cannot be defined in terms of sets of sufficient conditions in any case.

Kuhn argues that to acquire an everyday concept, one must rely on some range of similar and dissimilar features of the object. Engaging in routine research relies on the ability to classify objects and contexts according to primitive similarities, an ability derived from speculative examples. Kuhn also asserts that scientific concepts are, in principle, acquired through the same similarity-based processes as everyday concepts. However, one can always find similarities between examples of one concept and examples of other concepts, if one is willing to look for them. No doubt Kuhn was also aware of this problem. But he does not consider this problem to be difficult to solve, and he suggests that similarity relations do not depend only on the similarity of other members of the same type, but also on the dissimilarity of members of other types. We need to note that the relation of similarity that Kuhn introduces here refers to the relation between examples of a set of opposites (all lower concepts that depend on the same upper concept), so that it can be argued that the examples of these opposing concepts have more similarity to each other than to examples outside the concepts of the set of opposing concepts. From this, Kuhn arrives at the idea that one can always learn the concepts of the set of opposites together. We can also extend this fairly easily to an analysis of upper and lower levels of concepts. A general category can be decomposed into more specific categories, which then continue to be decomposed into more specific categories. Kuhn never explicitly

states this view, but only refers to the fact that "a more complete discussion of the similarities between members of a natural family allows for a hierarchy of similarity relations between natural families at a higher level". Modern psychology also demonstrates that empirical investigations show that a hierarchical structure of human concepts does exist.

Kuhn's theory that concepts are determined by similarity and difference relations suggests that there is a hierarchical structure in the middle of concepts. On the one hand, objects are divided into different classes in the conceptualisation process according to the similarities between them; on the other hand, the difference relation requires that all objects should and can correspond to only one of the concepts. If an object corresponds to two different concepts at the same time, the difference relation between these two concepts disappears and they are merged into one. Thus, an important requirement for contrasting concentrated concepts is that their extents must not overlap. Kuhn calls this the principle of non-overlap:

"No two class words, or two words with class labels, will overlap in their designation, unless they are related to each other by species and genus. There is no such thing as being a dog and a cat at the same time, or a gold and a silver at the same time, etc. It is for this reason that dog, cat, gold and silver each belong to a class. Thus, if members of the same speech community meet something that is both a dog and a cat (or, more practically, an animal that resembles a platypus), they cannot solve the problem simply by introducing new class words, but must make a reorganization of part of the classification system. " (Kuhn 1991, p. 413)

Similarity and difference relations also define the contrast set of upper-level concepts. According to the principle of non-overlap, all concepts in the upper level contrast set should be subordinated to a higher level concept, otherwise there would be overlap between the upper level concepts. Thus, a class hierarchy (a kind of classification tree) is naturally formed between concepts through similarity and difference relations. The principle of non-overlap between concepts in a contrastive set also implies the principle of inclusion between class hierarchies: all the special cases of a particular concept are also special cases for its higher-level concepts. Kuhn argues that the principle of non-overlap is important for maintaining the stability of the conceptual system, since violation of this principle will eventually lead to a reconfiguration of the existing

classification system. "If the same speech community does use overlapping class terms, the result will be either: one of the overlapping terms is discarded, or the community breaks up into two parts." (Kuhn, 1993, p. 235) In other words, denotational overlap will cause a scientific revolution, and denotational overlap among individual concepts may lead to an overall change in the structure of the whole concept.

III. A framework model for conceptual expression

ABC provides a cognitive reading of Kuhn's conceptual theory by drawing on the results of cognitive psychology and cognitive science, using a framework model of conceptual da. This paper will present ABC's rather fruitful reading of Kuhn and build on ABC's work to show that Kuhn, as a post-Kantian proclaimer, is not arbitrary in his category changes, but relies on certain lexical structural information and related categorical structures and similarity relations.

ABC outlines the framework model that Barsalou proposes to capture the general structure of human concepts. Kuhn later argues that the most important conceptual systems, i.e. category hierarchies or terms, can be expressed fairly easily through frames. A framework is a collection of multi-valued attributes united by structural relations, each of which can take on a different value. The framework model thus has some flexibility to cope with different situations, and the attributes in the framework should be understood as features that are most likely to occur in special cases. The framework model reveals three important structural relationships in the concept (see Chen Xiang 2001; Chen et al. 1998):

First, the framework model reveals a hierarchical relationship between features. Contrary to the conventional assumption that all features in a concept are structurally equal, the framework model divides features into two distinct levels: attributes and fetches; the latter are examples of the former.

Second, the framework model reveals several stable horizontal relationships between attributes. Because these relations are present in most special cases of the concept, they form a relatively fixed structure between attributes. They are therefore called structural constants.

Third, in the taking of values of attributes, the framework model also reveals the constraint relations between the taking of values of attributes. These

constraint possibilities locally affect the taking of values for a particular pair of attributes. They illustrate how a particular value of one attribute is associated with a particular value of another attribute (value constraints); these constraints may also affect the set of values across the board, determining the relationship between all values of certain attributes (attribute constraints). At their root, these constraints reflect the physical constraints of nature as well as human intentionality.

The conceptual framework model suggests that a single anomaly may directly cause an abrupt change in the classification system. There are attribute constraints and value restrictions in the framework model, and the various classification criteria must sometimes be used together. Since the framework of an upper-level concept determines its lower-level conceptual domain, a framework specifies all possible combinations of values according to its structural constants, attribute restrictions and value restrictions, thus specifying reasonable lower-level concepts. Due to the strong property and value restrictions, almost every anomaly can cause a change in the framework of the upper level concept and the corresponding classification system. In this way, changes are continuous not only at the level of observation, but also at the level of framing and classification. Revolutions can be formed through a series of gradual changes that do not need to be completed in an instant. The conceptual framework model allows for gradual change as a mode of scientific evolution; at the same time, the framework model does not deny the possibility of discontinuous change.

The framework model suggests that anomalies do not lead to a wholesale collapse of the entire scientific community, nor do they lead to a state of chaos. Different individuals may use different criteria to classify the same objects, and the presence of anomalies can cause a division of the scientific community. At the same time, the existing framework limits the number of possible responses to anomalies because of the restrictions between features. Thus, when a community breaks down into several subgroups, each subgroup, although classifying anomalies in its own way, is doing so on the basis of an existing conceptual system. Depending on the nature of the anomaly, individuals may recognise that they have classified objects by different characteristics. This situation may cause them to question existing frameworks and classification systems.

The frame model may provide a cognitive basis for understanding Kuhn's

point about the revolutionary consequences of overlapping referents. Since frames reveal very rich relationships within and between concepts, conditions can be created for the designation of other concepts as inductive predictions, especially those derived from the same set of contrasts. The differences between these inductive generalisations are not local, nor can they be reduced to linguistic conventions. Rather, their differences are integral, and their incompatibility is rooted in fact and evidence. In more realistic historical cases, such as the reification between Aristotle's and Newton's conceptions of 'force', these incompatible conceptualisations reflect incompatible laws of nature, and Newton's inductive prediction that the speed of an object moves in a vacuum under the action of a force increases gradually with the force. Aristotle, however, believed that the velocity immediately becomes infinite due to the absence of resistance. Thus, the framing model suggests that denotational overlap may jeopardise communication between members of the same speech community and eventually lead to a reconfiguration of existing classification systems.

Kuhn argues that not all violations of the principle of non-overlap are seen as equally dire by the scientific community, nor do they all necessarily cause an overall change in classification. In Kuhn's model of the stages of scientific development, a crisis can have two possible outcomes, either leading to a revolution or a return to conventional science. In order to understand these two possibilities, we must analyse how the hierarchical structure and framing of concepts affects the perception of anomie. All conceptual trope is presented in a hierarchy. Not all denotations of concepts are typical peculiarities; all concepts have a specific typical peculiarity or prototype, while other denotations each have varying degrees of typicality. This hierarchical structure explains the possible outcomes arising from anomalies or violations of the principle of non-overlap. In particular, whether the anomaly is resolved in the existing classification system and whether it will necessarily lead to revolutionary change depends on whether the concepts in question overlap in the prototype.

The internal structure of the concept, described in terms of a framework, also plays an important role in determining the outcome of the anomaly. As mentioned above, not all features are equal in a concept: some features are properties, some are simply values of properties. Even for attributes, some are more important or fundamental, and they can influence other attributes through structural constants and various restrictions. Overlap between atypical examples

can also cause revolutionary changes if the overlap involves basic properties of related concepts.

There is no sharp line between those anomalies that cause revolutionary change and those that do not, since both the typicality of the particular example and the importance of the property can vary asymptotically in a continuous system. Thus, some conceptual referents overlap and lead to holistic and revolutionary shifts in conceptual structure, others can cause only minor gradations, and others fall somewhere in between. Moreover, since members of the same linguistic community can have different prototypes for the same concepts and give different weights to the same attributes, their reactions to anomalies can be quite different. In this way, members of the same linguistic community may have different judgements about the severity of anomalies. These differences in judgement are not black and white, but vary in degree.

Framing models largely reduce the role of cultural and theoretical contexts in the evolution of classification systems. Depending on the framework representation of a concept, new prototypes can be constructed by assigning different values to the attributes of the framework in question. Thus, when we revise existing conceptual systems, we cannot do as we please; the structural links of existing frameworks limit our choices. Kuhn also notes: "Imagine that a denotative term is for each person a knot in a network of discourse, from which radiate the markers of the criteria one uses to identify the object to which the knotted term refers. These criteria link certain terms together and away from others, thus creating some multidimensional structure within the discourse. This structure mirrors some aspects of the world that can be described by this discourse, while at the same time limiting the phenomena that can be described by borrowing from the discourse." (Kuhn 1993, p. 55) There is no doubt that some of the structural relations in the framework reflect our cultural-theoretical context and our goals, but many more are independent of the cultural-theoretical context. Even if we want to transform a framework according to a new perspective, we are still constrained by structural relations that reflect objective reality. In practice, shifts in frameworks are usually caused by anomalies. That is, caused by environmental change. In the absence of environmental change sufficient to produce normality, scientists who accept a new framework rarely return to the old one. Conceptual change has a specific directionality. From this, we can also conclude that Kuhn was indeed a post-Kantian, whose concepts and

categories were not only subject to change, but that such change was limited and influenced by the structural relations of objective reality, rather than being randomly changed at will.

IV. Conclusion

In "After Structure", Kuhn summarises his post-Kantianism: like Kant's categories, lexicons can provide the preconditions for possible experience. But unlike Kant's categories, these lexical structures can change from one community to another over time and content. Whether or not these communities are replaced in time or conceptual space, their lexical structures must overlap in major ways, or there is not a pathway that allows members of one community access to the lexicon of another. In the midst of all the processes of differentiation and change, there must be something eternal, unchanging and stable. Kant's source of immutability lies outside of space and time; experience and description are only possible if a distinction is made between the describer and the described, and lexical structures can be distinguished in different ways, thus creating different, but not entirely different, ways of living. Some ways are better suited to certain purposes, but they cannot be accepted because they are judged to be right and rejected because they are wrong; nor can a real world be allowed to stand in opposition to a fictional one. The way of being-in-the-world offered by the structure of the lexicon is not relevant to judgements of truth or falsity.

This paper draws on the results of the ABC to show that we can use modern psychological and cognitive science approaches to understand Kuhn's post-Kantianism through a reading of Kuhn's theory of concepts. It remains to be noted, however, that Kuhn speaks of: his planned discussion of topics including rationality, relativism, positivism and truth, and in particular "incommensurability", a view which is often misunderstood as a threat to rational evaluation of true claims (true claims), but which is not actually the case, in a developed view "injustice" is an indispensable part of cognitive evaluation. In a developmental perspective, 'incommensurability' is an integral part of cognitive evaluation, defending beliefs such as truth and knowledge against the proliferation of postmodern trends such as strong agendas. (Kuhn, 1993, p. 243) While attempting to defend the view that science is cognitive,

Kuhn also attempts to refute any claim that 'scientific beliefs will successively converge on truth' by arguing that the relationship between beliefs and a conceived independent or 'external' world cannot be The relationship between beliefs and a conceived independent or "external" world cannot be the subject of a true claim. While seeking truth, Kuhn rejects the argument that "scientific beliefs will successively approach truth" as incompatible with "incommensurability". There is an underlying tension between these two different tasks. What, moreover, does 'incommensurability' in a developmental perspective mean? Does it refer to "post-Kantianism"? If so, this is only a project. Although Kuhn refers to his post-Kantian position on several occasions, this view is only cursorily presented and not exhaustively elaborated. Perhaps we can still continue to reflect on this question.

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