

Incommensurability in cognitive guise

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ABSTRACT Philosophers and historians of science have made the claim that successive scientific theories are incommensurable, that is, that many or all of their concepts fail to coincide. This claim has been echoed by cognitive psychologists who have applied it to the successive conceptual schemes of young children, or of children and adults. This paper examines the psychological evidence for the claim and proposes ways of reinterpreting it which do not involve imputing incommensurability. An alternative approach to understanding conceptual change is suggested, according to which novel concepts are introduced against a background of shared concepts, rather than as part of incommensurable conceptual schemes.

The idea has gained currency in recent years that the “child is the parent of the scientist” [1]. The general claim, which has been elaborated by philosophers of science and developmental psychologists alike, is that there are some similarities in the manner in which children develop their concepts and theories about the world and the ways in which scientists do so in the course of the history of science. A more specific thesis that has been taken up by some of these writers is that theories at successive developmental stages in both domains are incommensurable with their predecessors. The idea of incommensurability was first proposed by Paul Feyerabend and Thomas Kuhn for the history of science; their claim was that theories or paradigms separated by scientific revolutions are incommensurable with one another. Some developmental psychologists have found evidence for the incommensurability thesis in their investigations into conceptual change in the evolving belief systems of young children. In this paper, two of these recent attempts will be examined. The new cognitivist elaborations of incommensurability do not convincingly support the ideas first put forward by Kuhn and Feyerabend and they do not give us good reasons for accepting a form of conceptual relativism among adults and children. A brief survey of some of Kuhn’s and Feyerabend’s views on incommensurability will be followed by elaborations of their ideas by two cognitive psychologists, Susan Carey and Alison Gopnik. After questioning the conclusions of these psychologists and suggesting some reinterpretations of their evidence, some proposals will be made for understanding the phenomenon of conceptual change or development.

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Feyerabend and Kuhn on incommensurability

Feyerabend is fairly consistent in his characterization of incommensurability over a period of some two decades. He explains the reasons for incommensurability by saying that there are certain “universal rules” or “principles of construction” that govern the terms of one theory and are violated by the other theory. Since the second theory violates these rules or principles, any attempt to state the claims of that theory in terms of the first will be rendered futile. Indeed, there are things that *cannot* be said or discovered without violating the rules or principles (Feyerabend, 1975, p. 269). As an example of this phenomenon, consider two theories T and T' , where T is classical celestial mechanics, including the spacetime framework, and T' is general relativity theory. About these theories, Feyerabend claims that the classical concepts of *mass* and *distance* cannot be defined within T' . The reason is that any such definition must assume the absence of an upper limit for signal velocities and cannot therefore be given within T' . In fact, he claims that there is not a single primitive descriptive term of T that can be incorporated into T' and concludes that the meanings of all descriptive terms of the two theories, primitive as well as defined terms, will be different. That is what he means by saying that T and T' are incommensurable theories (Feyerabend, 1965, p. 115). Principles, such as the absence of an upper limit for signal velocities, govern all of the terms in celestial mechanics and these terms cannot be expressed at all once such principles are violated, as they will be by general relativity theory.

The reason that these universal rules infect the meanings of all the terms of the theory that contains them is to be found in Feyerabend’s theory of meaning, which he calls a “contextual theory of meaning”. He uses this contextual theory to define “strong alternatives” to a given scientific theory: theories that can be considered true competitors to a dominant theory, as opposed to mere variants. He explains that, “One of the main properties of strong alternatives is that they disagree everywhere if they disagree at a finite number of points” (Feyerabend, 1965, p. 115). In other words, one sign that a theory is substantively different from another is that the differences between them infect the meanings of all terms; otherwise, Feyerabend implies, the rival theory is not a genuine alternative but a mere variant. All such strong alternatives are incommensurable. Elsewhere, he says that the meaning of a term is not an intrinsic property of it, but is dependent on the way in which the term has been incorporated into a theory (Feyerabend, 1962, p. 74). This is the gist of what Feyerabend calls a “contextual theory of meaning”. It also accords with his ridicule of what he calls the “hole theory” or the “Swiss cheese theory” of meaning, which holds that the conceptual cavities in a theory or language can be plugged without displacing the meanings of any of the existing terms (Feyerabend, 1975, p. 266). The idea of a “contextual theory” is tantamount to extreme holism about meaning. The meaning of every term in the theory is affected by the general principles governing the theory and the principles change with every substantial theoretical change, so the meaning of every term also changes.

In *The Structure of Scientific Revolutions*, Kuhn also puts incommensurability in terms of change of meaning. He writes that the referents of some Einsteinian

concepts (*space, time, mass*) are not the same as those of the Newtonian concepts that bear the same names and he refers to this change in meaning as a displacement of the conceptual network that “is central to the revolutionary impact of Einstein’s theory” (Kuhn, 1962/1970, p. 102). However, in the same work, Kuhn sometimes suggests, paradoxically, that translation *is* possible between two incommensurable theories or paradigms. He also says that the participants in a communication breakdown can recognize each other as members of different language communities and then become translators, resorting to shared everyday vocabularies in doing so. If this is carried out successfully, Kuhn thinks, then each will have learned to translate the other’s theory, and this is what the historian of science does when dealing with out-of-date scientific theories (Kuhn, 1962/1970, p. 202). However, in an article written some 20 years later, Kuhn seems to reverse himself by stating quite baldly that incommensurability equals untranslatability (Kuhn, 1990, p. 299). In another article written after *The Structure of Scientific Revolutions*, Kuhn also states that this version of the claim was the same as the “original version” of the incommensurability thesis, which he characterizes as follows:

The claim that two theories are incommensurable is then the claim that there is no language, neutral or otherwise, into which both theories, conceived as sets of sentences, can be translated without residue or loss. (Kuhn, 1983, p. 670)

The resolution of this tension between these seemingly conflicting pronouncements can be effected by observing what Kuhn says just after equating incommensurability with untranslatability. He writes that incommensurability does not bar the activity of professional translators, but rather a “quasi-mechanical activity” governed by a translation manual that specifies for each string in one language a string in another (as a function of context) (Kuhn, 1990, p. 299). Such a quasi-mechanical translation cannot be effected because of certain concrete problems posed by the translation of a scientific theory by a translator who does not share that theory. Kuhn claims that the problems of translating a scientific text into a foreign language or a later version of the same language are very similar to the problems of translating literature. He does not provide a catalogue of the specific translational difficulties that are shared by the two enterprises, but there is one particular obstacle that emerges out of his later writings on the subject of incommensurability, which is worth explicating here [2].

One of the reasons Kuhn gives for incommensurability in his later work can be called the problem of *clusters of interdefined terms*. Kuhn uses the example of the 18th century chemical term “phlogiston” to illustrate his point. He says that the term cannot be translated into terms of later chemical theory because of its relation to a number of other terms in the phlogiston theory, like “principle” and “element”. Together with “phlogiston”, Kuhn explains, these terms constitute an interrelated or interdefined set that must be acquired together, as a whole, before any of them can be used (Kuhn, 1983, p. 676). He acknowledges that one can introduce a neologism for a term from a previous scientific theory that is no longer part of the current

scientific vocabulary. However, he suggests that when there are whole clusters of such interrelated terms, translation is no longer possible, presumably because each neologism needs to be explicated in terms of the extant vocabulary, making whole clusters of them resist such explication.

Kuhn's differences with Feyerabend can be reduced to two basic ones, although they may not be independent. The first is that Kuhn's variety of incommensurability is less widespread and is localized in the vicinity of a single cluster of terms. Feyerabend holds that fundamental changes of theory lead to changes of meaning for all the terms in a particular theory, whereas Kuhn thinks that fundamental changes of theory affect a local cluster of interrelated terms. The other significant difference between them concerns the reasons for incommensurability. While Kuhn thinks that incommensurability stems from specific translational difficulties involving problematic terms, Feyerabend's variety of incommensurability seems to result from a kind of extreme holism about meaning.

Significantly, both Feyerabend and Kuhn use the analogy of a child learning a new language to explain a scientist's ability to learn a new theory. Rather than translating between languages, Feyerabend says that, "We can learn a language or a culture from scratch, as a child learns them, without detour through our native tongue ..." (Feyerabend, 1987, p. 266). Similarly, Kuhn thinks that scientists who learn a new theory do not merely translate the new terms into the old terms; rather they begin from scratch in the way that learners of a language do. A language learner, Kuhn states, will not always "be able to translate from his newly acquired language to the one with which he was raised" (Kuhn, 1990, p. 300). Psychologists influenced by Kuhn and Feyerabend have adapted the claim of incommensurability so that it applies not to a child learning a new natural language but to learning successive stages of the child's native tongue. Two of these adaptations will be examined in the following two sections.

Clusters of interdefined terms: Carey

Carey (1985, 1988) has argued that the conceptual schemes of children and adults (or of children at different ages) are incommensurable with one another. She has followed Kuhn in holding that pairs of incommensurable theories are ones containing clusters of interdefined terms that resist translation from one into the other. She has found some evidence for the claim in the theories attributed to young children, discovering in them whole clusters of concepts all of which resist one-word translations into the adult vocabulary. Carey has made this claim for the preschool child's concepts *alive*, *dead*, *living thing*, *animal*, *plant*, *baby* and others [3].

One of Carey's striking examples concerns the preschooler's concepts of *animal* and *baby*. One source of evidence for her claim that these concepts are not shared by adult and child is that four-year-olds do not usually realize that all animals have babies but think that only some do. As she explains it, children think of babies as small, helpless versions of bigger creatures who, because of their behavioral limitations, require bigger animals to take care of them. Carey describes the case of a

typical four-year-old boy who confirms that dogs have baby dogs and that cows have baby cows, while strenuously denying that worms have baby worms. The boy's reasoning, according to Carey, is that worms are so behaviorally bankrupt that there is no way for the small ones to have a smaller behavioral repertoire than the big ones. The four-year-old insists that there are *short* worms, not *baby* worms, (Carey, 1988, pp. 167–168).

Carey admits that this and similar cases merely raise the *possibility* of local incommensurability, since it is still possible that the child holds different beliefs from the adult, beliefs that are formulated over the *same* conceptual base. In this case, for example, we might say that the child believes that worms do not have babies. However, she says that the only way to tell is to analyze the whole set of concepts and beliefs that underlie them, and that when one does so the possibility of local incommensurability is made more probable, although she stops short of endorsing it unequivocally (Carey, 1988, pp. 174–175). Not only is the concept *baby* not shared, according to Carey, the related concepts *animal*, *life*, *death*, *living thing* and *body* are also different for adult and child. Recall that it is the existence of an interrelated chain of concepts, none of which can be translated into our terms that renders a corpus of beliefs incommensurable with our own, according to Kuhn. For example, Carey claims that the preschool child's concept *death* is nonbiological. According to the child's understanding, the dead live on in altered circumstances and death is avoidable and reversible, as a special type of sleep. Since children do not make a distinction between *dead* and *unreal*, *nonexistent* and *inanimate*, their single nondifferentiated concept *dead* does not correspond to any unitary adult concept. This concept includes both *not alive* (as applied to a deceased grandfather) and *inanimate* (as applied to a table) and plays no role in the adult conceptual system (Carey, 1988, pp. 176–177). To illustrate, Carey reports the following exchange with a three-year-old child. "Isn't it funny," the child asks, "statues aren't alive but you can still see them?" Carey replies, "What's funny about that?" The child replies, "Grandpa's dead and you can't see him" (Carey, 1988, p. 178). Similar things apply to their concept *alive*. When preschool children are deciding whether the sun is alive or not, they are not answering the question whether the sun is animate or inanimate because they cannot even entertain that question, not having differentiated *inanimate* from *dead*. Rather, they are deciding whether the sun is active, real, existent, present or whether it is dead, imaginary, nonexistent, or a mere representation (Carey, 1988, pp. 177–178; cf. 1985, pp. 25–26). Their concepts of *life* and *death* do not make any of these distinctions, which *are* made in the adult conceptual scheme. In the course of the emergence of an intuitive biological theory in the years before age 10, all of these concepts are "simultaneously adjusted", and none are identical with the adult concepts (Carey, 1988, p. 180; cf. 1985, pp. 39–40).

Notice that Carey has just told us a fair amount about the preschooler's conceptual scheme using our very own adult terms. She explains that this exegesis of the children's concepts, *baby*, *alive*, *dead*, and so on, is what she calls, following Kuhn, *a translator's gloss*. She holds that the child's beliefs cannot be expressed in the adult language without such a gloss (Carey, 1988, p. 180). What makes this a gloss on the translation rather than part of the translation itself is presumably the fact that

it is expressed partly in meta-linguistic terms. The gloss involves taking a step back from the theory to point out that unitary concepts for children can be interpreted in terms of more than one of our concepts. We need to point out that the children's concept can be unpacked in terms of more than one of our concepts, a move that involves *mentioning* their concepts rather than *using* them, to use W.V. Quine's well-known distinction. It is as if we were to introduce their terms in quotation marks, rather than employ them directly [4].

However, there seem to be ways of reinterpreting Carey's evidence that enable us to avoid local incommensurability. For some concepts, we might say that the child's concept is the same as the adult's, but that the child has some false beliefs associated with that concept. For example, we can say that preschoolers share our concept *baby*, but add that they believe that worms do not have babies and think that babies are behaviorally bankrupt versions of adults. In this case, we have used our own concept (*baby*) to convey their beliefs. We need not resort to a translator's gloss, as Carey does, to explain how their mental life differs from ours. This treatment is perhaps most plausible for the concepts *baby* and *animal*. For other concepts, we can say that the child's concept is equivalent to some concept of ours that is picked out by another word. This seems a reasonable course of action with the concept that the child associates with the term "alive", which may correspond with the adult concept *active*. Thus, the child's beliefs about the sun being alive might be interpreted as being about the sun being active. For yet other concepts, we may be forced to conclude that the child's concept is not equivalent to any of ours and that we must neologize by coining a new term that would serve to stand in for the child's concept. This may be the aptest treatment for the concept associated with the word "dead", which does not seem to correspond neatly to any adult concept. Now, the third option is perhaps the one taken to raise problems of incommensurability. It is surely not tantamount to incommensurability on its own, but when neologizing becomes rampant, there might seem to be some justification for allowing that there is a certain slippage between the two theories. An interpretation that neologizes for a whole cluster of closely-related concepts may give us some grounds for claiming incommensurability.

Can we ensure that this degree of neologizing does not occur? There does not seem to be a knock-down argument against this eventuality, but the above analysis already renders neologizing implausible for some of the other concepts Carey mentions, namely *baby*, *animal*, and *alive*. Even if we must neologize for some of the concepts she examines, for example *dead*, we need not resort to neologisms for the others. The reason that neologizing is more plausible in the last case is that an argument can be made that there is no saying whether the child uses "dead" to mean dead (no longer living) or inanimate (never lived). Neither of the two substitutions seems to capture the children's beliefs faithfully, so it would not be legitimate to ascribe one rather than the other. However, no parallel case can be made for the child's term "baby", for example. It does not appear necessary to ascribe an entirely new concept simply because the extension of this term is different for adult and child. Moreover, the fact that terms for which we require neologisms are closely related to other terms, does not imply that those other terms require neologisms too.

If the child's term "dead" has no equivalent in the adult lexicon, and if that term is closely related to the child's terms "baby" and "animal", it does not follow that the latter terms also have no equivalent in the adult lexicon. That is because there are generally no constant, unchanging definitions in the context of changing beliefs. The history of science has taught us that beliefs once considered definitional are often rejected as false as more facts come to light. Similarly, a close association between these terms in the child's lexicon does not support the claim that, if one changes, then the rest inevitably follow suit.

In childhood, as in science, a new concept (e.g. *dead*) is usually introduced against the background of the old ones (e.g. *baby* and *animal*). This seems to be a typical characteristic of the evolution or development of belief systems, whether in childhood or in science: limited conceptual innovation is accompanied by considerable conceptual continuity. That is indeed what we would expect if we were to imagine the transition from one scheme to another from the point of view of the agents undergoing the transformation, and it seems to provide a more plausible explanation of Carey's evidence. The possibility of limited neologizing (for the children's term "dead" but not for the others) is not adequately discussed by Carey and seems on reflection to be an attractive interpretation [5].

Having proposed an alternative way of interpreting Carey's evidence about the mental life of preschoolers, it is worth emphasizing that it presupposes that concept-matching is an all-or-nothing affair. I have proposed that most of the child's concepts can be matched up with adult concepts, even when different beliefs are associated with those concepts, and that the rest can be assigned altogether new concepts. By contrast, Carey holds that there is a "continuum of degrees of conceptual differences", at the extreme end of which are concepts embedded in incommensurable conceptual systems (Carey, 1988, p. 168). I will attempt to justify my alternative further in the conclusion.

Extreme holism: Gopnik

While Carey explicitly builds on one of Kuhn's versions of incommensurability, Gopnik's understanding of the reasons for incommensurability are more akin to Feyerabend's. She claims that the child's concepts of *object-permanence*, *space*, and *object-identity*, are closely related and that all will change as the theory changes. According to Gopnik (1983, 1988), there are a number of structural similarities between the development of children's knowledge about the world and the development of scientific theories, and many early words used by children are best understood as theoretical terms. In particular, asking whether or not the six-month-old has a concept of *object-permanence* in the same sense that the 18-month-old does is like asking whether or not the alchemist and the chemist have the same concept of *gold*, or whether Newton had the same concept of *space* as Einstein. As in theory change in science, there is a certain incommensurability between the concepts of the old and new theories. Particular concepts are inextricably intertwined with other concepts in the theory and there is no simple way of making inter-theoretical

comparisons. Since meaning is determined by the relations between a term and other terms in a theory, as theories change meanings do too (Gopnik, 1988, p. 205). So “the picture of semantic development as converging on adult meanings is incorrect”. Rather, the concepts of the child’s theory evolve through a series of incommensurable stages (Gopnik, 1988, p. 213) [6].

Gopnik concentrates on a cluster of children’s terms, including “gone”, “no”, “more”, “there”, and “uh-oh”. She states that each word encodes some single concept exemplified in all contexts in which it is used and that each of them is rather difficult to translate into adult terms. To illustrate, she claims that children use “gone” in a way only tangentially related to adult use and she proceeds to list three typical instances in which they would apply this term. First, they use it when they perceive an object and then stop perceiving it. Second, they say “gone” when they search for a missing object even if they have not actually seen the object disappear, indeed even if they have not seen it at all. For example, one child says “gone” as he searches for a peg to fit the space of a pegboard, although there is no such peg. Third, they say “gone” occasionally when a stable configuration is transformed, for example, when a folding ironing board suddenly collapses (Gopnik, 1983, pp. 171–172). Similar remarks are made about the young child’s use of the word “no”. Gopnik claims that children in the one-word stage use “no” when they reject proposals, protest the actions of others, try to do something and fail, and change their minds. In general, she says that “no” is not just used for negation in the child’s language, but that it encodes the fact that the child has a plan that is not successfully implemented (Gopnik, 1983, p. 172). Gopnik also analyzes the 18-month-old’s use of the word “more”. In her estimation, children at this age do not use the word to encode concepts of number or quantity; rather, they say “more” when they try to repeat an action that will lead to a particular event. She concludes that “more” encodes the fact that the child wants to repeat a plan. Finally, two other early words also seem to encode relationships between children and their plans. Children say “there” when they successfully complete a plan, and they use a variety of terms including “uh-oh” and “oh dear” when they fail to complete a plan. Gopnik says that the concepts of success and failure encoded by these expressions are not very significant in the adult semantic system and children pick up marginal expressions, like “uh-oh” and “oh dear”, or distort the meaning of expressions like “there”, to encode them in their own language (Gopnik, 1983, p. 172).

The reason that these terms are associated with concepts incommensurable with adult concepts is that they share some common characteristics, according to Gopnik. There are two principal characteristics that govern these concepts: they involve plans and actions performed on objects to achieve goals, and they have an egocentric quality (Gopnik, 1983, p. 173). These characteristics, which supposedly pervade the terms under investigation, seem to play the role of Feyerabend’s “universal rules” or “principles of construction”, which govern the meanings of all the central terms of a theory and cannot be revised without changing the meaning of all these terms. This similarity between Gopnik’s position and Feyerabend’s is confirmed when she explains that the notions of success and failure encoded by these expressions are not very significant in the adult semantic system. In adult

English, she claims, our terms do not encode the global concept of a plan, or of an action-performed-on-objects-by-an-actor-in-order-to-achieve-a-goal. Furthermore, we do not have a set of terms applicable only to the *speaker's* actions, intentions, and perceptions. Because of these wide-ranging differences, the child's meanings are at once broader and narrower than the adult's meanings (Gopnik, 1983, p. 173). She goes on to explain that these concepts are developed at around 18 months and not before because children are not able to reflect on plans and to consider or compare them until 18 months (Gopnik, 1983, pp. 173–174). Gopnik posits that the ability to make generalizations about plans seems to underlie the development of the abstract concepts encoded by “no”, “more”, “uh-oh”, and “there”.

The evidence cited by Gopnik and the issues raised by this evidence are variegated and complex. It is impossible to discuss them all from a purely philosophical perspective. But certain ways can be indicated for accounting for the evidence, that do not lead ineluctably to the conclusion that the child's conceptual system is incommensurable with the adult's. First, some aspects of the uses that Gopnik cites, especially when it comes to such exclamatory terms as “gone”, “no”, “uh-oh”, and “there”, may be relegated to the pragmatic force of those terms rather than their literal meaning. Some of the contexts she discusses seem to call for doing things with words rather than issuing descriptive judgements. For example, this may be the case when, as she relates, a child says “there” when completing a task; indeed, the same usage is present in the vocabulary of many adults. That is not to say that the child consciously distinguishes between the semantic meaning and pragmatic force of certain terms. The child need not be aware of it, but there may yet be certain modes of expression associated with the non-descriptive application of terms, for example, exclamation, command, and protest. And Gopnik may be paraphrasing those aspects rather than the literal meaning [7].

A second way of dealing with the evidence is to consider the child's pronouncement an abbreviation for an adult utterance. When it comes to the usages cited of the word “more”, it could be appropriate in the adult's vocabulary to say “once more” in such contexts. Similar remarks can be made about the uses she cites of the word “no”. In adult usage, protesting the actions of others and changing one's mind are both appropriate contexts to use the word “no”, whether on its own or in the context of a phrase. Picketers and demonstrators make frequent use of the word “no”, and people thinking aloud while making decisions will often signal a change of mind with a phrase such as, “No, that won't work.” In both cases, the child's utterances could be regarded as abbreviated or truncated versions of more elaborate adult pronouncements.

A third option for reinterpreting some of the cases cited by Gopnik would be to regard them as cases of semantic overextension rather than the association of an altogether different concept with that word. This may be the proper explanation of the uses she cites of the word “more”. When children use it to express their desire to repeat a certain action, it can be seen as a natural way of overextending a shared concept rather than the introduction of a novel concept that adults do not share. Here, it is important to note that the very notion of overextension, which is pervasive in the developmental literature, can only be understood if we assume that there is a

concept common to both adult and child, which the latter is deploying incorrectly. Talk of overextension presumes that the child is applying the same concept to a wider range of instances than the adult would. Otherwise, if we posit that the child has a different concept than the adult's, we should say that the child is merely applying a novel concept, one that the adult simply lacks. Moreover, since that concept is the child's concept, he or she cannot overextend it in the normal case, since it is the individual child's idiolect that serves as the standard for correct application of the concept.

Someone might respond that this conclusion is too hasty, since developmentalists could still make sense of the phenomenon of overextension without positing coincidence of concepts, by comparing the adult's concept to the child's concept and noting that the latter applies to a wider range of instances than the former. However, this could only be determined if we had some way of measuring the degree of overlap among concepts, say by examining the feature lists that fell under each concept. But that presupposes that at least some of those features themselves coincide in the idiolects of the adult and the child, that is, that there are other concepts shared among them. To talk of overextension at all we must eventually presume that there is widespread sharing of concepts across the developmental divide.

It might also be protested that one need only assume that the *word* or *term* rather than the concept is being overextended, in order to make sense of the phenomenon of overextension. However, that is not the way the phenomenon is described in the psychological literature; it is concepts rather than words that are routinely described as being overextended. At any rate, the main interest in the overextension of children's words consists of using this phenomenon as a guide to the nature and extension of their concepts. The overextension of terms is regularly used as evidence that the corresponding *concepts* are being overextended or misapplied [8].

This third response to Gopnik closely parallels some of the remarks made about Carey's analysis of her empirical evidence. Gopnik does not seem to consider the option that the concepts in each case are the same but that part of the theory in which they are embedded is different. This seems to be an option in at least some of the cases cited. For instance, when it comes to the word "gone", its use in such contexts as the nonexistence of a certain part in a child's game or to signal the disappearance of some configuration rather than an object, may be explained by saying that the child has a different theory about how objects disappear, which things are objects, and where they go when they disappear. It does not require us to say that children have a different concept of *disappearance* [9]. It may be difficult to decide which interpretation to use in such cases (whether to posit the same concept and different beliefs or an altogether new concept), but it will depend generally on which interpretation makes best overall sense of the child. In determining this, Gopnik may yet be right that a finding of conceptual difference is a superior overall interpretation than a finding of theoretical difference, but the alternative has, at least, not yet been convincingly dismissed.

This attempt to reinterpret Gopnik's evidence may, however, appear irrelevant if she shares Feyerabend's adherence to the doctrine of extreme holism about

meaning, which holds that the revision of a few central theoretical tenets changes the meanings of all the terms that feature in a given theory. If this assumption is built into our theory of meaning, then the above considerations may be dismissed. It may be said that Gopnik's point is that the egocentricity and plan-oriented assumptions are central to the child's theory and that their revision will alter all concepts tainted by these assumptions. In response, some theorists of meaning may want to appeal to an atomist theory of meaning, according to which the meaning of each word is given, not by its relations to other words, but directly by physical relations to the world itself. However, one need not resort to such a theory, for there is a more moderate version of holism about meaning that does not have the extremist consequences mentioned. One can maintain that the meaning of any word depends generally on the way that other words are used, but resist the suggestion that an alteration in the use of *any* word changes the meaning of *every* related word. Instead, there are instances in which radical theoretical changes alter the meaning of *some* terms in the theory. On a moderate holist theory of meaning, the meanings of an agent's terms are determined by that agent's overall linguistic practices, but assignments of meaning are given by our interpretation of the agent. If concepts are equated with word meanings, then concepts match by virtue of the fact that meanings coincide, and meanings coincide whenever one term from one idiolect is used to translate another from another idiolect [10]. In this case, concepts are shared among adult and child every time the adult uses one of his or her terms to interpret the child (assuming that that interpretation does not have to be revised in light of future evidence). Interpreters do not regard every difference in belief as leading to a difference in concept, but absorb large differences in belief into the shared concepts they ascribe to the subjects they are interpreting. This is a routine practice when adults interpret other adults and should not be any different for children. This practice ensures that every change of belief does not lead ineluctably to a change in meaning of all our terms. There are cases when sufficient theoretical differences lead us to impute conceptual differences, but we never do so across the board. Such an interpretive practice would vitiate the whole point of interpretation, which is precisely to render someone else's concepts in our own terms. This provides us with a moderate holist alternative to extreme holism [11].

Conclusion

I have argued that the psychological evidence examined in this paper does not give us adequate reasons to accept the claims of incommensurability among the concepts of children and adults. The issues raised by these cognitivist accounts of incommensurability touch on fundamental problems in cognition, the most controversial of which concerns the nature of concepts and of our interpretive practices.

If one objectifies concepts and thinks of them as concrete mental representations, perhaps even as physical entities in the brain with definite spatiotemporal properties, then it may be tempting to view them as partially overlapping and to posit degrees of conceptual difference. If, however, concepts are thought of as

theoretical posits, or entities facilitating the task of interpreting human agents, rather than substantive objects in their own right, then it is more natural to think of conceptual matching as an all-or-nothing affair. On this latter view, the concepts ascribed to human cognizers are those that enable us to make the best overall sense of them after all the psychological evidence has been taken into account. Concepts are identified with word meanings and word meanings are shared every time we decide to use one of our words to translate one of theirs. Whenever we make the decision to use one of our words in interpreting someone else's thoughts, we have thereby ruled that the corresponding meaning or concept is shared between us. Clearly, the interpretive decision to ascribe or withhold a word is a bivalent one, and accordingly, concept-sharing is all-or-nothing. If words stand for concepts, and words are either shared or not, the same goes for concepts. I have further explicated this view of concepts, which underlies the account of conceptual development being advocated here, in Khalidi (1995). It is also closely affiliated with at least one other view of conceptual development in the literature. Woodfield (1993) has argued that if concepts are viewed as internal mental representations, then no sense can be made of conceptual development. Since there is no way to individuate a concept aside from its semantic content, and since that content is said to change over time, it becomes impossible to maintain that it is the very same concept that develops or changes. In a series of papers, he has distinguished between *concepts*, which should not be thought of as exhibiting internal change, and *conceptions*, which can be viewed as changing, developing, and so on. Conceptions can also be likened to miniature theories or theory fragments [12].

Finally, I will put forward two reasons for subscribing to this account of conceptual change rather than the alternative. The first reason is that to allow the partial overlap of concepts rather than posit the complete coincidence or noncoincidence of concepts is to forget the role of concepts in reasoning and inference. Once we admit that there are degrees of conceptual overlap, it becomes impossible to frame arguments involving those concepts, or even to say where exactly the adult differences with children lie. Imagine that we have ruled that four-year-olds think that worms do not have babies while adults do. The natural thing to say is that there is a disagreement between adults and children as to whether worms have babies or not. But if we were to posit only partial overlap between the adult's concept and the child's, then not only would it be incorrect to talk about a single concept *baby*, we could no longer say that there is a genuine disagreement, but rather that there is perhaps a partial disagreement. As we do not have a logic of partial contradiction to go along with partial conceptual overlap, positing degrees of conceptual overlap exacts a heavy price. Moreover, it is a price we need not pay, as we can equally say what we assumed before in describing this case, namely that the adult and children concepts agree and that we have a disagreement in beliefs formulated over the same conceptual base. In fact, in the initial description of the case, this seems to be what Carey implicitly assumes too.

Another reason for proceeding in the way I have proposed is that unless we do so, conceptual development becomes a rather mysterious process. If concept matching is all-or-nothing, then conceptual change should be thought of as change of

concepts rather than change *in* concepts. That is, it should be thought of as the addition or subtraction of concepts to or from the entire repertoire, rather than change within individual concepts. When rampant conceptual change is imputed at each developmental stage, it is difficult to see how the child or scientist is capable of moving from one stage to another. It becomes difficult to understand the process of conceptual development from the *inside*, as it were. If, by contrast, we think of conceptual development in childhood and in science as a process whereby concepts remain by and large the same, with new beliefs formulated over the same conceptual base, then it is easier to understand how the cognizer moves from one stage to the next. This view does not preclude the emergence of brand new concepts and the discarding of old ones, but it regards it as a sideshow to the main event, which is the addition and subtraction of beliefs involving the very same concepts.

On the basis of the above considerations, I conclude that, although successive children's theories may involve limited conceptual innovation, they do not appear to introduce a whole range of incommensurable concepts at each developmental stage. This means that conceptual change should be seen as a continuous process rather than a series of discontinuous ruptures. But, although the developmental evidence discussed above has not succeeded in vindicating incommensurability, the fruitfulness of comparing conceptual change in science with conceptual change in childhood has not been discredited. Since I would argue that science too does not progress by introducing a brand new conceptual base with every major theoretical advance, the child may indeed be the parent of the scientist and the ontogeny of concepts may yet recapitulate their phylogeny.

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Notes

- [1] The phrase derives from Kitcher (1988), but the idea of comparing children's conceptual development and conceptual change in science is of older provenance. See for example, Piaget (1954, p. 367) and Kuhn (1964/1970, pp. 246ff) for two seminal sources for this comparison. Incidentally, Kitcher endorses the view that there is incommensurability between adults and children, which is the claim to be challenged in this paper: "Incommensurability ... is relatively commonplace in science, past or present, and it would be surprising if we couldn't discern a shift between incommensurable languages in the development of the young child" (Kitcher, 1988, p. 226).
- [2] Elsewhere, in Khalidi (forthcoming), I have distinguished this translational obstacle from another that can be detected in Kuhn's later work, although Kuhn himself does not seem to distinguish clearly between them.
- [3] Strictly speaking, since the child's concepts are different from the adults, it is misleading to talk about a single concept *baby*. Rather, such locutions should be understood as pertaining to two different concepts associated with a single word, "baby".

- [4] The logical distinction between using a term and mentioning it can be illustrated by the following two sentences:

Quine is bald.
 "Quine" has five letters.

In the first sentence, the term "Quine" is *used* to refer to the philosopher; in the second, it is merely *mentioned* and refers to a linguistic expression.

- [5] One issue being shelved here concerns the possibility of finding contradictory beliefs in the child's corpus. Children are prone to harbor contradictory beliefs, which sometimes complicates the task of attributing concepts to them. But that is a problem for anyone interpreting a human agent, whether child or adult (since adults may be equally, if not more, guilty of this offense).
- [6] Gopnik clearly does not deny that children's meanings eventually coincide with adult ones, but she denies that the process is one of gradual convergence.
- [7] For a similar strategy in reinterpreting developmental evidence, see Huttenlocher and Smiley (1987). They argue that evidence taken by other psychologists to indicate "complexive" overextension by children (e.g. the use of "cookie" to refer to the cookie jar) may sometimes be reinterpreted as a *request* for a cookie in the presence of a cookie jar. The semantic-pragmatic distinction is not without its difficulties, and there are some who would deny it altogether. But much work in the cognitive sciences presupposes a line between literal and nonliteral meaning. For a dissenting view, see Lakoff (1987).
- [8] Of course, Gopnik might deny the phenomenon of overextension altogether, but then she owes us an alternative explanation of the considerable evidence in the psychological literature.
- [9] Strictly speaking, Gopnik needs to say that the children do not have the concept of *disappearance* at all, but a similar concept, which is expressed by the word "gone" (cf. [3]).
- [10] It is worth pointing out that it is idiolectic meaning that is at issue here (the dialect or language can be thought of as the intersection of idiolects). For more on internalized or idiolectic concepts (I-concepts), see Jackendoff (1992, pp. 22–23). The notion is rooted in Chomsky's notion of an I-language, as articulated in Chomsky (1986, pp. 21ff).
- [11] For more on moderate holism and the contrast with extreme holism, see Khalidi (1995).
- [12] See also Woodfield (1993) and (1996) for further details. In this series of papers, Woodfield gives additional arguments to counter talk of individual concepts changing or developing. By contrast, Carey holds that the concept of *life* itself "develops" (Carey, 1985, p. 40).

References

- CAREY, S. (1985). *Conceptual change in childhood*. Cambridge: MIT Press.
- CAREY, S. (1988). Conceptual differences between children and adults. *Mind & Language*, 3, 167–181.
- CHOMSKY, N. (1986). *Knowledge of Language*. New York: Praeger.
- FEYERABEND, P.K. (1962). Explanation, reduction, and empiricism. In *Realism, rationalism and scientific method: philosophical papers vol. 1* (pp. 44–96). Cambridge: Cambridge University Press.
- FEYERABEND, P.K. (1965) Reply to criticism: comments on Smart, Sellars, and Putnam. In *Realism, rationalism and scientific method: philosophical papers vol. 1* (pp. 104–131). Cambridge: Cambridge University Press.
- FEYERABEND, P.K. (1975). *Against method*. London: Verso.
- FEYERABEND, P.K. (1987). Putnam on incommensurability. In *Farewell to reason*. London: Verso.
- GOPNIK, A. (1983). Conceptual and semantic change in scientists and children: why there are no semantic universals. *Linguistics*, 21, 163–179.
- GOPNIK, A. (1988). Conceptual and semantic development as theory change: the case of object permanence. *Mind & Language*, 3, 197–216.
- HUTTENLOCHER, J. & SMILEY, P. (1987). Early word meanings: the case of object names. *Cognitive Psychology*, 19, 63–89.
- JACKENDOFF, R. (1992). *Languages of the mind*. Cambridge: MIT Press.

- KHALIDI, M.A. (1995). Two concepts of concept. *Mind & Language*, 10, 402–422.
- KHALIDI, M.A. (forthcoming). Incommensurability. In W.H. NEWTON-SMITH (Ed.) *A companion to the philosophy of science*. Oxford: Blackwell.
- KITCHER, P. (1988). The child as parent of the scientist. *Mind & Language*, 3, 217–228.
- KUHN, T.S. (1962/1970). *The structure of scientific revolutions*, 2nd edition. Chicago: University of Chicago Press.
- KUHN, T.S. (1964/1970). A function for thought experiments. In *The essential tension*. Chicago: University of Chicago Press.
- KUHN, T.S. (1983). Commensurability, comparability, communicability. In P.D. ASQUITH & T. NICKLES (Eds) *PSA 1982: Proceedings of the 1982 Biennial Meeting of the Philosophy of Science Association*, vol. 2. East Lansing: Philosophy of Science Association.
- KUHN, T.S. (1990). Dubbing and redubbing: the vulnerability of rigid designation. In C. WADE SAVAGE (Ed.) *Minnesota studies in the philosophy of science*, vol. 14. Minneapolis: University of Minnesota Press.
- LAKOFF, G. (1987). *Women, fire, and dangerous things*. Chicago: Chicago University Press.
- PIAGET, J. (1954). *The construction of reality in the child*. (Trans. Margaret Cook). New York: Basic Books.
- WOODFIELD, A. (1991). Conceptions. *Mind*, 100, 547–572.
- WOODFIELD, A. (1993). Do your concepts develop? In C. HOOKWAY & D. PETERSON (Eds) *Philosophy and cognitive science*. Cambridge: Cambridge University Press.
- WOODFIELD, A. (1996). Which theoretical concepts do children use? *Philosophical Papers*, 25, 1–20.