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ABSTRACT

A review of the literature on the development of children's abilities to comprehend and produce metaphorical language shows this development to be a continuous process rather than one characterized by stages, and to be constrained primarily by limitations in children's knowledge and information processing abilities. More specifically, the literature suggests that metaphor production develops out of children's undifferentiated similarity notions that become differentiated into literal and nonliteral similarity judgments as their conceptual knowledge becomes organized in categories similar to those of adults. In addition, the research shows that metaphor comprehension starts during the preschool years, is originally limited to a few metaphorical expressions that occur in predictable linguistic and situational contexts, and develops rapidly to encompass a greater variety of metaphorical domains as children's knowledge and information processing abilities increase. Finally, the literature suggests that child metaphors are a reflection on the language of an underlying transfer of knowledge from one conceptual domain to another, similar to the transfer of knowledge that occurs in adults. An 11-page reference list is appended. (HOD)

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Technical Report No. 370

CHILDREN AND METAPHORS

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Abstract

Recent research on the development of children's abilities to comprehend and produce metaphorical language is reviewed. It is argued that this research supports the view that the ability to produce and comprehend metaphorical language emerges out of children's undifferentiated similarity notions and develops gradually to encompass a greater variety of conceptual domains. Although we do not yet have adequate theories of how metaphor comprehension or production develop, there is good reason to believe that this is a continuous, rather than a stage-like process, and that it is constrained primarily by limitations in children's knowledge and information processing abilities. Furthermore, it appears that the comprehension and production of metaphorical language involves transfer of knowledge from one conceptual domain to another which, on the one hand, depends critically on the conceptual knowledge the child already has, but on the other acts to enrich and advance this conceptual knowledge.

Children and Metaphors

During the last decade we have witnessed a proliferation of research on metaphor. This research has changed many of our ideas about how metaphoric competence develops and about the cognitive and linguistic skills that allow this development to take place. For example, while just a few years ago it was believed that elementary school children are incapable of understanding metaphors, it is now widely accepted that metaphoric understanding emerges during the preschool years and develops gradually to encompass a greater variety of metaphorical expressions. The purpose of this paper is to describe the research that has brought about these changes, to summarize current trends, and to identify areas for future research. The focus of the review is on general developmental processes. The question of individual differences in metaphoric competence and their relation to creativity is not discussed. A recent review of the literature on this latter topic can be found in Kogan (1983).

We start with a discussion of the literature on metaphor production. Since children produce utterances that have the appearance of being metaphorical as soon as they start talking, it is important to define the criteria for deciding whether such child utterances are metaphors. In this paper it is suggested that metaphors involve the juxtaposition or comparison of

concepts belonging to different adult conventional categories and that in order for a child utterance to qualify as a metaphor we must show that the child (a) can form conventional categories, and (b) is capable of overriding these categories to see similarity between things that are not really similar, but "sort of" similar. It is argued that contrary to Piaget's (1962) claims, the current empirical evidence supports the view that by 4 years children can distinguish literal from nonliteral similarity, and therefore are capable, in principle, of producing and comprehending metaphorical language. To the extent that a given child metaphor represents a true metaphor or not depends, however, on the particular conceptual domains involved and the child's awareness of the similarities and differences between these domains.

Next, the early literature on metaphor comprehension is reviewed and some of its methodological limitations are discussed. It is argued that the current empirical evidence supports the position that the beginnings of metaphor comprehension emerge during the preschool years but that this development is not complete until the late childhood years, when the child's conceptual and linguistic knowledge approximates that of the adult's. Although we do not yet have good theories of the development of metaphor comprehension, recent research seems to indicate that this is a continuous rather than a stage-like process and that it is greatly influenced by variables such as,

the content of the metaphor, the linguistic form in which it is expressed, and the context in which it occurs. Particular importance is paid to the content of the metaphor for it is quite unlikely that a metaphor will be understood if it compares concepts children (or adults) know little about. Some proposals about how conceptual knowledge influences the development of metaphoric competence are discussed. We conclude by suggesting that instead of seeing metaphor as the result of the immature thinking of the preconceptual child, we can conceptualize it as the reflection on the language of an underlying transfer of knowledge from one conceptual domain to another, similar to the transfer of knowledge that takes place in adults.

Metaphor Production

Are "Child" Metaphors "Real" Metaphors?

Almost as soon as they start to talk children produce utterances that have the superficial appearance of a metaphor (e.g., Carlson & Anisfeld, 1969; Chukovsky, 1968; Clark, 1973; Piaget, 1962; Werner & Kaplan, 1967). For example, according to Winner, McCarthy, Kleinman & Gardner (1979), a 26-month-old child exclaimed "corn, corn!" pointing to a yellow plastic baseball hat, while an 18-month-old child called a toy car "a snake" while twisting it up his mother's arm. Carlson's 24-month-old son said "Cup swimming," while pushing a cup along in the bath water, and "I'm a big waterfall," while sliding down from his father (Carlson & Anisfeld, 1969). Finally, Piaget's (1962) daughter

Jacheline said (between the ages of 3;6 and 4;7) of a bent twig, "It's like a machine for putting in petrol," of a caddis-fly in a stream, "It's an insect in its cage," and of a winding river, "It's like a snake."

Utterances such as these are known as "child metaphors" because they violate the conventions of reference (they refer to things by a name different from their literal names), or because they make a comparison between two objects that belong to different conventional categories. The question for the developmental psychologist is whether these "child metaphors" are "real metaphors" comparable to the ones produced by adults. Here researchers disagree. Some argue that child metaphors are nothing more than the result of accidents or errors of categorization (e.g., Chukovsky, 1968; Matter & Davis, 1975) or the product of the symbolic, imagistic type of thinking characteristic of the preoperational child (Piaget, 1962). Others claim that child metaphors represent the conscious violation of an established category and thus that they are truly metaphorical (Billow, 1981; Gardner, Winner, Bechhofer, & Wolf, 1978). These differing positions are based on conflicting views about (a) the nature of metaphor, (b) young children's classification abilities, and (c) the criteria for defining child utterances as metaphorical.

The nature of metaphor. Historically, there have been three views on the nature of metaphor: according to the substitution

theory metaphor involves the substitution of a literal expression (Richard is brave) with a metaphorical one (Richard is a lion); according to the comparison theory it involves the assertion of a similarity or comparison between two terms--the topic (Richard) and the term used metaphorically, usually called the vehicle (lion); and according to the interaction theory the relationship between the two terms in a metaphor is an interaction that allows the topic to be seen from the perspective of one's knowledge about the vehicle. All three theories have been criticized on various grounds and, in recent years, have undergone a number of modifications which have reduced their differences substantially (e.g., see Ortony, 1979; Tourangeau & Sternberg, 1981, 1982; and Verbrugge & McCarrell, 1977 for a more extensive discussion of these issues).

Rather than getting embroiled in a complicated philosophical debate, we chose here to take a position on this issue and to make clear how we view metaphors. In our view metaphors are meaningful statements which communicate something about a concept by comparing it or juxtaposing it to a similar concept from a different conventional category. There are two aspects of this definition which are of particular importance. First, the two concepts which are compared or juxtaposed must be based on some perceptible similarity, otherwise the statement would be an anomaly, not a metaphor. Second, the two concepts must belong to different conventional categories, otherwise the statement would

represent a literal comparison, not a metaphor. Metaphoricity, according to this definition, depends primarily on "domain incongruence"--whether the two concepts involved in the metaphor come from different conventional categories.

One problem with such a definition is that the boundaries between what may be considered as a conventional vs. a non-conventional adult category are not well defined. In addition, as Sternberg and his colleagues have shown, metaphoricity also depends on the remoteness of the categories to which the topic and the vehicle belong. The less remote these categories are, the less metaphorical a statement is judged (Sternberg, Tourangeau, & Nigro, 1979; Tourangeau & Sternberg, 1981, 1982). Thus, there can be borderline cases where adults may disagree on whether a statement can be called metaphorical or not.[1]

The literal/metaphorical distinction becomes even more problematic, however, when dealing with child utterances. There, one must demonstrate not only that the topic and vehicle belong to different and remote conventional categories, but also that the child has formed the conceptual categories the metaphor violates, and is aware that this violation is taking place. Developmental psychologists disagree on whether they should attribute metaphoric competence to preschool children either because they believe that children are not capable of forming conceptual categories similar to those formed by adults (e.g., Piaget, 1962), or because they employ different criteria for

deciding whether a given utterance is metaphorical or not (e.g., Billow, 1981; Winner, 1979).

Children's classification skills. According to the argument advanced by Piaget (1962) and researchers working within a Piagetian framework (Cometa & Eson, 1978; Elkind, 1970; Matter & Davis, 1975; Ricco & Overton, 1985), preschool children are incapable of producing metaphors, because they are incapable of forming the conceptual categories which metaphors are supposed to violate. Piaget argues that preschool children think in terms of preconcepts based on action schemata and symbolic images and not in terms of true concepts "defined by the objective qualities of the objects themselves" and in which "there is inclusion of an object in a class and of one class in another" (p. 220). Thus, the metaphor-like utterances of the preschooler are not based on the violation of stable categories but rather on the perception of similarity between individual elements. It follows that these utterances do not represent real metaphors, and that the production of real metaphors must await the development of the concrete logical operations which allow a hierarchical conceptual system to be formed.

In recent years Piaget's views have come under heavy attack. First the "classical" view of concepts (that is, that concepts can be characterized in terms of a hierarchical organization of classes and that all instances of a class share common properties that are necessary conditions for their definition), on which

Piaget has based his theory of conceptual development has been challenged. Many adult concepts cannot be defined in terms of common properties but only in terms of family resemblances (Fodor, 1981; Rosch & Mervis, 1975; Smith & Medin, 1981; Wittgenstein, 1953). Indeed, according to Rosch and Mervis' (1975) prototype theory, much of adult thinking could be characterized as "preconceptual" according to Piagetian standards (see also Rosch, 1983).

Second, while preschool children do have difficulties with Piagetian class-inclusion tasks, the ability to classify objects hierarchically seems to emerge much earlier than originally thought. Work by Rosch and her colleagues (Rosch, Mervis, Gay, Boyes-Braem, & Johnson, 1976) has distinguished a superordinate from a less abstract, basic level of categorization. Unlike most classification experiments which used objects belonging to a superordinate category, Rosch et al. (1976) showed that children as young as 3 years of age could sort objects according to a consistent criterion if they belonged to a basic category. Since then, it has been shown that even 1 1/2 year olds may be capable of taxonomic groupings at the basic level (Ross, 1980; Sugarman, 1979).

Obviously, the literature on the development of classification is too complex and diverse to be presented here in any detail (see Carey, 1983; Gelman & Baillargeon, 1983; and Mandler, 1983; for a discussion of these issues). There is

general agreement, however, that the ability to construct consistent and exhaustive classes starts quite early in life and develops to encompass more complex stimuli as the child's knowledge of the world and information processing capacities increase. Such a view of the development of classification skills entails that preschool children may be aware that some comparisons violate category boundaries and thus that they are metaphorical.

Contrary to Piaget's claims, it thus appears that preschool children may well be capable, in principle, of producing and understanding metaphorical language. From that, it does not necessarily follow that all child utterances that appear metaphorical from an adult point of view are metaphors. One needs to develop criteria to distinguish utterances based on literal similarity from those based on nonliteral similarity. Only recently have such criteria been developed and applied to empirical data.

Criteria for deciding whether a given child utterance is metaphorical. In one study, Billow (1981) followed 73 preschoolers (between 2.7 to 6.0 years) during regular school days, recording all utterances which referred to an object, feeling, or event by a term which would not ordinarily be used for that referent. These utterances were then scored as metaphors if they were based on perceptible similarity. For instance, if a child used the word "grass" to refer to a green

carpet, she was credited with the production of a metaphor based on the perceptual similarity between grass and green carpets. Most of the utterances that appeared metaphorical were based on similarity, and were thus scored as metaphors. Only about 6% of the utterances were judged to have been based on possible errors of reference.

The results of this study suggest that child metaphors are deliberate and meaningful rather than accidental or anomalous. However, the definitional problem remains. Billow did not demonstrate that the children were aware that their utterances violated conventional categories, and thus, that they distinguished literal from nonliteral similarity. The perception of similarity alone does not justify calling an utterance metaphorical. For example, we know from recent research that even 12 month old infants are capable of seeing similarity between events in different sensory modalities, like a high/low tone and a tall/short line, but we do not know that they override habitual modes of classification in doing so (Wagner, Winner, Cicchetti, & Gardner, 1981). The critical question is not whether young children can see similarity between superficially dissimilar objects and events, but whether they can distinguish literal from metaphorical similarity.

According to Winner and her colleagues (Winner, 1979; Winner, McCarthy, & Gardner, 1980; and Winner, McCarthy, Kleinman, & Gardner, 1979), the first step towards deciding whether a child

utterance is a metaphor requires distinguishing overextensions from renamings. Overextensions represent instances where a known word is used to refer to an object whose conventional name the child does not yet know. Renamings represent the instances where the child already knows how an object is named but chooses to call it something else. Winner and her colleagues argued that only renamings qualify as metaphors. Overextensions cannot be cconsidered as metaphors because they do not indicate an intention from the part of the child to make a nonliteral comparison.

Winner et al. (1979, 1980) developed criteria to distinguish overextensions from renamings and applied these criteria to the analysis of the spontaneous speech of one child (between the ages of 27 and 58 months) as well as to the elicited speech of children (ranging in age from 3 to 10 years) participating in a game of renaming. An utterance was called a renaming if the experimenter had information that the child knew the literal name of the item that was referred to metaphorically, or if the child's gestures indicated that she was in a pretend mode (the assumption being that in this case there was an intention on the part of the child to use language nonliterally). Otherwise, the utterance was considered to be an overextension, and therefore not metaphorical. Since 72% of the spontaneous apparent metaphors and 66% of the elicited ones were judged to be

renamings or pretend comparisons, Winner concluded that these utterances represented genuine metaphors.

Unfortunately, the distinction between overextensions and renamings does not solve the problem of distinguishing literal from nonliteral utterances. First, while overextensions do not demonstrate an intent from the part of the child to make a nonliteral comparison, they could qualify as genuine metaphors if the child was aware of the fact that a conventional category was being violated. Indeed, many adult metaphors which are used to express an idea for which an appropriate literal term cannot be easily found or does not exist, could be seen as overextensions. According to Ortony (1975), metaphors are "necessary and not just nice" precisely because they make it possible to communicate ideas which are difficult to express in literal language. In the history of language, metaphors were often created to fill gaps in the lexicon; that is probably why metaphor is so pervasive (Lakoff & Johnson, 1980). Children may be motivated to use overextensions because they often find themselves in situations of inexpressibility (Marschark & Nall, in press), but they may be aware of the category violations involved. What is needed is not to automatically exclude overextensions from consideration as metaphors, but to develop criteria for distinguishing literal from nonliteral overextensions.

Second, renamings may not necessarily be metaphorical. In a renaming the child may simply intend to indicate that the two

objects being compared are literally similar, instead of being "sort of" similar. What seems to be needed is the additional information that the child who uses a renaming is aware that these two objects belong to different conceptual domains.

Finally, the decision to call metaphors all pretend renamings occurring in the context of symbolic play is not without problems, either. Winner (1979) claims that "if one is willing to grant symbolic status to the object substitutions of what is typically called symbolic play, then one must accept the accompanying renamings as nonliterally intended. Whether the child knows the literal name of the misnamed object is irrelevant" (p. 477). While we agree with Winner that there is something fundamentally nonliteral about symbolic play, calling pretend renamings metaphors obscures fundamental differences between these two types of utterances. In our view pretend renamings could be best conceptualized as precursors to metaphor because, like metaphors, are based on children's tendencies to impose a familiar schema on the object world. They are different from metaphors, however, in the following respects.

First, metaphors involve the comparison and juxtaposition of concepts, whereas pretend renamings are intended to change the identity of the real object itself. When a child calls a block a "cup," he or she is not referring to any conceptual similarities between blocks and cups, but intents to use the block as something to drink out from. Second, metaphors have a

communicative intent which is missing from pretend renamings. During play, an object is renamed to fit the pretend schema, not to communicate anything about the object itself. Take the example of the 18-month-old who called a toy car "a snake" (Winner, et al., 1980). Obviously, this child was not trying to communicate anything about toy cars in this instance. Third, metaphors are based on similarity, whereas similarity is not a necessary characteristic of pretend renamings. In half of the pretend action metaphors identified by Winner, there was no perceptible similarity between the actual object and its renaming. Such renamings are totally meaningless outside the specific pretend play schema in which they occur and could hardly be called metaphors. Finally, as Gardner and Winner (1978) themselves discuss, pretend play may not even represent the conscious violation of reality. It is possible that for the young child pretense may override reality with the pretend object taking over the properties of the real one while the play act lasts. In this case, of course, no metaphoric ability can be deduced.

From the discussion so far it has become apparent that to qualify as a metaphor a child utterance must (a) be based on some perceptible similarity between the two juxtaposed objects, and (b) there must be some evidence that the child distinguishes literal from nonliteral similarity, i.e., that the child is aware that the two objects belong to different conventional categories.

Vosniadou and Ortony (1983a) demonstrated this awareness by examining the performance of 3- to 6-year olds in one of two tasks. In a comparison task, children completed statements of the form "A is like X" choosing one of two words from (a) a metaphorical/literal pair (e.g., "Rain is like tears" vs. "Rain is like snow"); (b) a literal/anomalous pair (e.g., "Rain is like snow" vs. "Rain is like a chair"); or (c) a metaphorical/anomalous pair (e.g., "Rain is like tears" vs. "Rain is like a chair"). In a categorization task, children completed statements of the form "A is the same kind of thing as X" choosing only from a metaphorical/literal pair. Even the youngest children preferred meaningful (literal or metaphorical) from anomalous alternatives in both tasks, and by age 4, many children selected the literal alternatives in the categorization task. For example, while the metaphorical comparison "rain is like tears" was the preferred one in the comparison task, most 4-year-olds selected the literal comparison "rain is the same kind of thing as snow" in the categorization task. Apparently, by 4 years children can distinguish between a literal and a metaphorical comparison when it involves familiar items. It is, of course, possible that younger children could do better in tasks in which the comparisons were embedded in a meaningful context, or in non-verbal tasks, but that still remains to be seen.

A study by Mendelson, Robinson, Gardner, and Winner (1984) is consistent with the claim that four-year-old children can

distinguish literal from metaphorical comparisons. In this study, 4- and 5-year-old children were given three choices from which to select a match for a visual stimulus. The choices represented either a conventional match, a metaphorical match, or an unrelated match, and were presented either in a pictorial, a verbal, or a picture-verbal condition. Children were more likely to classify objects according to a conventional category than by a visual similarity that cut across conventional categories (e.g., were more likely to classify a cherry lollipop with a chocolate bar than with a stop sign). Mendelson et al. interpreted the results as indicating that preschoolers' predominant mode of classification is conventional, and thus as providing support to the argument that unconventional namings (i.e., child metaphors) reflect intentional violations of conventional categories.

While these results demonstrate that conventional modes of classification are accessible to preschoolers, they should be interpreted with caution. As Marschark and Nall (in press) note, the demonstration of literal classification skills with one set of materials in one context does not necessarily imply the intentional violation of a conventional category with different materials in another context. Although both the Mendelson et al. (1984) and the Vosniadou and Ortony (1983a) studies demonstrate that 4-5 year old children can, under some circumstances, differentiate literal from metaphorical comparisons or exhibit

literal classification skills, they do not demonstrate that all children's utterances that appear to be metaphorical to an adult were so intended by the children. This depends on the particular conceptual domains that are involved and the child's awareness of the similarities and differences between these domains. This implies that a complete theory of metaphor production is dependent on a theory of conceptual development, an issue which will be discussed in greater detail in the third section of this paper.

The roots of metaphoric competence. According to Winner et al. (1980), there are two forms of metaphor; the "enactive" metaphor that grows out of the actions of symbolic play and the "perceptual" metaphor that arises out of the observance of similarities between objects. A different possibility is that there is just one form of metaphor, one that arises out of both the perception of similarity and the actions of symbolic play.

Indeed, it appears that while the perception of similarity and the actions of symbolic play have independent beginnings, they eventually come together to give rise to similarity based renamings at about the same time when we would expect children to make the literal/nonliteral distinction. Children are capable of perceiving similarity between objects, feelings and events from very early on. The perception of these similarities is fundamental for category formation and classification. In order to produce a metaphor, however, the child must override habitual

forms of categorization, and see similarity between objects and events that are similar only in certain respects. In symbolic play children start by overriding the conventional name of an object and calling it something else. Originally it appears that these pretend renamings are arbitrary, without concern for the similarity between the object and its renaming, but become increasingly constrained by similarity as the child develops. According to Winner (1979), similarity based pretend renamings increase from 25% at age two to 76% by age four in the spontaneous speech of the child she studied. By that age there is increasing evidence that children have become capable of distinguishing between literal and nonliteral similarity.

Is there a decline in metaphor production with age? There is some evidence that children's linguistic creativity decreases with age (Billow, 1981; Gardner, Kirchner, Winner, & Perkins, 1975; Gardner et al., 1978; Pollio & Pollio, 1974). Billow noticed a decline in the number of naturally occurring metaphors among preschoolers with age, while Gardner et al. (1978) reported that elementary school children often resisted attempts to engage in the use of figurative language. Based on these findings, Gardner and his associates (e.g., Gardner et al., 1978; Gardner & Winner, 1978) have proposed that the development of metaphor production follows a U-shaped curve: production of metaphor is common during the preschool years, declines during the elementary

school years (as children are consolidating the literal meaning of words) and increases again with the advent of preadolescence.

It now appears that the apparent decline in metaphor production with age may have been overestimated. For instance, Pollio and Pollio (1974) observed that different estimates can be obtained about elementary school children's use of figurative language depending on the tasks employed. They found that third-, fourth-, and fifth-grade students varied considerably both in the amount and in the kind of figurative language they used in three different tasks: a composition task (in which they wrote a composition on a given topic), a multiple sentence task (in which they produced as many sentences as possible with a set of five words), and a comparison task (in which they found as many similarities as possible between word pairs, like "clock" and "child"). Winner, McCarthy, & Gardner (1980) also noted a discrepancy in estimates of metaphor production obtained from spontaneous utterances and those elicited under experimental conditions and suggested that the literal stage may reflect more a motivational rather than a competence problem.

Gardner's argument that there is a decline in metaphor production with age rests on the assumption that all child metaphors are real metaphors. If it is true, as we have argued in this paper, that some child metaphors are not real metaphors (either because they represent literal overextensions or non-similarity based pretend renamings), then what appears to be a

decline in metaphor production is maybe only a decline in the proportion of utterances which appear metaphorical from the adult point of view but are not real metaphors. Such an argument would be consistent with the findings by Gardner et al. (1975) that the number of appropriate metaphors (appropriate by adult standards) produced by children increase with age.

To sum up, in order for a child utterance to qualify as a real metaphor (a) it must be based on similarity, and (b) the child must be aware of the category violation. It appears that at least by the age of 4 children are capable of distinguishing literal from nonliteral comparisons, and thus also capable of producing metaphors. Metaphoric competence emerges out of children's ability to see similarity between different objects and events as well as out of children's tendency to impose familiar schemas on the object world. Evidence for the first can be found in preschool children's overextensions and perceptual renamings, while evidence for the second can be found in their action or pretend renamings. As children's conceptual knowledge becomes organized in categories similar to those of adults, children become more capable of distinguishing between literal and nonliteral similarity, and thus of producing "true" metaphors.

Needless to say, more research along the lines started by Winner (1979) is needed to systematically investigate the kinds of renamings and overextensions children produce in conjunction

with the development of their symbolic play and classification skills. The empirical evidence that we have so far is too slim to allow any conclusive statements to be made about the emergence of metaphoric competence. In addition to providing information about the emergence of metaphor production and comprehension, such an investigation would also provide important information about conceptual development itself.

Metaphor Comprehension

The Emergence of Metaphoric Understanding

Early research on children's comprehension of metaphorical language produced conflicting results. A few studies which tested metaphor comprehension indirectly (i.e., using non-verbal tasks in which children matched words to metaphorically related pictures), suggested that preschool children can see similarity between items belonging to different adult conceptual categories. For example, Gardner (1974) demonstrated that 4-year-old children could match pairs of polar adjectives ("loud-quiet") not only to literal alternatives (e.g., loud and quiet sounds) but also to metaphorical ones (e.g., pairs of colors, faces, etc.). In addition, preschoolers were as able as adults to answer questions like "If a tree had a knee where should it be?" by locating the imaginary knee on the picture of a tree (Gentner, 1977).

But most of the early studies which tested the comprehension of metaphorical language directly, that is, by using verbal tasks which required children to paraphrase or explain a metaphorical

expression, suggested that children below 10-12 years of age are incapable of metaphor comprehension. For example, not until about 14 years of age could Winner, Rosenstiel, and Gardner (1976) find that children fully explain the meaning of metaphorical sentences such as "The prison guard was a hard rock." Similarly, Asch and Nerlove (1960) showed that only after age 11 could children understand the dual function (physical or psychological) of terms like "sweet" and "bright."

These results were generally consistent with the Piagetian position (Piaget, 1962) that metaphoric competence is a late development. Piaget's comments on metaphor applied to the production rather than the comprehension of metaphorical language but his general account has been extended to metaphor comprehension. In one Piagetian experiment, Smith (1976) selected metaphors from fifth-grade textbooks and asked 80 sixth- and eighth-grade children to paraphrase them. According to Smith, the poorest paraphrases showed characteristics of concrete and pre-operational thinking, while the best showed characteristics of formal-operational thought. In another experiment, Billow (1975) made a distinction between similarity metaphors ("Hair is spaghetti") and proportional metaphors ("My head is an apple without a core"). Similarity metaphors, Billow argued, are related to the ability to make classifications based on shared attributes, an ability which is assumed by Inhelder and Piaget (1964) to develop during the concrete operational stage.

Proportional metaphors are based on the ability to make classifications based on shared relations, an ability which is assumed to develop during the stage of formal operations.

To test this hypothesis, Billow compared children's paraphrases of similarity and proportional metaphors to their performance on Piagetian concrete and formal operation tasks. Performance on the proportional metaphors was strongly correlated with performance on the combinatorial test that was assumed to test formal operations, but only about half of the children who understood the similarity metaphors were successful on the classification task assumed to test formal operations. Billow concluded that while comprehension of proportional metaphors is related to the emergence of formal operations, comprehension of similarity metaphors precedes the concrete operational stage.

Cometa and Eson (1978) criticized Billow's (1975) study on the grounds that the use of verbal classification tasks resulted in underestimating children's logical skills. Verbal classification tasks are more difficult than non-verbal ones, according to Cometa and Eson, because they depend not only on certain logical operations but also on language experience. Thus, the children in Billow's study who were able to comprehend metaphors probably had the logical operations characteristic of the concrete operational stage.

In a different interpretation of the Piagetian position, Cometa and Eson argued that the comprehension of a metaphor such

as "Man is sheep" requires the construction of an intersectional class which consists of the shared attributes of the two distinct classes "man" and "sheep." Intersectional classification is more complex than additive or multiplicative cross-classification, because it requires focusing on a specific subset of the total classification matrix (Inhelder & Piaget, 1964). Accordingly, intersectional classification is not mastered until the later phase of concrete operations. It follows that metaphor comprehension should not emerge until the child reaches the later phase of concrete operations.

To test this hypothesis, Cometa and Eson compared children's (kindergarten to eighth grade) paraphrases and explanations of metaphors with their performance on a battery of non-verbal Piagetian classification tasks. Only the children who performed well on the Piagetian classification tasks paraphrased the metaphors, thus supporting the position that the operation of intersectional classification is a necessary precondition for metaphor interpretation.

The Cometa and Eson and Billow experiments illustrate the kinds of problems encountered when trying to determine how children's abilities in a given domain are related to their cognitive development as measured by their performance in the standard Piagetian tasks. Because the same child's performance may vary widely across different concrete or formal operational tasks, the nature of the correlation between stages of cognitive

development and metaphor comprehension can vary a great deal (Berzonsky, 1971; Jamison, 1977). While such variability is not inconsistent with Piagetian theory, it does make it very difficult to interpret the results of any study that report a relationship between some cognitive ability and performance in a Piagetian task (see Gelman & Baillargeon, 1983, for a further discussion of this point).

The problem of relating metaphor comprehension to a cognitive developmental stage becomes even harder because the kinds of problems that arise in the assessment of concrete or formal operations also arise in the assessment of metaphor comprehension. For example, some have argued (Ortony, Reynolds, & Arter, 1978; Pollio, Barlow, Fine, & Pollio, 1977; Vosniadou & Ortony, in press) that paraphrase and explanation are poor measures of metaphor comprehension because they impose linguistic or metacognitive demands well in excess of those required for metaphor comprehension alone. In a direct test of this claim, Vosniadou and Ortony (in press) showed that six-year-old children were more likely to interpret a metaphor correctly when they acted out its meaning with toys than when they paraphrased it. Children demonstrate a greater understanding of metaphor in multiple-choice tasks than in paraphrase tasks, presumably because the former also impose fewer linguistic and metacognitive demands than the latter. Finally, Pollio and Pollio (1979) obtained different estimates of children's understanding of novel

vs. frozen figures of speech using a multiple-choice task than a production task. As Pollio and Pollio concluded, "a proper understanding of language (figurative and otherwise) can only emerge from a careful analysis of a number of different and theoretical meaningful tasks" (p. 119).

Another problem in interpreting the results of the Cometa and Eson (1978) and Billow (1975) studies has to do with the content of the particular metaphors employed. The metaphors that Cometa and Eson used (such as "Sally is a noodle," "My thoughts are twisted when I wake up," "He couldn't pay attention because his mind was cloudy") required knowledge about psychological states and traits, whereas the metaphors that Billow used (such as "Hair is spaghetti," "The pond is his mirror," "She has pearly teeth") were based on physical/perceptual similarity. Perceptual metaphors have usually been found easier to understand than psychological metaphors (Cicone, Gardner, & Winner, 1981). Thus, by employing easier classification tasks than Billow and less familiar metaphors, Cometa and Eson were able to show that intersectional classification precedes metaphor comprehension.

Similar criticisms apply to the studies of metaphor comprehension conducted outside the Piagetian framework (e.g., Asch & Nerlove, 1960; Winner et al., 1976). Also confounded in these studies was the ability to comprehend metaphorical language with the ability to verbally explain or paraphrase the meaning of a metaphorical statement. Further, the metaphorical sentences

were often presented to children in the absence of a meaningful linguistic or situational context. Lack of an appropriate context can cause comprehension difficulty even in adults (see Gentner, 1977; Ortony, Reynolds, & Arter, 1978; Pollio & Pickens, 1980; Vosniadou, Ortony, Reynolds, & Wilson, 1984 for similar arguments). In contrast, investigators who used tasks and materials more appropriate for the knowledge level of young children moved the evidence for metaphor comprehension prior to age 10. Thus, Reynolds and Ortony (1980) obtained evidence of metaphor comprehension by 7-year-olds in a multiple-choice task in which children read stories containing metaphors and selected the more appropriate of four continuation sentences. Nippold, Leonard, and Kail (1984) demonstrated that 7-year-olds understood proportional and psychological metaphors in a multiple-choice task. Honeck, Sowry, and Voegtle (1978) showed that 7-year-old children could understand proverbs when the proverbs were to be matched to one of two pictures--a non-literal correct interpretation and a foil.

Kogan, Connor, Gross, and Fava (1980) obtained evidence of metaphor comprehension in 7-year-old children using the Metaphoric Triads Task (MTT). This task allows three possible pairings of pictorial stimuli, one of which can be metaphorical. Metaphor comprehension was assessed by counting the number of metaphoric pairings formed. Slight modifications of the MTT task generated better levels of performance from the younger children,

as did exhaustive pairing, feedback on the pretest items, and the provision of verbal labels for each picture triad. Winner, Engel, and Cardner (1980) obtained evidence of metaphor comprehension by 6-year-olds using metaphorical sentences based on physical/perceptual similarity, both in an explication and a multiple-choice task. Keil (1984) showed that 5-year-old children could explicate metaphorical sentences when the items they compared belonged to conceptual domains the children had already distinguished. Malgady (1977) found that 5-year-olds were able to provide adequate explanations of similes based on physical/perceptual similarity (e.g., "The coat is like a shell"), a finding consistent with Billow's (1975). Finally, Vosniadou, Ortony, Reynolds, and Wilson (1984) obtained evidence of metaphor comprehension in 4-year-old children who enacted their metaphor interpretations with toys.

Thus, unlike what was believed a few years ago, the most recent evidence supports the view that the ability to understand metaphorical language emerges well before the age of 10 or 12. Two principal factors contributed to this change. One is the development of better tasks to assess metaphor comprehension, tasks that do not confound metaphor comprehension with lack of background knowledge, metalinguistic skill, ability to comprehend language out of context, and other variables that do not have much to do with metaphoric understanding per se. In this respect, research on the development of metaphoric competence has

followed a trend similar to the development of many other cognitive skills which have also been shown to emerge early on when assessed with familiar materials and simple tasks. The other factor concerns changes in our views regarding preschool children's classification skills which were discussed in the section on production. If young children are capable of forming conventional categories it is plausible that they can intentionally violate these categories or be aware of a category violation when it occurs.

The Development of Metaphoric Understanding

The early emergence of metaphoric understanding does not mean that this development is complete. There is great improvement in children's ability to comprehend figurative language during the elementary school years. Some theorists view this development as a process consisting of two or more stages (Asch & Nerlove, 1960; Cometa & Eson, 1978; Demorest, Silberstein, Gardner, & Winner, 1983; Elkind, 1974; Pollio, Barlow, Fine, & Pollio, 1977; Winner et al., 1976). Usually during the first stage children are thought to interpret figurative language literally. Only after this literal stage are there more sophisticated attempts to interpret metaphorical language.

According to Cometa and Eson (1978), the literal stage is followed by two other "distinct stages": paraphrase and explanation. Paraphrase presupposes functioning at the Piagetian

concrete operational stage, while explanation presupposes functioning at the stage of formal operations. Asch and Nerlove (1960) argue that there are three steps in children's understanding of double-function terms (such as, sweet, hard, bright): first children interpret double-function terms to refer only to concrete objects, then the psychological sense of these words develops as a separate vocabulary item, and finally the realization of their double-function property comes last. Winner et al. (1976) propose four steps in the development of metaphoric understanding (magical, metonymic, primitive metaphoric, and metaphoric), while Demorest, Silberstein, Gardner, and Winner (1983) propose a three-step model. First children fail to recognize the discrepancy between what speakers say and what they mean, thus interpreting figurative language literally. Second, the discrepancy between what is said and what is meant is recognized but children are unable to identify the speaker's purpose. Third, the speaker's intention can finally be understood.

A strict interpretation of the stage view of metaphoric development is inconsistent with the variability observed in the metaphor comprehension ability of the same child (Ackerman, 1984; Keil, 1984; Vosniadou et al., 1984). The same 5-year-old children in Keil's (1984) experiment could adequately explain the meaning of some metaphorical expressions (i.e., "The car was dead") but not others (i.e., "The idea bloomed"). Similarly, the

same 4-year-old children could correctly enact the same metaphorical sentences under some circumstances (more probable contexts, fewer metaphorical substitutions, etc.) but not others in the Vosniadou, et al., 1984 experiments. These findings are inconsistent with a stage view of the development of metaphor comprehension, since such a theory would place these children simultaneously in both the literal and the non-literal stage of metaphor comprehension! Stage accounts of metaphor comprehension do not take into consideration that children's (and adults') ability to understand metaphorical language is influenced by variables such as their prior knowledge, the context in which the metaphor occurs, and the linguistic complexity of the metaphorical input. Therefore, they fail to account for the fact that the same child may be able to understand some metaphors but not others, or understand the same metaphor in some contexts or tasks but not others.

In criticizing the stage theory views of the development of metaphoric understanding we do not mean to ignore the fact that there is a tendency in young children, a tendency that decreases with age, to interpret metaphorical language literally. This may be the case because children's limited knowledge of the world does not help them place adequate boundaries between the possible and the impossible, or the real and the imaginary. Young children are more likely to believe that a prison guard can turn into stone or that sweet people actually taste sweet. In

addition, literal interpretations of metaphors are often influenced by pretend-play. In our experiments children interpreted action metaphors like "The little girl was a bird flying to its nest" to mean that the little girl pretended to act like a bird by flopping her arms up and down. This is not surprising in view of the amount of time preschoolers spend on pretend-play and adds to our previous arguments that pretend play is different from metaphor.

In the most recent psychological literature metaphor comprehension is conceptualized as a continuous process which starts very early and develops gradually to encompass a greater variety of metaphorical linguistic inputs (Ackerman, 1984; Gentner & Stuart, 1983; Johnson, 1983; Keil, 1984; Vosniadou, 1985; Winner, Windmueller, Rosenblatt, Bosco, Best, & Gardner, 1985). The development of metaphor comprehension is constrained primarily by limitations in children's conceptual knowledge, linguistic skill, and information processing ability. That is why one can find evidence of metaphor comprehension in very young children if the metaphors used are simple and if they occur in an appropriate context. What develops, according to this view, is the ability to understand more complex metaphorical inputs in a variety of linguistic and situational contexts.

Variables Affecting the Complexity of the Metaphor Comprehension Task

In any developmental account of metaphor comprehension one must identify some of the critical variables that affect

comprehension and show how these variables interact with the developing abilities of the child. The following discussion will be focused on how the development of metaphor comprehension may be affected by four such specific variables: (a) the linguistic form in which the metaphorical statement is expressed, (b) the linguistic and pragmatic context in which it occurs, (c) the difficulty of the metaphor comprehension task, and (d) the content of the metaphor.

Form. Metaphorical expressions can take on many different linguistic forms, and it appears that some of these forms are easier to understand than others. This may be particularly true for young children whose knowledge of the language is limited. For example, it has been argued (Ortony, 1979; Reynolds & Ortony, 1980) that some of the difficulties young children have with metaphors may arise not from their inability to understand non-literal similarity but from their failure to interpret the predicative statement as an implicit comparison. Similes require the ability to understand non-literal similarity but impose fewer demands on children's linguistic and information processing abilities than metaphors, since they are explicit comparisons. Therefore, similes should be easier for young children to understand than metaphors.

This hypothesis has been supported by some empirical evidence (e.g., Reynolds & Ortony, 1980; Vosniadou et al., 1984) but not by other (Winner, Engel, & Gardner, 1980; Vosniadou &

Ortony, in press). Reynolds and Ortony found that there is an interaction between the form in which a non-literal linguistic input is expressed (i.e., similes vs. metaphors) and age. While children below 6-years-old usually find similes easier to understand than metaphors, this is not necessarily the case for older children.

Winner, Engel, and Gardner (1980) investigated the effect of the form of a metaphorical statement on 6-, 7- and 9-year-old children's performance in an explication task and a multiple-choice task. The same metaphorical sentences were presented in five different forms: (a) predicative metaphors ("The sky writing was a scar marking the sky"), (b) similes ("The sky writing was like a scar marking the sky"), (c) topicless metaphors ("A scar marked the sky"), (d) quasi-analogies ("A scar marks the skin like skywriting marks the sky"), and (e) riddles ("What is like a scar but marks the sky?"). The results supported the hypothesis that linguistic form affects metaphor comprehension. For instance, the riddles were found the easiest of all the forms to explicate, a finding attributed to the fact that the riddle is a more familiar linguistic form, while analogies were easier or as easy to understand than the topicless metaphors, a finding attributed to the explicitness of their metaphorical grounds.

To summarize, it appears that there are certain linguistic factors, such as familiarity with the linguistic form,

explicitness of the metaphoric comparison, explicitness of the metaphorical grounds, which can facilitate metaphor comprehension. Exactly how linguistic form affects metaphor comprehension may differ, however, depending on how it interacts with other factors--such as the age of the children, the metaphor comprehension task, and the content of the metaphor. At this point we know very little about such interactions.

Context. If context plays an important role in the comprehension of literal uses of language, it does even more so in the comprehension of non-literal uses of language. In the latter instance, contextual information is often indispensible to help the reader/listener establish the connection between what is said and what is meant. Context not only can provide a clue to the fact that a given sentence must be interpreted metaphorically (since a literal interpretation would not make sense), it can also provide important information regarding the metaphor's possible meaning. Since young children have limited conceptual and linguistic knowledge, it is natural to assume that they depend heavily on contextual information to interpret metaphorical language. In fact, it may be the case that metaphor comprehension is originally achieved only in situations where the already established context strongly leads to inferences that are consistent with the metaphor's implied meaning.

The role of contextual information on metaphor comprehension has been investigated by Vosniadou et al. (1984) and Ackerman

(1984). In the Vosniadou et al. experiments, children acted out short stories which concluded with a metaphorical sentence, describing more or less predictable outcome given the established context. The predictability of the metaphorical sentences was assessed on the basis of a control group in which children were read the stories without the concluding sentences and acted out their own endings. The more predictable metaphorical sentences were easier to enact than the less predictable ones, confirming the hypothesis that preschool children are capable of using contextual information to draw inferences about a metaphor's possible meaning.

While this research has demonstrated that an appropriate linguistic and situational context can facilitate the comprehension of metaphor, many questions remain unanswered. What are children's abilities to integrate various contextual cues, including both situational and linguistic information and how do they develop? Can young children revise an original interpretation of a metaphor when new and contradictory evidence is presented? Are young children more sensitive to a situational/pragmatic, than a linguistic context? When do children start to understand metaphors in the absence of any contextual information or in the presence of a context that is neutral or inconsistent with respect to the metaphor's meaning? More research is needed to clarify these questions which are relevant not only to a developmental account of metaphor

comprehension but to a developmental account of language comprehension in general.

Difficulty of the comprehension task. Task demands obviously affect our perception of a child's metaphoric competence. Paraphrase and explication are more difficult than multiple-choice tasks or tasks requiring acting out the metaphor's meaning, presumably because they have greater linguistic and metacognitive requirements. The difficulty of a metaphor comprehension task can also increase by the simultaneous addition of variables that may cause comprehension difficulty (such as a less familiar linguistic form, lack of a situational or linguistic context, or a complex metaphorical ground). For example, four-year-olds are capable of understanding predicative metaphors when they occur in a relative probable context but not when they occur in a less probable context. unless the predicative metaphors are changed into similes. Similes are in turn understood in less probable contexts only when one metaphorical substitution is required. Increasing the number of metaphorical substitutions results in comprehension difficulties for four-year-old children (Vosniadou et al., 1984).

What seems to matter, particularly for preschool children, is not any particular source of comprehension difficulty (similes or predicative metaphors, more or less probable contexts, or number of metaphorical substitutions, etc.), but the overall complexity of the metaphor comprehension task as measured by the

combination of difficulty sources. With age, children become able to deal with more complex metaphor comprehension tasks. This could be the result of a developmental change in information processing capacity (Pascual-Leone, 1970) or the result of increased knowledge and improved strategies (Brown, 1978; Chi, 1978).

Content. There is little doubt that the content of a metaphorical statement is an important determiner of comprehension. Both children and adults would find it difficult to understand metaphors that compare items they know little about, although knowledge of the metaphorical vehicle appears to be more important than knowledge of the topic. Metaphors are often used to introduce an unfamiliar concept in terms of a familiar one; in these cases knowledge of the vehicle is, of course, critical for comprehension.

To understand a metaphor children must not only know the words used, they must also have the concepts the words denote, and be aware of the multiplicity of conceptual relations which can form the grounds of a metaphorical statement. Such conceptual knowledge is particularly important for any developmental account of metaphor comprehension. Children not only have fewer concepts than adults but the knowledge of many of the concepts they have may be incomplete or biased.

One of the consistent findings in the metaphor comprehension literature is that young children find metaphors based on

physical/perceptual similarity easier to understand than metaphors based on abstract and complex relations (e.g., Billow, 1975; Gentner & Stuart, 1983), or metaphors that use a physical term to describe a psychological state (e.g., Cicone, Gardner, & Winner, 1981; Winner, Rosenstiel, & Gardner, 1976). This may not be an accidental finding. The physical/perceptual properties of objects are very salient and, in many cases, may constitute the child's only knowledge of the object (see Vosniadou & Ortony, 1983b for a discussion of this issue).

Findings such as these have been interpreted more broadly to indicate that children have difficulty in seeing similarity that holds between relational properties as compared to attributes. This conclusion is not consistent with at least some of the development evidence (e.g., Gentner, 1977; Holyoak, Junn, & Billman, 1984). For example, Gentner (1977) showed that preschoolers can correctly map relations from the domain of the human body to trees or mountains, while Holyoak et al. (1984) demonstrated that preschool children can see similarity between two stories related analogically not only when this similarity is perceptual but also when it is of a structural/relational nature.

Recently, Gentner and Stuart (1983) proposed that while young children have some fundamental competence to make relational mappings, they do not appear to do so consistently for various reasons. They may lack the necessary background knowledge, the ability to do complex mappings, or have a

different aesthetic. According to this view, what develops with age is the child's ability to make consistent relational mappings between domains. This conclusion was supported by an experiment which compared children's (5- and 9-year-old) and adults' interpretations based either on simple attribute properties (i.e., "Pancakes are nickels"), relational properties (i.e., "A camera is a tape recorder"), or both (i.e., "Plant stems are drinking straws"). A strong developmental trend was obtained in the use of relations but not attributes.

As Gentner and Stuart discuss, the results of this experiment are not conclusive because the interpretation task may have underestimated the young child's comprehension of metaphors. Also, the relational metaphors may have placed more requirements on the children's background knowledge than the attribute metaphors. Consider, for example, the metaphor "Plant stems are drinking straws." It is highly debatable whether one should expect a 5-year-old to know that plant stems have liquids running through them, whereas the knowledge that both plant stems and straws are relatively tall and thin is readily available. To test the hypothesis that children have particular difficulty with relational similarity, we need relational and attribute metaphors whose knowledge requirements are comparable.

Some evidence suggests that when the knowledge variable is controlled, relational metaphors are not harder to understand than attribute metaphors. For example, in a recent study, Dent

(1984) showed that 5-, 7- and 10-year-old children found it easier to perceive metaphoric similarity between moving objects (like a ballerina dancing and a top spinning) than between stationary objects (like a curvey river and a curvy snake). Similar results were obtained by Calhoun (1984). Here we interpret actions such as "dancing" and "spinning" to require relational mappings, as they do in Gentner's (1983) structure-mapping theory.

The claim that children may have a capacity to make relational mappings but do not have a propensity to do so is hard to accept because, as Verbrugge (1979) has argued, the perceptual information for events, for linguistic structure, and for coordinated action that young children use to make sense of the world around them is primarily relational. Nevertheless, care must be exercised in defining relational similarity. As Dent (1984) notes, the distinction between perceptual similarity and functional (action) similarity obscures the fact that similarity in action can also be of a perceptual nature; i.e., that one perceives action as one perceives a stationary object. Similarity in relations based on perceptual information may be more salient and, thus, noticed earlier than similarity in relations that are of a conceptual nature and that do not have a perceptual or experiential basis. Again, as was the case with metaphor production, a theory of metaphor comprehension would require that we know what kinds of conceptual distinctions young

children make first, how these conceptual distinctions become differentiated with development, and how conceptual development influences the acquisition of metaphor.

Metaphoric Competence and Conceptual Development

At present we know little about how the development of metaphoric competence is influenced by conceptual development. Some of the relevant research will be described in the pages that follow. It is important to notice, however, that while the child's ability to produce and comprehend metaphors depends critically on what the child already knows, metaphors can also advance and enrich conceptual development itself. The nature of this interaction between conceptual development and metaphoric competence will be explored in this section.

How conceptual knowledge influences the development of metaphoric competence. Keil (1984) attempts to answer the question of how the child's conceptual system influences metaphor comprehension by using the notion of the semantic field (Lehrer, 1978). A semantic field is defined as a cluster of related concepts, and Keil suggests that metaphors involve not two terms in isolation but the interaction of domains or semantic fields. (This notion is similar to a proposal by Tourangeau and Sternberg, 1982, that conceptual domains guide the production and comprehension of metaphor.) Keil advances two specific hypotheses regarding the acquisition of metaphorical understanding: (a) metaphors emerge on a field-by-field basis;

that is, if one member of a semantic field becomes extended metaphorically, so do the other members of the field; and (b) conceptual distinctions that are acquired earlier will be the first ones used by the child in understanding metaphors. For instance, since the distinction between animate and inanimate objects is acquired before that between physical and non-physical objects, animate/inanimate metaphors should be acquired before physical/non-physical metaphors.

Keil (1984) did an experiment in which kindergarten, second- and fourth-grade children explained the meaning of metaphorical sentences from different semantic fields. The results showed that the children who understood one metaphor from a given semantic field tended to understand all the other metaphors in that field. In addition, the order of acquisition of the fields corresponded with the order of acquisition of certain conceptual distinctions noted in earlier work by Keil (1979). As expected, metaphors based on an animate/inaminate distinction were acquired before metaphors based on an animal/human or physical object/non-physical object distinction. It was concluded that "children's ability to comprehend metaphors . . ., develops on a field by field basis, where the order of emergence of these fields is related to other work in conceptual development" (Keil, 1984, p. 9).

A problem with Keil's work is that the concept of semantic field is only vaguely defined. We do not really know what a

semantic field is, how different semantic fields are related to each other, or to other theoretical constructs (e.g., classes, schemas, concepts, theories), and what developmental predictions follow from this distinction. Only a few examples are presented and these map domains with very different internal structures, like the semantic field of "human vocalization" terms (i.e., "whispered," "screamed," "moaned") and the field of animate terms (i.e., "thirsty," "dead," and "tired"), without providing a justification as to why these particular groupings of items form a semantic field. Keil's approach provides some new and creative ideas about how conceptual knowledge might influence metaphor comprehension, but more work is needed to better define the concepts involved and to test their empirical implications.

In another attempt to understand how a child's understanding of metaphor is influenced by the underlying conceptual system, first and third-grade children were read short stories containing an analogy from a more to a less familiar domain (i.e., the healing of an infection was described in terms of winning a war) and answered some questions about them (Vosniadou & Ortony, 1983b). Six types of conceptual relations were identified as possible areas of transfer from the familiar topic to the unfamiliar vehicle: (a) descriptive properties, (b) characteristic activities, (c) emotions and thoughts, (d) structural and functional characteristics, (e) causal properties, and (f) plans and goals. While the children did not make errors

in transferring descriptive properties and characteristic activities, they were willing to attribute human emotions and thoughts to inanimate things. For instance, when the children were told that white blood cells are like soldiers, they did not conclude that the white blood cells wear uniforms, eat breakfast, or use guns. Even the fifth-grade students thought, however, that white blood cells think that germs are bad and feel frightened when they fight them. Since the children did not transfer all possible human characteristics to blood cells but only feelings and thoughts, one may conclude that the children did not lack the human/animal or animate/inanimate distinction altogether (as, for example, Keil may have argued), but only certain aspects of this distinction.

Another interesting finding was that the transfer of properties worked only from the domain of humans to that of animals and blood cells, and not in the other direction. Carey (1985) also reports that there is an asymmetry in young children's attributions of properties to people and animals depending on who they think has these properties. Children under 10-years-old are likely to project that animals have spleens if they are taught that people have them, but do not project that people have spleens if they are taught that dogs or bees have them.

These findings suggest that the process of distinguishing one conceptual domain from another is something that occurs over

a long period of time, with some distinctions mastered well before others. Thus, to understand the development of children's comprehension and production of metaphorical language, we must know not only which conceptual domains are distinguished before others, but also at what level (i.e., descriptive, functional, structural, ideational) and in what direction.

How metaphorical thinking influences the development of conceptual knowledge. Within the framework of Piaget's theory, metaphor has been seen as the product of the imagistic, preconceptual thinking of the preoperational child. According to this view, preschool children think in terms of similarity whereas older children make deductive inferences from category membership (see Piaget, 1962). This view has not been altogether supported by the empirical evidence. Preschool children are sometimes capable of making deductive inferences from category membership when dealing with familiar domains (e.g., Gellman & Markman, 1984; Smith, 1979). Conversely, adults also make inferences on the basis of similarity in many cases. Much of the research on adult human reasoning in recent years has shown that far from operating on the basis of content-free general rules, human reasoning is tied to particular bodies of knowledge and is greatly influenced by the context in which it occurs (e.g., Wason & Johnson-Laird, 1972). Certainly there is enough evidence to show that adults often think in terms of specific cases and vivid experiences (Tversky & Kahneman, 1982), or mental models

(Johnson-Laird, 1983; Gentner & Stevens, 1983), rather than by logical deduction from abstract principles, as Piaget claims (Inhelder & Piaget, 1958).

When knowledge is organized in a procedural, content-dependent system, the problem of knowledge acquisition becomes a formidable one. In an interesting discussion of the problem of learning, Rumelhart and Norman (1981) point out that the process of adding new knowledge to a procedurally based system is enormously more complex than the process of adding new knowledge to a declarative based system. In the latter case the process is simply one of adding a new body of facts and applying the same general inference rules to them. In the former case, however, the inference rules are embedded within specific knowledge domains and it is not at all easy to see how old knowledge can be transferred to a new domain. Rumelhart and Norman argue that what people commonly do is transfer knowledge from one domain to another via analogical types of reasoning, and that metaphor and analogy are important mechanisms for the acquisition of new knowledge. Indeed, metaphors and analogies have received a lot of attention from cognitive scientists, an interest related to the shift from declarative to procedural models of knowledge representations.

This work has important developmental implications. Since children's reasoning has many of the characteristics one would expect from a procedural system, metaphorical thinking may play

an important role in the child's attempts to acquire new knowledge. Indeed, all we know about early conceptual development suggests that children from a very early age are actively relating new information to existing knowledge via analogical types of processes (see Mandler, 1983, for a discussion of this issue). What we are suggesting is that instead of conceptualizing metaphor as the product of the imagistic, preconceptual thinking of the preschool child, we can conceptualize it as the reflection on the linguistic medium of an underlying transfer of knowledge from one conceptual domain to another, similar in kind to the transfer of knowledge taking place in adults. Such a view of metaphor makes a lot of sense particularly in the context of domain-specific theories of conceptual development (Carey, 1985), in which the child is seen to begin knowledge acquisition with a few conceptual domains which are later restructured and differentiated into new ones.

Metaphorical thinking can play an important role in such a process because it allows children to use existing knowledge to understand new phenomena, phenomena which are not quite similar to anything they have experienced before (see Vosniadou & Brewer, 1985). For example, children can use their model of people to understand animals, just like adults use their model of computers to understand the brain--knowing they are not quite the same things but slowly figuring out the full range of their differences. Also, metaphorical thinking can help children

differentiate existing knowledge into new conceptual frameworks. For instance, seeing the body as a machine can provide a new explanatory framework for conceptualizing body functions usually seen by children from a psychological point of view (Carey, 1985).

Viewing metaphor as a vehicle for knowledge acquisition can provide new insights not only about how metaphoric competence develops, but also about cognitive development itself. Future research in the area of metaphor could potentially make significant contributions to cognitive developmental theory by examining more closely the domains children spontaneously use as metaphorical vehicles and topics, the processes whereby the transfer of knowledge is accomplished, and the differentiation and reorganization of existing knowledge that metaphors promote.

Conclusions

It has been argued that the development of both metaphor production and comprehension is a continuous process rather than one characterized by stages and that it is primarily constrained by limitations in children's knowledge and information processing abilities. More specifically, it has been suggested that metaphor production develops out of children's undifferentiated similarity notions which become differentiated into literal and nonliteral similarity judgments as their conceptual knowledge becomes organized in categories similar to those of adults. Similarly, metaphor comprehension starts during the preschool

years, is originally limited to a few metaphorical expressions which occur in predictable linguistic and situational contexts, but develops rapidly to encompass a greater variety of metaphorical domains as children's knowledge and information processing abilities increase.

Finally, it has been suggested that child metaphors are a reflection on the language of an underlying transfer of knowledge from one conceptual domain to another similar to the kind of transfer of knowledge occurring in adults. Such a view of metaphor is consistent with domain-specific theories of conceptual development which claim that children begin by acquiring knowledge in a few domains which is later differentiated or transferred to other domains. Thus, while a complete understanding of how metaphoric competence develops requires an understanding of how conceptual domains develop and become differentiated, the study of the development of metaphoric competence can also enrich our understanding of conceptual development itself. Future research in the area of metaphoric competence would have to say more not only about how metaphor production and comprehension develop but also about the transfer and reorganization of conceptual knowledge that metaphors promote.

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Footnote

[1]One such case is the statement "Chicago is the New York of the Midwest," which appears to be metaphorical although it juxtaposes two items (Chicago and New York) which do not belong to different conventional categories (both are cities). What is really juxtaposed in this metaphor, however, is not "Chicago vs. New York," but "cities of the Midwest vs. cities of the East." That this is true becomes evident if we consider that the statement "Chicago is New York" is meaningless. In order to make a metaphor, the speaker must provide information to the listener about the relevant category which is being violated--in this case, Chicago as a city of the Midwest vs. New York as a city of the East.