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Precursors of Creativity: Metaphor, Symbolic Play and Categorization in Early Childhood

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PRECURSORS OF CREATIVITY: METAPHOR, SYMBOLIC PLAY AND CATEGORIZATION IN EARLY CHILDHOOD

by

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Abstract

PRECURSORS OF CREATIVITY: METAPHOR, SYMBOLIC PLAY AND CATEGORIZATION IN EARLY CHILDHOOD

By

Jay A. Seitz

Advisor: Professor Harry Beilin

Four and 6-year-olds were presented with seven different types of metaphorical relationships in both pictures and words. The core task consisted of a metaphor comprehension task of identical triads (target, nonliteral match, literal match) comprising perceptual/color, perceptual/shape, physiognomic, cross-modal, collectional, psychophysical and taxonomic matches. Children matched items based either on nonliteral similarity or literal contiguity. A series of symbolic play tasks were given to half the subjects at each age group and were hypothesized to facilitate the comprehension of metaphor because of an underlying structural similarity common to systems of reference invoked in both the act of metaphor comprehension and symbolic play. Developmentally, it was hypothesized that younger children would prefer more natural, concrete matches (perceptual, physiognomic and cross-modal) whereas older children would prefer more abstract, socially constructed ones

(psychological-physical and taxonomic) with a transitional group in between (collectional matches). Pictures were hypothesized to facilitate the comprehension of metaphor over words in the younger groups, but a reversal of the trend in the older groups, because of a dual-coding hypothesis. In order to contest the claim that operativity is necessary to comprehend metaphor, the 6-year-old group was divided into two equal groups of pre-operational and concrete-operational children. It was predicted that there would be no significant difference between the two groups.

Results supported three of the major hypotheses, but failed to substantiate the facilitation of metaphor comprehension by symbolic play. Explanations were offered for this finding. For the stage main effect there were no significant differences at the same chronological age except for collectional matches. Consequently, there is little supporting evidence for previous claims for a close link between operativity and the comprehension of metaphor. Pictures facilitated the comprehension of perceptual and collectional matches and words facilitated the comprehension of cross-modal and taxonomic matches. Within age, 4-year-olds did significantly better on picture tasks for perceptual, physiognomic and

collectional matches. However, across age, 6-year-olds did significantly better on all metaphorical types in the linguistic medium and perceptual, collectional and taxonomic picture tasks. Overall, there was a greater mean difference on word tasks over picture tasks for 6-year-olds as compared to 4-year-olds for all seven metaphorical types.

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Table of Contents

List of Tables

Precursors of creativity: Metaphor, symbolic play and categorization in early childhood

I. Introduction: Metaphor & categorization

It has been maintained that metaphoric similarity is a "cross-category phenomenon in which objects and events ordinarily unrelated are brought together by virtue of some shared feature" (Kogan, 1983, p. 656; cf. Tourangeau & Sternberg, 1981), e.g., man and wolf as sharing the properties of ferociousness and aggressiveness. Furthermore, metaphoric similarity or what Ortony refers to as nonliteral similarity[1] (Ortony, 1979) or Gardner and his associates refer to as unconventional categorization (Mendolsohn, Robinson, Gardner, & Winner, 1984; Winner, 1979) has its roots in early perception and action which in development is captured in various symbol systems, typically language (Verbrugge, 1979). Nonliteral similarity or unconventional categorization contrasts with literal similarity or conventional categorization in that the latter is a same-category phenomenon in which there is no violation of category boundaries, e.g., dog and wolf as sharing the properties of canines.[2] Moreover, metaphor is conceptualized as a cognitive process or agency of thought, rather than merely a particular kind

of linguistic embellishment or comparison (e.g., Miall, 1979; Verbrugge, 1977).

Two lines of research bear on the nature of metaphoric thought and categorization. The first is the Bruner, Olver, & Greenfield (1966) set of studies on the development of object sorting proceeding from early perceptual to functional to later taxonomic/nominal groupings, as well as the early studies by Kagen, Moss & Sigel (1963) on styles of conceptualization. The other is the literature on the acquisition of word meaning in very young children. Clark (1973) held the position that early overextensions of words are based on perceptible features of objects including movement, shape, size, and sound although it is more likely that both perceptual and functional bases are involved in children's first word meanings (Blewitt, 1982; Nelson, 1974, 1977a, 1983a). In the metaphor domain Gardner and his associates (Winner, McCarthy, & Gardner, 1980) have shown a developmental progression from metaphors based on action to those based on perceptual to those based on conceptual grounds.

Recent reports on the relation between metaphor and categorization yield conflicting results. One set of studies (e.g., Mendelsohn et al., 1984; Shantiris, 1983) with children from approximately 4 to 7 years of

age show that young children have the categorical flexibility to intentionally violate category boundaries. These studies are distinguished by minimization of metalinguistic and task demands and the use of both verbal and nonverbal materials (e.g., Mendelsohn et al., 1984). Other studies (e.g., Billow, 1975; Cometa & Eson, 1978; Ricco & Overton, 1985) purport to show that operational thought, if not a necessary precursor, is still highly correlated with the understanding of metaphoric similarity although metalinguistic and task demands were appreciably more difficult and based on verbal materials (except for the Billow, 1975 study).

Categorization. There are two issues involved here. One is the role of categorization in human development. It is misleading to claim that "a stable set of conventional categories underlie any literal/non-literal distinction" in order to invoke "the necessity of operational thought for metaphorical thought" (Ricco & Overton, 1985, pp. 1-2) when these categories do not arise, sui generis, at the concrete-operational stage.[3] Eimas et al. (1971) and Bornstein (1981) have shown that young infants possess adult "categories" for both perceiving phonemic boundaries and distinguishing color hues. Eimas et al. (1971) describe "categorical perception" as follows:

"Infants are able to sort acoustic variations of adult phonemes into categories with relatively limited exposure to speech" (p. 306). Infants can also assess auditory and visual synchrony (Spelke, 1981) presumably an incipient cross-category phenomenon, and the case can be made that this kind of inchoate cross-modal understanding is an early instance of "metaphorical mapping" (Wagner, Winner, Cicchetti & Gardner, 1981). Recent work at Harvard Project Zero and by Ortony and his associates (Mendelsohn et al., 1984; Vosniadou & Ortony, 1983) supports the view that while preschoolers' predominant mode of classification is conventional they can intentionally violate category boundaries indicating that they have some rudimentary metaphorical competence. In addition, our own research suggests that children as young as 2 years 10 months attribute physiognomic qualities to photographs of everyday objects, indicating the cross-classification of visual/affective experience, presumably an early harbinger of more sophisticated metaphors to come (Seitz & Bellin, 1985).

Research by Rosch and her colleagues on the categorization of natural objects (Mervis & Rosch, 1981) has shown that young children initially sort objects using basic level categories and later encode categories using superordinate or subordinate

distinctions. As they note, "categorization may be considered one of the most basic functions of living creatures. . . . Without any categorization an organism could not interact profitably with the infinitely distinguishable objects and events it experiences. Therefore even infants should be able to categorize" (Mervis & Rosch, 1981, pp. 89, 94). Insofar as metaphoric production and comprehension has been acknowledged to be a cross-category phenomenon or unconventional categorization it could very well be accessible in some form(s) at very young ages.

Historically, the Aristotelian position is that metaphor is based on similarity, which itself is based on shared category membership (Aristotle, 1967; cf. Tourangeau & Sternberg, 1981). Aristotle (1967) claimed that "making good metaphors depends on perceiving the likeness of things" (p. 61). He asserted (Aristotle, 1909) that "if we wish to adorn, we must take our metaphor from something better in the same class of things . . . the metaphors by which we give names to nameless things, must not be far-fetched, but drawn from things so kindred, and so similar, that the affinity appears at first sight" (p. 149). It seems clear from these passages that Aristotle predicated metaphoric similarity on class membership. This reading is consonant with Hannah Arendt's (1978)

view: "But this similarity, for Aristotle too, is not a similarity present in otherwise dissimilar objects but a similarity of relations as in an analogy" (p. 103). Quine (1969) believes that, "a man's judgements of similarity do and should depend on his theory, on his beliefs; but similarity itself, what the man's judgements purport to be judgements of, purports to be an objective relation in the world" (p. 134). Black (1962), moreover, maintains that metaphor creates the similarity. "It would be more illuminating in some of these cases to say that the metaphor creates the similarity than to say that it formulates some similarity antecedently existing" (p. 37). Goodman (1972) argues that metaphor explains the similarity better than similarity explains the metaphor. Recent reviews suggest that similarity is not a sufficient condition for category membership, e.g., Murphy & Medin (1985). This view is consistent with Bornstein's (1984). He argues that early categories are perceptually based, including intramodal (e.g., color and shape), dimensional (e.g., infants translating from two-dimensional to three-dimensional representations) and cross-modal equivalences. Later categories arise from conceptual equivalence derived from sensory, conceptual or linguistic experience, the latter two rooted in convention. As he says, "the categorization

processes children invoke may be built directly on prior category abilities and are even formally identical to at least one category process they have newly mastered" (p. 333). The gist of the present study is that developmentally early "categories" rest on innate characteristics and later "categories" rest on experience or convention (conceptual or linguistic).

Black (1962, 1977) and Richards (1936) maintain that metaphor is an "interaction" between thoughts of different things which result in an emergent meaning. Ryle (1949) defines metaphor as a "category mistake" as follows: "It represents the facts of mental life as if they belonged to one logical type or category (or range of types or categories) when they actually belong to another" (p. 16). Turbayne (1970) views metaphor as a form of "sort-crossing" in which objects ordinarily in one category are seen in some new or different category. Goodman (1976) proposes that metaphor is a "calculated category mistake" in which a term with an extension established by habit is applied elsewhere under the influence of that habit. There is thus, general agreement that metaphor involves an alteration of certain conventional categorizations or systems of concepts.

Consequently, the claim that knowledge of class inclusion or intersectional classification is necessary

for the production and comprehension of metaphor appears to be too strong a claim to impose on the process of creating and comprehending metaphors.[4] Of course, older children will be better able to explain the basis of a metaphor--particularly in the linguistic mode--where they have a significant edge in both real-world knowledge and verbal facility. However, even adults have difficulty explaining the basis of some common metaphors and proverbs (e.g., Richardson & Church, 1959, p.176). It follows then that children of the same age regardless of "operational level", should show equivalent performance on a task of metaphoric comprehension.

Picture superiority effect. The second issue is the putative "picture superiority effect" in which pictures have been found to facilitate children's performance over words in paired-associate learning, discrimination learning and recognition tasks (Reznick, 1977). Kogan and Chadrow (1986), however, did not find a pictorial advantage over verbal materials in a study of metaphoric comprehension in 2nd and 5th graders, although the children were significantly older, ranging from 7 1/2 to 10 years and 7 months. Although it could be argued that when words appear in sentences and paragraphs comprehension is facilitated, the same could be expected of pictures (e.g., Dent, 1984). The issue

is really whether pictures, because they capitalize on the "primacy of the visual image" (Gombrich, 1982) in our experience, are by their very nature easier to comprehend. Research generally supports the view that some forms of pictorial recognition indicate an unlearned ability (Dirks & Gibson, 1979; Hochberg & Brooks, 1962). Retention of pictorial materials by preschoolers is comparable to that of adults and the ability to process pictorial materials nonverbally develops rapidly (Reznick, 1977, p. 159). Covert verbalization procedures (labeling and/or rehearsing) have been advanced to explain the picture superiority effect, but because they rely on language facility, their effect would be expected to develop during the later preschool/school age years (5 to 7 years approximately). Younger children would suffer from production deficiencies in which there would be a failure to produce linguistic mediators in order to process pictorial information (Flavell, 1971). The assumption follows that younger preschool children use only iconic/imaginal codes in processing pictorial information but by 6 or 7 years an independent verbal channel emerges with its own verbal codes (Reznick, 1977, p. 159). Therefore during the preschool period the younger child (approximately 3 to 4 years of age) will not be able to use verbal codes in processing

pictorial material whereas the older preschool child, according to Reznick, will have begun to integrate the verbal and iconic channels leading to superior performance on picture/word tasks.[5] Honeck, Sowry & Voegtle (1978) found that in 7 to 9-year-olds, thematic pictures facilitated comprehension of proverbs suggesting the increasing integration of these two channels. Moreover, Reznick's formulation is consonant with Paivio's (1979) dual-coding approach. Paivio claims that pictures and concrete words are more easily recalled and make for efficient information storage because they are multimodal, i.e., provide both visual and verbal storage, and because they both possess high imageability and are redintegrative (access to one part accesses the whole). They should, therefore, provide an additional subjective, referential context and thus aid comprehension.

It follows that in a metaphor task in which pictorial and verbal materials are equivalent, younger children should show a picture superiority effect and should do better on a picture metaphor task than on a verbal task of metaphoric comprehension. In older children the picture superiority effect should increase, but because knowledge stores are both multimodal and redintegrative, there should be little difference in performance on the two tasks. It was

predicted that (1) younger children would perform better on a visual metaphor task and (2) older children would outperform their younger counterparts on both a visual and verbal task of metaphoric comprehension but to a greater extent on the verbal task.

Notes

[1]Ortony proposes that "metaphoricity" requires that high salient features of the vehicle are linked to nonsalient salient features of the tenor. An asymmetry is invoked between the predicate (vehicle) and the subject (topic or tenor). The predicate is then able to organize the meaning of the subject in new ways. Only in perceptually grounded metaphors (see text) does there appear to be a more symmetrical relationship between the predicate and the subject, i.e., little, if any, salience imbalance. Comparing a pickle to a nose does not lose its force by reversing the terms of comparison.

[2]The use of the terms "literal" and "nonliteral" is expressed clearly in Barfield's (1960) dichotomization: "We call a sentence 'literal' when it means what it affirms on the face of it, and nothing else. If some sentences are not literal, that is because it is possible, by recognized usage, to affirm one thing and to mean another thing, either instead of or as well as the first . . . that is, to sentences which convey a secondary meaning, while still in some measure retaining the primary, or literal, one (I will call this 'concomitant meaning'), we have already crossed the frontier between prose and poetry" (p. 48). Lakoff distinguishes 4 kinds of literality of which the above would be categorized as "nonmetaphorical literality." For an extended discussion see Lakoff (1986). Marschark & Nall (1985) claim that it is difficult to determine exactly what is nonliteral from the child's point of view. This conservative position, however, is unwarranted, raising a red herring and failing to consider either the formal criteria advanced by Winner (1979) or the nature of the interaction between the literal and the metaphoric "worlds" (e.g, Lakoff & Johnson, 1980) essential to cognitive development.

[3]As Vosniadou & Ortony (1983) note, the real question--if metaphor is defined in terms of nonliteral similarity--is whether the child can distinguish literal from nonliteral similarity, rather than does s/he have complete knowledge of class-inclusion and hierarchical ordering.

[4]These claims have generally been made only within the context of linguistic metaphors presented to children. Consider Spence's argument (Spence, 1982) that language so fractionates thought by requiring a

translation to a secondary code largely cultural in nature that it would underrepresent the phenomenological experience of the analysand and, mutatis mutandis, of the child too.

[5]Part of the picture superiority effect is predicated on the fact that children start reading at a significantly later age than they begin speaking. Considered as a symbol system, written language "piggybacks" on the symbol system of spoken language.

Ia. Metaphor tasks

Picture/word tasks. The present study addressed the two claims discussed above, i.e., the categorization issue and the picture superiority effect by presenting children at 2 age levels (4-year-olds and 6-year-olds) two metaphoric comprehension tasks (MCT), one in pictures and one in words, in which, as much as possible, near-identical content was maintained. Both tasks consisted of a series of 3 sets of pictures or words in which there were 2 pairing possibilities, one of which was metaphoric. For instance, one triad included the items "unfriendly man," "rock" and "shoes" (in either pictures or words) and the child was required to connect and explain the nonliteral pair. Children were assigned to either the picture ($subtask_1$) or word ($subtask_2$) condition. This type of method has been used in a number of studies (Kogan, Conner, Gross, & Fava, 1980; Morison & Gardner, 1978; Ricco & Overton, 1985; Vosniadou & Ortony, 1983). In all cases the topic, e.g., "unfriendly man," had a picture/word item that was related by literal contiguity, e.g., "shoes" (as a part of clothing) and one by nonliteral similarity, e.g., "rock" (as in comparing an unfriendly man to a rock). The child matched in either case using an associative or metaphoric relation but the defining criteria were

based on the child's explanation for the match. Since contiguity can also be categorized as syntagmatic or metonymic, and nonliteral similarity as paradigmatic or metaphoric (cf. Jakobson, 1981; Nelson, 1977b, Winner, McCarthy, & Gardner, 1980), the ways children categorize principally revolved around these two defining dimensions.

Conservation/Classification tasks. To test the claim that operational thought is necessary for metaphoric comprehension, children in the older age group were given a series of conservation tasks (CT), i.e., conservation of liquid and solid quantities, and a classification task (class inclusion) prior to the MCT tasks and were assigned to one of two groups: preoperational (PO) or concrete- operational (CO). The two groups did not differ significantly in age and every effort was made to draw children from the normal IQ range, insofar as test data were available from school records. This was necessary because previous research suggests a substantial correlation between IQ and Piagetian tasks (Humphreys, Rich, & Davey, 1985) and between IQ and metaphoric comprehension (Seitz & Bellin, 1985). The older age groups were treated identically to the younger age group: they were assigned to either the picture or word condition and were expected to pair the stimuli.

Class inclusion task. A class inclusion task was included with the conservation tasks because H_1 claims that "operativity" is not necessary for metaphor comprehension and class inclusion is a strong measure of classification skills, i.e., children must maintain the whole class in mind while simultaneously attending to its subclasses. Note that Inhelder and Piaget (1969) define "class inclusion" as "the conditions of 'class inclusion' are satisfied if and only if the following propositions both obtain: (1) All A are some B; (2) A < B" (p. 8).

Metaphorical types. Since metaphor has been defined as a cross-category phenonemon (section I) it was necessary to address: (1) what kinds of metaphoric categories are most natural in the child's native experience and (2) what categories arise in the child's development that are more socially constructed. The bulk of the empirical evidence points to early metaphors uttered by children arising from the perceptual attributes of objects, predominantly color and shape. This preference is not limited to metaphor, e.g., Suchman & Trabasso (1966), as it occurs in symbolic play or other event/action contexts (e.g., Gardner, 1974; Gardner, Winner, Bechhofer & Wolf, 1978; Verbrugge, 1979; Winner, 1979; Winner, McCarthy, Kleinman & Gardner, 1979; Winner, Wapner, Cicone &

Gardner, 1979). Therefore, natural candidates for early metaphors would be those that rest on nonliteral similarity predicated on the perceptual features of color and shape. This category does not exhaust the possibilities, however. Another early class of metaphors includes those that arise from the "physiognomic" qualities of animate and inanimate objects based on the cross-classification of physiognomic-affective experience (e.g., Kogan et al., 1980; Seitz & Bellin, 1985; Werner, 1948, 1956; Werner & Kaplan, 1984; E. Winner, personal communication, October, 1985).[1] Support for this "innate" category rests additionally on two lines of research. Children as young as 3 years can differentiate between animate and inanimate objects (Bullock, 1985; Dolgin & Behrend, 1984) and at an earlier age than previously presumed (Piaget, 1960). Moreover, infants evidence a "social" smile as early as 21 days (Meltzoff & Moore, 1977) and can discriminate a range of emotions in adult human faces which undergoes development in the first 2 years (e.g., Izard, Huebner, Risser, McGinnes & Dougherty, 1980; Stern, 1985). These presumably early physiognomic experiences may foreshadow Asch's psychological-physical adjectives which appear to be employed as metaphors during the later school years (Asch, 1952, 1958; Asch & Nerlove, 1960).

Prior to this age, however, Winner, Rosenstiel & Gardner (1976) note that cross-modal cross-classifications of experience or synesthetic metaphors (Gardner, 1974; Kogan et al., 1980; Osgood, 1960) prove easier to comprehend than psychological-physical metaphors. Support for synesthesia as a "innate" category comes from infant studies. Infants possess some competence for assessing the similarity of experience arising simultaneously in two sensory modalities (e.g., Meltzoff & Borton, 1979; Spelke, 1976, 1981; Stern, 1985; Stern, Hofer, Haft & Dore, in press; Starkey, Spelke & Gelman, 1983) and appears to have important implications for socioemotional development (Stern et al., in press) in spite of previous claims for amodality in infancy (Bower, 1982; Werner, 1948). Neurophysiological evidence also shows the importance of the cross-modal zones in the cerebral cortex for integrating sensory information from different modalities (e.g., Geschwind, 1964). Moreover, the cross-modal zones do not develop completely in other infra-human primates. These categories (perceptual: color/shape, physiognomic-affective & cross-modal) should be easiest and most accessible to metaphorical presentation in young children. Vosniadou & Ortony (1983) present evidence suggesting that children 3-years-old are only capable of

undifferentiated similarity distinguishing it from anomaly. By the age of 4 years, however, it becomes differentiated into literal (conventional) and nonliteral (unconventional) similarity. Metaphorical comparisons initially rest on descriptive or perceptual properties with later comparisons of a more abstract or relational nature, the latter allowing more differentiated salience levels (see note one). They speculate that familiarity, perceptual and functional salience, and nonverbal tasks may enable children to differentiate between literal and metaphorical comparisons at an earlier age.

Later metaphors, socially constructed, would reflect 3 classes of experience: psychological-physical, taxonomic and collectional. The first two appear to be the most difficult for children. As noted previously (Winner et al., 1976), young children are not as adept at comprehending psychological-physical metaphors. Cicone, Gardner and Winner (1981) found that the difficulty appears to be related not to the lack of knowledge of the psychological domain, but the inability to link two, apparently, inordinately disparate domains. Tourangeau and Sternberg (1981) claim that it is not simply "domain incongruence" (Ortony, 1979) that implicates nonliteral similarity or that features must be literally shared (Black, 1962),

since in comparing a person to a rock a person is not literally "hard." Rather, it is the relative position of the comparison within the respective domains of (as in the example above) emotionality and physicality that contributes to the comprehension of a metaphor. This presents a substantial difficulty for young children because it involves an abstract relation between two classes, including a knowledge of the class members (extensional criteria) and the class attributes (intensional criteria). This is appreciably more abstract than a perceptually grounded metaphor. Taxonomic organization, i.e., relying on shared superordinate categories, would also reflect an abstract relation between two items in the same category based on shared conceptual features. Psychological-physical metaphors involve taxonomic relationships that invoke different categories. They are a special case of a more general category of taxonomic metaphors that involve shared conceptual relationships between different superordinate categories, e.g., comparing a violin to a singing canary (Kogan et al., 1980). Tversky (1985) observes a shift toward a taxonomic basis for organization in both named and pictured objects in children from 3 to 8 years of age. Although there is no modality effect, pictures facilitated articulation of perceptual

justifications. However, a modality effect cannot be ruled out since only simple line drawings were used. Moreover, Tversky was not testing for children's comprehension of metaphorical relationships where media of presentation may play a more crucial role in highlighting similarity.[2]

A shift from perceptually grounded to more conceptually organized metaphors may involve an intermediate step, that of collections, based on a relational organization of people, objects and things (Markman, 1983; see section III). This relational organization involves a class of metaphors termed collectional because they reflect more literal part-whole relations, as distinct from class inclusion relations, and provide greater psychological coherence than do taxonomic organizations. They thus bridge the gap between perceptually grounded metaphors and higher-order taxonomic organizations. An example is a comparison between a group of marching men and a flock of birds or comparing a family relationship to a collection of blocks.

The categories of psychological-physical, taxonomic and collectional metaphors are considered to be socially constructed because they rely extensively, inter alia, on linguistic facility and real-world knowledge. They reflect the development of higher-

order psychological processes that have deep roots in the physical and social environment (e.g., Cole & Scribner, 1974; Piaget, 1966; Scribner & Cole, 1981; Vygotsky, 1962; Vygotsky, 1978; Vygotsky, 1985).

In summary, there were seven different metaphorical types. Perceptual matches were based primarily on color and shape. For instance, a child might compare a cherry lollipop to a frying pan (shape) or to blood (color). Here the child is specifying a similarity between two objects that on the surface would appear to have little in common. The similarity or "ground" for the match is based on nonliteral features of shape or color rather than literal features, such as comparing a cherry lollipop to an orange one. Cross-modal or synesthetic metaphors cross-classified sensory modalities as in comparing a sound to a smell or visual experience to a touch, e.g., "the smell of her perfume was bright sunshine." Physiognomic matches involved comparing emotional qualities to inanimate and animate objects, as in saying that a pretzel looks like a human face that is smiling. Collectional matches involved the use of a collective noun to compare a group of objects as in the case of a child comparing a "family" relationship to a collection of dolls or blocks, e.g., "this is the daddy, this is the mommy and these are the babies."

Psychological-physical matches compared a physical aspect of an object to a psychological characteristic or mental state of a person, e.g., "he was as hard as a rock." Taxonomic matches involved comparing an abstract property of two different things, where there is no physical resemblance between the two things, e.g., comparing a violin to a singing canary.

Metaphor type tasks. Children were presented with 19 triads of pictures or words in which each kind of metaphorical relationship was depicted or described in groups of three triads (except perceptual matches which included two triads each): perceptual (color/shape), physiognomic, cross-modal, collectional, taxonomic and psychological- physical. Independent adult judges were recruited to provide reliability in categorizing the items. Items were constructed along the lines of Kogan et al. (1980) with extensive modifications for young children and either generated afresh or drawn from a variety of sources (Billow, 1975; Chukovsky, 1963; Cicone, Gardner & Winner, 1981; Fainsilber & Kogan, 1984; Gardner, 1974; Gardner & Winner, 1982; Gardner, Winner, Bechhofer & Wolf, 1978; Gardner & Wolf, 1983; Kogan et al., 1980; Mendelsohn et al., 1984; Silberstein, Gardner, Phelps & Winner, 1982; Verbrugge & McCarrell, 1977; Vosniadou & Ortony, 1983; Winner, 1979; Winner,

Engel & Gardner, 1980; Winner, McCarthy & Gardner, 1980; Winner, McCarthy, Kleinman & Gardner, 1979; Winner, Rosentiel & Gardner, 1976).

In constructing psychological-physical metaphors chronological word norms for emotion words were derived from Ridgeway, Waters and Kuczaj (1985). Only basic-level terms in the top 75 of the list were used. It was hypothesized that a developmental pattern would emerge proceeding from metaphoric extensions based on perceptual/cross-modal/physiognomic qualities to collectional to taxonomic/psychological-physical relations. Because cross-modal metaphors were presented in the visual and verbal modalities rather than in the modalities of interest (visual-olfactory, auditory-haptic, and olfactory-auditory) they should be more difficult than perceptual and physiognomic metaphors. Therefore, among the "innate" categories, cross-modal metaphors were predicted to be more difficult for younger children and would approach in difficulty collectional metaphors.

Notes

[1]Kogan et al. (1980) define physiognomic perception as "the fusion of postural-affective states and objectively 'neutral' stimuli (e.g., the attribution of emotional properties to line patterns)" (p. 1). E. Winner, personal communication, October, 1985, suggests that the definition of physiognomic metaphor be limited to inanimate objects. The problem with this, however, is that it may play a greater role in the ability, ostensibly starting in infancy, to learn to read facial and bodily expressions of emotions. While some rigor may be gained by limiting the definition, more is lost in narrowing the range of the phenomenon.

[2]A recent study reports evidence against a shift to a taxonomic preference and instead a preference for complementary pairings in the age range 3 to 15 years (Greenfield & Scott, 1986). There are a number of problems with this study, however. For one, asking questions like "Where do you put this?" and "Why do the _____ and _____ go together?" favors a literal (in their terms, complementary) response. We have found a clear preference (during piloting) for literal matches with questions that include "go together" and "go with," whereas with "like," "look like," and "alike" a definite preference for nonliteral matches is evidenced. When asked for a literal match ("go together") children will pair on the basis of high association.

II. Symbolic play and metaphor

Symbolic functioning in childhood, in one view, has been argued to be a unitary phenomenon (Piaget, 1962, 1969) and pretend behavior to mark the beginning of representational thought and the emergence of the semiotic function (Fein, 1981). Gardner (1983) argues, however, for domain specificity in symbolic development at least in some areas (e.g., music & language), but recognizes the importance of the advent of pretense (Morison & Gardner, 1978). The relation of pretend behavior to various cognitive domains has been investigated in language (e.g., Hudson & Nelson, 1984; Shore, O'Connell, & Bates, 1984) in symbolic transformation of objects (e.g., Ungerer, Zelazo, Kearsley, & O'Leary, 1981) and in conservation tasks (e.g., Golomb & Cornelius, 1977). Other studies have reported the effects of different kinds of play on problem-solving skill (e.g., Sylva, Bruner & Genova, 1976) and divergent-thinking indices (e.g., Dansky & Silverman, 1973; Feitelson & Ross, 1973). To quote Vandenberg (1980, p. 64), "play seems to develop a more generalized attitude and/or schema which predisposes the individual to creating and using novelty."

There is little or no direct evidence on the relation between symbolic play and metaphor comprehension. Ungerer et al. (1981) stress that

action and perceptual cues are important in young children's use of symbols in play in object-substitution tasks and parallel both early word acquistion in which perceptual features are given heightened saliency (as discussed above in section I) as well as developmental studies of metaphor in which metaphors based on perceptual grounds increase with age (Winner, 1979; Winner et al., 1979; as discussed above in section I). Golomb claims (Golomb & Cornelius, 1977; Golomb & Bonen, 1981) that underlying symbolic play and conservation are similar cognitive structures as advanced by Piaget, namely, reversible mental operations, the hallmark of concrete-operational thought. She maintains, however, that primitive forms of the reversible mental operations of identity, inversion and compensation are available to the preoperational child. Pretend play also utilizes these operations within the two dual reference systems, reality and make-believe, which are coordinated via reversible mental operations: they "(a) maintain the enduring identity of objects and roles, (b) regulate the compensatory relations which exist between the adopted and the real identities and, finally, (c) cancel the pretend transformations at the end of the game" (Golumb & Bonen, 1981, p. 140).

The second part of the present study makes the claim that in the act of understanding a metaphorical relation between two things, a dual system of reference is invoked between literal similarity (the "world" of reality[1]) and nonliteral similarity (the "world" of the metaphor). Support for this claim comes from Ricoeur's (1978) theory of metaphor in which understanding metaphor is based on suspension of reference to the everyday world, what is termed non-ostensive reference, in order to make possible a new creative reference, a "remaking" of reality. It was proposed, therefore, that cognitive operations that appear in primitive form prior to operational thought enable the expression of metaphoric comprehension prior to the concrete-operational period.

Notes

[1]"World" is roughly translated, according to Black's (1962) notion of a "system of associated commonplaces"; see Black (1977) and Ricoeur (1981) for further discussion.

III. Symbolic play and categorization

Vygotsky (1966) maintains that symbolic play is a leading factor in development. It operates in the following way. In symbolic play, the symbol (denotatum), acts as a "pivot" for severing the meaning of something (i.e., its sense or intension) from its referent (i.e., its reference group or extension). Early in development, since perception and action are inextricably intertwined (cf. Michotte, 1950) the pivot/symbol is functionally and perceptually similar to its referent. In Vygotsky's words, thought is inseparable from the real situation, e.g., a stuffed horse will stand in place of a real horse. Later in development a stick may stand in place of or be used as a horse. The pivot/symbol is a creation of the child's imagination enabling him with the aid of symbols to go beyond immediate reality. This symbolic relationship holds as well for actions as it does for objects (including presumably pictures) and words (Vygotsky, 1966, p. 14). Since the pivot/symbol functions to tie an incipient reference class of actions/objects/words to a meaning/sense, it represents an early development of categorization that goes beyond the immediately perceived to a level of symbolic thought (cf. Piaget, 1962). Recent research supports this position (see

Rubin, Fein & Vandenberg, 1983, pp. 716-728 for a review of the evidence).

Subsequent to the development of symbolic thought, preschool children begin to notice relations that exist between objects based on extensional criteria that Markman (1983) has termed "collections" after Piaget (Inhelder & Piaget, 1969). As she notes, "collections are similar to events or themes that also have relational organization" (p. 168), and therefore are presumably easier for preschool children to comprehend (cf. Nelson, 1981). They have more literal part-whole relations than classes (Inhelder & Piaget, 1969) and greater psychological coherence. For example, the collective noun 'family' has a strong psychological meaning for the child since it coheres naturally as a unit. This is because collections rely more on contextual information than abstract relations of a formal category that would depend on class-inclusion relations (Inhelder & Piaget, 1969). This last development would signal movement into a later period, i.e., the concrete-operational stage, and the eventual development of intersectional classification (Cometa & Eson, 1978; Inhelder & Piaget, 1958).

Markman (1984) defines collections as the "referents of collective nouns" (p. 388). They would include, for example, forest, pile, family, because

they are structured into part-whole hierarchies, e.g., a tree is part of a forest, a block is part of a pile, a child is part of a family. Collections are simpler hierarchies than class inclusion because the part-whole relations are more manifest. At times, Markman has argued as though the understanding of collections and classes is mediated through language. That is, a syntactic frame distinguishes the "part of" relation of a collection (as in "the child is part of the family") from the "is a" relation of class inclusion (as in "the dog is a kind of animal"). In the latter, the mutual exclusivity of subordinate and superordinate classes is maintained, i.e., the dog is a dog but also is an animal. In the former, the child is a child but part of a family, i.e., mutual exclusivity is not maintained. At other times, a syntactic frame is not provided (Markman, 1984, p. 390). For instance, the word "class" is substituted for "children" in "Here are some kindergarten _____." The present study argues that an explicit syntactic frame is not necessarily needed because the collectional nature of the materials is already implicit in the referents of the collective nouns (pictures and words).

Thus, during late infancy and the preschool years, symbolic play may lie at the very heart of the child's developing ability to categorize the world. Winner

(1979) and Ungerer et al. (1981) argue that early metaphors arise out of symbolic play object transformations and one would presume social and other uses to which symbolic play is put by young children (cf. Billow, 1981; Rubin, Fein & Vandenberg, 1983). At a later stage, metaphoric extensions uttered by the child would begin to reflect the collective nature of their categories as a result of greater psychological coherence, more literal part-whole relations and the use of more contextual information. In this regard Hadley (1983) demonstrates that younger children need more contextual support in their figurative assertions than older children. At some point, presumably the concrete-operational stage, metaphoric overextensions would begin to reflect class-inclusion relations or higher-order taxonomic relationships. The evidence for this last development is twofold. One is the claim that so-called proportional metaphors where four or more elements are compared, such as "my head is an apple without a core" (head:apple::brain:core), and "spring is a lady in a new coat" turn on an analogical relationship between two reference classes that reflect higher-order abstract relations. As such they would presumably be too difficult for preschool children to fully comprehend although some have claimed, probably erroneously, that they cannot be comprehended until the

formal-operational stage (cf. Billow, 1975). Understanding may of course turn, inter alia, on the requirements of linguistic facility and real-world knowledge. Billow (1975) and Richardson & Church (1959) have found that virtually no proverbs are solved by children younger than 11 years of age. This contradicts a more recent study wherein 7 to 9-year-olds showed above-chance comprehension across subjects, ages and proverbs (Honeck, Sowry & Voegtle, 1978). To minimize linguistic and real-world knowledge demands subjects were required to match each proverb against two thematic pictures, one a nonliteral correct interpretation and the other a foil.

It is evident that school-age children cannot interpret proverbs in linguistic isolation as some, but probably not all, adults are able to do. However, pictures facilitated comprehension. Moreover, proverbs like proportional metaphors seem to draw on analogical relationships between disparate reference classes that reflect hierarchical and abstract relations, e.g., "even a strong man won't go into a tiger's cage" and "a small fan can't blow away a big fog." These would await the advent of the understanding of class-inclusion relations, not formal-operational reasoning.

Overall, the evidence suggests that early metaphors arise out of symbolic play, in which a

pivot/symbol functions to tie an incipient reference class of objects to a meaning. This meaning is then extended to collections of objects via a metaphor, as in the case of a child comparing a "family" relationship to a collection of dolls or blocks, e.g., "this is the daddy, this is the mommy and these are the babies." Finally, children are able to understand the relationships of more disparate reference classes of objects that have more abstract relations presumably of a hierarchical and class-inclusion kind.

IIIa. Symbolic play tasks

In order to test the claim of a relation between metaphor comprehension and symbolic play, the MCT tasks were supplemented by symbolic play tasks (SPT). There were two task conditions. In condition 1 (SPT_1), a series of symbolic play tasks adapted from Golomb & Cornelius (1977) and Golomb and Bonen (1981), both "child-initiated" and "adult-initiated", were given to half of the subjects at each age followed by the metaphor tasks with a short break in between. In the "child-initiated" part, the child was asked to teach the adult (the experimenter) a make-believe game. During the game and at the conclusion, the child was asked a series of questions in order to fix the child's attention on the make-believe aspects and to elicit a verbal account from the child for the pretend transformation:

> The questions were designed to elicit a verbal account of the pretend transformation as proceeded from the child's or the object's original identity to a make-believe one and returned to the original identity. The child's dual role in pretense and/or the dual nature of the object in pretense were focused upon, and the child was actively encouraged to explain his or her behaviors and thoughts regarding pretend

> play. Thus, for example, the child who used a shoe box to represent an airplane, might explain that the box can be an airplane as well as a shoe box, that it becomes an airplane for the sake of the game, when you pretend it to be a plane, that it really is only a box and that it becomes a box again once the game is over (Golomb & Bonen, pp. 146-147).

The probe questions were open-ended depending upon the child's use of the materials at hand and his or her responses to the probes. There was no rule-governed procedure on the use of these "ad hoc" probes except insofar as they exemplified the flavor of the procedure quoted above. In the "adult-initiated" part, an adult engaged the child in pretense but then "plays dumb" in order to inquire of the child how the play object could be two different things at once, i.e., itself and a make-believe thing. For example (Golomb & Cornelius, 1977):

> The subject was asked to pick a "kitten" from an array of objects (two stuffed forms, a pan scrubber, a sponge, a furry hat) in a "pet store." Once the selection was made, the examiner turned away to get a bed for the pet and on returning asked for the kitten, only to exclaim that the child had nothing but a sponge

(or stuffed form, etc.) in his/her hand. (p. 249)

In both the child-initiated and the adult-initiated parts the child is prompted to explain both the symbolic function and its reversible nature. Appropriate play materials were provided.

In condition 2 (SPT_2), the other half of subjects were given a colored, plastic form board prior to the MCT tasks. The material was chosen because it involves manipulating physical objects and thus would not interfere with the MCT tasks. It was hypothesized that symbolic play would "facilitate" metaphor comprehension because of an underlying structural similarity common to both, irrespective of the operational level of the child.

Semantic analysis. Since in piloting, children in the symbolic play condition would often respond to the materials with the use of the words "real," "pretend," "make-believe" and "fake," a semantic analysis was made of the four words using a procedure modified from Carey (1985). Equal groups of 4- and 6-year-olds were asked the meaning of the word and then to name some things that corresponded to the word. The justification for this additional analysis was to adumbrate children's understanding of the word

"pretend" and thus the symbolic function of the game, given that the experimenter used the word in a symbolic context.

IV. Major hypotheses of study

H_1: "Operativity" should not contribute significantly to the comprehension of metaphor. Preoperational children in the older group should show no significant disadvantage on either of the MCT subtasks in comparison to performance by operational children. Overall, there should be an age effect with the older groups making more metaphoric matches.

H_2: Visual metaphor tasks should prove easier to comprehend at least for younger children. In the MCT tasks, the picture subtask should "facilitate" comprehension in the younger group, but there should be a greater effect as a function of age than medium.

H_3: Younger children should prefer natural, concrete matches whereas older children should prefer more abstract, socially constructed ones. Developmentally, MCT tasks should reflect a trend proceeding from metaphoric extensions based on perceptual/physiognomic qualities to cross-modal to collectional to taxonomic/psychological-physical relations. That is, children should initially violate category boundaries from an innate sense of similarity, with an increasing ability, with age, to violate category boundaries that rely on learning and the rejection of conventions.

H_4: "Training" in symbolic play should lead to increasing ability to understand metaphor. SPT tasks should "facilitate" performance on both MCT subtasks but should differentially affect the younger group to a greater extent than the older groups.

V. Method

A. Subjects

Subjects consisted of 60 4-year-olds (4 to 4.11 years) and 100 6-year-olds (6 to 6.11 years). They were recruited from day care centers, private and public schools in Manhattan. Only children with a signed parental consent form and who spoke English as their first language were used.

B. Design

The overall design called for 160 subjects. Forty 4-year-olds and 80 6-year-olds plus 40 additional subjects for the word recognition task, semantic features task and semantic analysis. Half of the 4-year-olds received the symbolic play tasks (20 subjects) while the other half received the constructive play tasks. Half of each of these groups (10 subjects each) received the metaphor tasks in either pictures or words. The 6-year-olds were initially divided into two groups (40 subjects each) according to their performance on the conservation and classification pretests. Half received the symbolic play tasks (20 subjects each) while the other half received the constructive play tasks. Half of each of these groups (10 subjects each) received the metaphor tasks in either pictures or words.

A summary of the tasks to follow is presented in Table 1 below.

Table 1

Glossary of tasks

Metaphor Tasks

A task of metaphoric comprehension presented both in pictures and words in a triads procedure (target, nonliteral match, literal match). A literal match was based on contiguity whereas a nonliteral match was based on similarity (see text above). All principal analyses were based on the nonliteral matches.

Conservation/Classification Tasks

Conservation of liquid quantity (colored water).

Conservation of solid quantity (playdough).

Class inclusion (colored plastic objects).

Symbolic Play Tasks

5 make-believe games both child-initiated and adult-initiated. A "neutral" constructive play task.

Semantic Features Task

A series of questions about the metaphor task items designed to assess the ecological validity of the items, i.e., the children's real-world knowledge.

Word Recognition Task

A task designed to assess children's knowledge of the words presented in the metaphor tasks, i.e., their level of verbal ability as regards these items.

Semantic Analysis

An analysis of 4- and 6-year-olds use of the words "real," "pretend," "make-believe" and "fake," i.e., their meanings and referents.

D. Metaphor tasks

Materials. There were 19 triads. Each picture or word was drawn or printed on 12.5 cm (4.9 in.) by 17.5 cm (6.8 in.) heavy art supply cards. Words were generated on an Apple Macintosh PC, centered, boldface and approximately one in. in height. Pictures were hand drawn by an artist using pen, ink and colored pencils. From an original sample of 42 triads that were piloted, 19 were selected from seven categories: 2 perceptual/ color, 2 perceptual/shape, and three each of physiognomic, cross-modal, collectional, psychological-physical and taxonomic. For a list of items see Appendix A.

Procedure. The subject and examiner were seated across from each other at a small desk or table (whatever was available at the school location). The

examiner laid out the target item in front of the child on the table and then, in randomized order, the literal or nonliteral items above, and to the left and right of the child. The examiner pointed to the bottom item (target) and asked the child to pick one of the top two items that was "like" the bottom one: "Is this like this or like this? Why?" For words, the examiner read the word, if the child could not read the word him- or herself. If the child made a literal match on the first trial, then the child was asked if he or she could match the nonliteral items, i.e., pointing to the nonliteral item, the experimenter asked the child whether it "is like" the target item. Piloting determined that "like" facilitated metaphoric (nonliteral) responding whereas "go together" promoted literal responding, therefore, the former was used. Stimuli were laid out in two "tiers" in order to inhibit thematic responding, i.e., making up a story about the items. Children had two chances on each triad to make a nonliteral match. Responses were recorded both by hand (on a separate subject sheet) and on an Aiwa TPS-30 cassette recorder.

Adult raters. Four adult judges were asked to use the 7-category system to classify the original 42 picture triads for the nonliteral matches only. They were informed that the categories were not mutually

exclusive and could fit under more than one category. For 15 of the triads (79%), of the 19 items finally selected in piloting, at least 3 out of 4 judges agreed on a primary classification of an item to a category. For the additional 4 items, a fifth judge was recruited and at least 3 of the 5 judges agreed on a primary classification of an item to a category. Two additional judges rated the word triads and there was 85.7% interrater agreement between them on the assignment of an item to a primary classification.

Scoring. A 3-point scale was used to quantify subjects understanding of the nonliteral similarity within each triad. The scale was directly adapted from Kogan et al. (1980):

0 Subject matches on a literal basis or gives no response at all.

1 Subject matches on a nonliteral basis but gives an inappropriate explanation.

2 Subject matches on a nonliteral basis and gives an appropriate explanation.

A score of 1 represented partial knowledge on the subject's part, but a failure to offer an adequate explanation. For example, a subject gave a purely perceptual response failing to grasp the underlying cross-modal equivalence on triad number 11: "That's spraying and the sun is shining." A score of 2

represented complete knowledge of the underlying similarity demonstrated in an appropriate explanation. For example, a subject correctly identified the underlying conceptual equivalence on triad number 17: "The bird sings sometimes and you can use it (violin) to make music." A total score was obtained by summing across triads. Subscores were derived from the total scored on a per-type basis. Scoring also distinguished between "criterion" and "noncriterion" matches as well. A criterion match reflected previously established adult criteria (the 7 metaphorical types) whereas a noncriterion match reflected an appropriate identification and explanation but inconsistent with previously established adult criteria. Interrater reliability was assessed using a sample of 30% of the protocols and 2 independent adult judges to establish reliability of scoring.

E. Conservation/Classification tasks

Materials. The conservation of liquid quantity subtask consisted of 3 glasses, two 7.3 cm (2.9 in.) by 7.6 cm (3.0 in.), one taller and thinner, 6.3 cm (2.5 in.) by 12.9 cm (5.0 in.), and yellow-colored water. The conservation of solid quantity subtask consisted of two balls of yellow playdough approximately 5 cm (2.0 in.) in diameter. The class inclusion task consisted

of 5 blue plastic bits and 3 red plastic bits each approximately one in. in diameter.

Procedure. On the first trial the child was presented with 2 glasses identical in size and asked to verify that both had the same amount of water in each. If the subject disagreed, the examiner adjusted the water level until the subject agreed that both glasses had the same amount of water. The examiner then poured the water from one of the two glasses into the third glass which was taller and thinner. The child was asked, "Does this one have more, less or the same amount of water as this glass? Can you tell me why?" As the water was poured back into the original glass the child was asked, "Now I'm going to pour this back. Tell me, does this one have the same amount of water as this one? Why?"

On the 2nd trial the child was presented with 2 balls of yellow playdough. Again, the examiner inquired if the 2 balls were equal and if not adjusted them in size by removing playdough from one ball and adding it to the second. The examiner then rolled one of the balls into a sausage and asked the child, "Does this one have more, less, or the same amount of clay as the ball? Can you tell me why?" As the sausage was rolled back into its original shape the child was asked, "Now I am going to make a ball again. Tell me,

does this one have as much clay as that one?" The procedure and scoring (below) were directly adopted from Golomb & Cornelius (1977).

On the 3rd trial the child was presented with 5 blue and 3 red plastic bits and the examiner said: "Here are some flowers. These are the blue flowers (points to blue plastic bits) and these are red flowers (points to red plastic bits) and these are the flowers all together (delineates group as a whole). Are there more blue flowers or are there more flowers all together?"

Scoring. A 3-point scale was adopted. A score of 0 reflected an incorrect conservation judgement, a score of 1 a correct conservation judgement with an inadequate explanation, and a score of 2 a correct conservation judgement with an adequate explanation. Only explanations invoking identity, inversion and compensation (Piaget & Inhelder, 1969) were classified as conserving responses. Two independent adult raters were recruited to judge reliability of scoring on 30% of the protocols. Class inclusion responses were scored on a pass/fail basis.

F. Symbolic play tasks

Materials. For the "child-initiated" part (game 1), symbolic play stimuli consisted of an animal hand puppet (Minnie Mouse), 5 colored blocks, and a stuffed

animal (Garfield). For the "adult-intiated" part, stimuli consisted of red playdough (game 2); ball of yarn, fluffy beany cap, 2 kitchen sponges (game 3); animal hand puppet (green frog), pebbles, and a shoebox (games 4 and 5).

Procedure. The 5 pretense play situations were presented on 2 separate days. Each game engaged the child in a pretense situation and then the examiner "plays dumb" in order to inquire of the child how the play object could be 2 different things, itself and a make-believe one. The child was prompted to explain the symbolic function and its reversible nature.

In the "child-initiated" part, the examiner asked the child to teach him a make-believe game. Questions followed to focus the child's attention on his or her make-believe actions in order to elicit from the child the object's original identity and its make-believe one. The child was encouraged to explain his or her thoughts and behaviors regarding the dual nature of pretend play.

In the "adult-initiated" part, the games involved further role adoption and object transformation. There were 4 games (see Appendix B). The examiner asked the child to do something (e.g., go on a picnic) and then as the game moved along, stepped out of his pretend role and asked a series of questions requiring the

child to elaborate on the pretend action and object, e.g., "How can playdough be a hamburger? Why?" The child was encouraged to explain how an object can be both itself and a make-believe thing and how this was brought about. The tasks were directly adapted from Golomb & Cornelius (1977) and Golomb & Bonen (1981). SPT tasks were administered generally on 2 consecutive days, the 2nd administration immediately prior to administration of the metaphor tasks.

Scoring. A separate record was kept of the amount of productive metaphor for each child. Criteria for deciding what is a metaphor was directly adopted from Winner (1969). A Pearson product moment correlation was computed between metaphorical utterances (amount and kind) made in the symbolic play and in the metaphor comprehension tasks.

G. Semantic analysis

Ten 4-year-olds and 10 6-year-olds were asked if they knew what it means for something to be "real," "pretend," "make-believe" and "fake." After answering, they were asked to name some things that are "real," "pretend," "make-believe" and "fake" and some things that are not. This procedure was adapted from Carey (1985, p. 23).

H. Semantic features task

In order to assess that 4- and 6-year-olds know certain key features necessary for comprehending the visual metaphors used in the MCT tasks, a separate pilot group of 5 subjects in each age group were asked a series of questions for each picture in each triad (see Appendix C). The questions were designed to tap the relevant information necessary to comprehend the metaphorical relations, such as information about the ground, and key features in the pictures, such as the child's understanding of pictorial "runes" (Kennedy, 1982). Children appear to be well-acquainted with this kind of non-mimetic information (e.g., waft lines to connote odor) by 4-years-of-age (Friedman & Stevenson, 1975, 1980; Newton, 1985). The task was adapted from Nippold, Leonard & Kail (1984).

I. Word recognition task

For all 57 words (3 by 19 triads), a separate pilot group of subjects, 5 4-year-olds and 5 6-year-olds were asked to identify and define the word on each card. The task was adapted from Nippold et al. (1984).

VI. Statistical analysis

A multivariate analysis of variance with stage (PO, CO), age (4, 6), task (SPT_1, SPT_2) and medium (pictures, words) as between-subject variables (2 x 2 x 2 x 2) and type (shape, color, physiognomic, cross-modal, collectional, taxonomic and psychological-physical) as the within-subject variable, comprised the independent and dependent variables, respectively (see Appendix D). Dependent variable scoring consisted of a 3-point scale of metaphoric comprehension (0-2) as outlined in Kogan et al. (1980; see above). Additional scoring consisted of a total score summed across triads and a subscore for types (on a mean per-type basis). Criterion and noncriterion matches were scored and analyzed separately. Multivariate regression analyses using a hierarchical inclusion model assessed the nonorthogonality of factors with age and medium presumed to add the most variance followed by task and stage. Separate one-way analyses of variance assessed main effects (stage, age, task and medium) and two-way ANOVAs assessed significant higher order interactions for criterion and noncriterion matches. A Pearson product-moment correlation assessed the relationship between spontaneous metaphor generated in symbolic play and the metaphor comprehension tasks.

A. Interrater reliability. 30% of the metaphor comprehension task protocols were rated by 2 independent judges. There was 98.7% agreement on the assignment of a score (0, 1, 2) to a triad. 30% of the conservation of liquid and solid quantity task protocols were rated by the same 2 independent judges. There was 98% agreement on the assignment of a score (0, 1, 2) to a conservation task.

B. Criterial matches on second pairings. A separate analysis was done on the number of nonliteral matches (criterial matches) that were made on the second pairing after a literal match was made on the first pairing on the same triad, for both pictures and words. 9.1% of nonliteral matches were made on the second pairing. This trend was evident across age, stage and medium. Since this was a relatively small effect, it was not included in any further analyses (see Table 2 below).

Table 2

Criterial Matches on Second Pairings[a]

Age	Stage	Task	Medium	Percentage
4	PO	SPT	P	7.9%
4	PO	SPT	W	3.7%
4	PO	CP	W	13.7%
4	PO	CP	P	16.8%
6	CO	SPT	W	3.7%
6	PO	SPT	W	8.9%
6	PO	SPT	P	8.4%
6	CO	SPT	P	14.7%
6	PO	CP	P	6.8%
6	CO	CP	P	8.4%
6	PO	CP	W	7.4%
6	CO	CP	W	8.9%

[a]SPT = symbolic play task, CP = constructive play task.

VII. Results

Metaphor comprehension tasks. Separate multivariate analyses of variance (SPSSx, 1986, pp. 476-551) were performed on criterial and noncriterial matches. Main effects were further assessed using one-way analyses of variance (ANOVA) for each between-subject effect (stage, age, task and medium). The effect of age, independent of medium, was assessed using separate ANOVAs and the effect of medium, independent of age, was also assessed using separate ANOVAs. The only significant higher-order interaction was a two-way interaction between age and medium and was assessed using two-way analyses of variance for both criterial and noncriterial matches. Multiple regression analyses for both criterion and noncriterion matches were assessed to further evaluate the contribution of between-subject variables (SPSSx, 1986, pp. 662-686).

Criterion matches are presented first, then noncriterion matches, in the following sections. For each section, MANOVA results are reported first in the order: multivariate tests, followed by two-way and one-way ANOVA results. Note that criterion matches reflected previously established adult criteria (the 7 metaphorical types), whereas a noncriterion match reflected an appropriate identificatinn and explanation

but inconsistent with previously established adult criteria. See Appendix E for typical explanations.

Criterion matches - pooled within group correlations for dependent variables. Table 3 presents the results of the pooled within group correlations for the dependent variables (metaphorical types).

Table 3

Pooled Within Group Correlations for Metaphorical Types

Type	P/C	P/S	PHYS	COLL	C-M	P-P	TAX
P/C							
P/S	.10						
PHYS	.08	.33					
COLL	.09	.35	.29				
C-M	.08	.24	.25	.14			
P-P	.21	.26	.41	.23	.36		
TAX	.05	.29	.20	.28	.27	.32	

The correlations indicate that, although the metaphorical types are clearly differentiated from one another, there are moderate correlations between them, except for perceptual/color matches which have low correlations with 5 of the 6 metaphorical types.

Criterion matches - main effect/medium. The main effect of medium was significant, Pillai's F

(7, 102) = 12.80, $p < .001$. Pillai's Trace (Norusis, 1985, pp. 220-221), is the most robust criterion of significance given on the SPSSx output, including Wilks' Lambda, Hotelling's Trace and Roy's Largest Root. Consequently, a one-way ANOVA was computed for each dependent variable to further assess the main effect of medium. Mean scores and their accompanying F values are presented in Table 4 for the medium main effect.

Table 4

Mean Scores for the Medium Main Effect by Type

	Medium		ANOVA Results	
Type	Pictures	Words	F(1, 118)	Alpha
P/C	3.08	2.10	24.45	.001
P/S	3.28	2.57	7.67	.01
PHYS	3.28	3.45	ns	
COLL	4.17	2.75	17.69	.001
C-M	1.42	2.83	35.01	.001
P-P	2.00	2.45	ns	
TAX	2.02	2.65	5.76	.02

The results indicated that pictures facilitated the comprehension of perceptual and collectional

matches whereas words facilitated the comprehension of cross-modal and taxonomic matches.

Criterion matches - main effect/age. Tables 5, 6 and 7 highlight the age effect, comparing cumulative scores, percentages and mean scores per triad group, respectively, for all subjects in each age group by metaphorical type. As seen in Table 5, 4-year-olds had a fairly even number of metaphorical matches in the 70-90 range for perceptual, physiognomic, and collectional matches. However, there was a substantial drop into the 50s range for cross-modal, psychophysical and taxonomic matches. For 6-year-olds, there was an fairly even number of metaphorical matches in the 130-170 range (when adjusted by half to equate for groups) for perceptual, physiognomic and collectional matches. Again, there was a substantial drop into the 100-120 range for cross-modal, but a slight rise for psychophysical and taxonomic matches. This trend is observed in Table 6 as regards percentages of nonliteral matches and Table 7 as regards mean scores which are numerical values of the the percentages in Table 6. Note that since subjects had 2 opportunities to make a nonliteral match, the score data (1 or 2) reported in Table 6 is not explicable in terms of chance probabilities. That is, only in a forced-choice situation, where equal probabilities are involved,

could the results be explained in terms of a 50-50 chance probability.

Table 5

Metaphorical Matches by Age and Type[a]

	MCT (criterion matches)						
Age	P/C	P/S	PHYS	COLL	C-M	P-P	TAX
4 years	79	73	93	89	53	58	56
6 years	259	283	338	316	202	235	224
(1/2)	130	142	169	158	101	118	112

[a]The 6-year-olds were adjusted by half to equate for group number. Values represent cumulative scores for all subjects in each age group. The maximum score possible for the 4-year-olds is 160 (4 X 40) for P/C, P/S and 240 (6 X 40) for all others. For 6-year-olds, the maximum score is 320 (4 X 80) for the former and 480 (6 X 80) for the latter.

Table 6

Percentage of Nonliteral Matches by Age and Type[a]

	MCT (criterion matches)						
Age	P/C	P/S	PHYS	COLL	C-M	P-P	TAX
4 years	49	46	39	37	22	24	23
score 1	14	12	26	21	21	23	17
score 2	35	34	13	16	1	1	6
6 years	81	88	70	66	42	49	47
score 1	17	3	27	20	29	45	23.5
score 2	64	85	43	46	13	4	23.5

[a]Values for rows 1 and 4 represent percentages of total scores possible for all subjects in each age group. Rows 2-3 and 4-6 represent percentages of total scores in which subjects responded with either an inadequate (score of 1) or adequate (score of 2) explanation.

Table 7

Mean Scores per Triadic Group for Nonliteral Matches by Age and Type[a]

	MCT (criterion matches)						
Age	P/C	P/S	PHYS	COLL	C-M	P-P	TAX
4 years	1.98	1.83	2.33	2.23	1.33	1.45	1.40
by triad	.99	.92	.78	.74	.44	.48	.47
6 years	3.24	3.54	4.23	3.95	2.53	2.94	2.80
by triad	1.62	1.77	1.41	1.32	.84	.98	.93

[a]Mean scores are presented first by triadic group (2-3 triads) and then by individual triads.

The main effect of age was significant, Pillai's $F(7, 102) = 12.05$, $p < .001$. Consequently, a one-way ANOVA was computed for each dependent variable to further assess the age main effect. Each was significant, with the 6-year-olds favored in all cases. Mean scores and accompanying F values for the age main effect are presented in Table 8.

Table 8

Mean Scores for the Age Main Effect by Type

	Age		ANOVA Results	
Type	4-Year-Olds	6-Year-Olds	F(1, 118)	Alpha
P/C	1.93	2.93	22.11	.001
P/S	1.70	3.54	65.47	.001
PHYS	2.23	3.94	37.87	.001
COLL	2.23	4.08	29.07	.001
C-M	1.33	2.53	20.16	.001
P-P	1.45	2.61	23.25	.001
TAX	1.40	2.80	29.88	.001

The results indicated that, for the age between-subjects variable, 6-year-olds did significantly better on all 7 metaphorical types.

Criterion matches - main effect/task. The main effect of task was significant, Pillai's $F(7, 102) = 3.19$, $p < .005$. Consequently, a one-way ANOVA was computed for each dependent variable to further assess the task main effect. Mean scores and accompanying F values for the task main effect are presented in Table 9.

Table 9

Mean Scores for the Task Main Effect by Type[a]

Type	Task		ANOVA Results	
	SPT	CP	F(1, 118)	Alpha
P/C	2.28	2.90	8.54	.005
P/S	2.62	3.23	5.59	.02
PHYS	3.30	3.43	ns	
COLL	3.07	3.85	4.89	.05
C-M	1.92	2.33	ns	
P-P	2.10	2.35	ns	
TAX	1.93	2.73	9.46	.005

[a]SPT = symbolic play task, CP = constructive play task.

The results indicated that the symbolic play tasks did not facilitate the comprehension of metaphor across any of the 7 types. A fuller discussion of the implications of hypothesis H_3, given the nonsignificance of the symbolic play tasks, is taken up in detail in section VIII. For perceptual, collectional and taxonomic matches, the constructive play task facilitated the comprehension of metaphor, but the effect was small, given the relatively low F values.

Criterion matches - main effect/stage. The main effect of stage was nonsignificant, Pillai's $F(1, 102) = 1.99$, $p > .05$. Separate one-way ANOVAs were computed for each dependent variable for the stage main effect. When 4-year-olds were removed from the analysis, in order to avoid the confounding of stage and age, the only significant effect was for collectional matches in which concrete-operational children had an advantage, $F(1, 78) = 7.04$, $p < .01$. Mean scores and accompanying F values for the stage main effect for 6-year-olds ($n = 80$) are presented in Table 10.

Table 10

Mean Scores for 6-Year-Olds for the Stage Main Effect by Type[a]

	Stage		ANOVA Results	
Type	PreOp	ConOp	F(1, 78)	Alpha
P/C	2.93	2.93	ns	
P/S	3.50	3.58	ns	
PHYS	3.70	4.18	ns	
COLL	3.58	4.58	7.04	.01
C-M	2.28	2.78	ns	
P-P	2.45	2.78	ns	
TAX	2.78	2.83	ns	

[a]n = 80.

The results indicated that the main effect of stage was not significant, except for collectional matches, when 4-year-olds were removed from the analysis, in order to avoid the confounding of age and stage.

Criterion matches - age by medium interaction. The age X medium interaction was significant, Pillai's $F(7, 102) = 4.04$, $p < .001$. A separate two-way ANOVA was assessed for each dependent variable. Perceptual/color matches were significant, $F(1,$

116) = 5.15, $p < .025$; as well as perceptual/shape matches, $F(1, 116) = 7.56$, $p < .01$; physiognomic matches, $F(1, 116) = 19.21$, $p < .001$; collectional matches, $F(1, 116) = 5.09$, $p < .05$; cross-modal matches, $F(1, 116) = 19.88$, $p < .001$; psychophysical matches, $F(1, 116) = 4.31$, $p < .05$; and taxonomic matches, $F(1, 116) = 3.71$, $p < .06$ indicating an age X medium interaction for all 7 types of metaphor.

The above results indicated that, for all 7 metaphorical types, 6-year-olds had larger mean differences on both the word and picture tasks. The mean differences were greater, however, for the word tasks. Note, however, that the age X medium interaction was driven by the greater number of 6-year-old subjects. Therefore, in order to make greater sense of the significance tests, further analyses are reported below.

Separate one-way ANOVAs were computed for 4- and 6-year-olds in order to tease out the medium effect. Table 11 presents the mean scores and accompanying F values for 4-year-olds (n = 40) for the medium main effect.

Table 11

Mean Scores for 4-Year-Olds for the Medium Main Effect by Type[a]

Type	Medium		ANOVA Results	
	Pictures	Words	F(1, 38)	Alpha
P/C	2.70	1.15	21.36	.001
P/S	2.45	0.95	13.38	.001
PHYS	2.90	1.55	8.17	.01
COLL	3.40	1.05	28.46	.001
C-M	1.25	1.40	ns	
P-P	1.55	1.35	ns	
TAX	1.40	1.40	ns	

[a]n = 40.

The results indicated that for 4-year-olds, pictures facilitated the comprehension of perceptual, physiognomic and collectional matches, but there were no differences between pictures and words for cross-modal, psychophysical and taxonomic matches.

Table 12 presents the mean scores and accompanying F values for 6-year-olds (n = 80) for the medium main effect.

Table 12

Mean Scores for 6-Year-Olds for the Medium Main Effect by Type[a]

Type	Medium		ANOVA Results	
	Pictures	Words	F(1, 78)	Alpha
P/C	3.27	2.57	11.63	.001
P/S	3.70	3.38	ns	
PHYS	3.47	4.40	10.80	.002
COLL	4.55	3.60	6.29	.02
C-M	1.50	3.55	68.36	.001
P-P	2.22	3.00	8.93	.005
TAX	2.32	3.27	10.61	.002

[a]n = 80.

The results indicated that for 6-year-olds, pictures facilitated the comprehension of perceptual/color and collectional matches, whereas words facilitated the comprehension of physiognomic, cross-modal, psychophysical and taxonomic matches.

In order to test the age effect independent of medium, one-way ANOVAs were computed for pictures and words. Table 13 presents the mean scores and accompanying F values for pictures (n = 60) for the age main effect.

Table 13

Mean Scores for Pictures for the Age Main Effect by Type[a]

	Age		ANOVA Results	
Type	4-Year-Olds	6-Year-olds	F(1, 58)	Alpha
P/C	2.70	3.27	4.72	.05
P/S	2.45	3.70	16.04	.001
PHYS	2.90	3.47	ns	
COLL	3.40	4.55	7.59	.01
C-M	1.25	1.50	ns	
P-P	1.55	2.22	ns	
TAX	1.40	2.32	7.92	.01

[a]n = 60.

The results indicated that 6-year-olds did significantly better, across age, on perceptual, collectional and taxonomic picture tasks.

Table 14 presents mean scores and accompanying F values for words (n = 60) for the age main effect.

Table 14

Mean Scores for Words for the Age Main Effect by Type[a]

	Age		ANOVA Results	
Type	4-Year-Olds	6-Year-Olds	F(1, 58)	Alpha
P/C	1.15	2.57	28.91	.001
P/S	0.95	3.38	72.97	.001
PHYS	1.55	4.40	65.06	.001
COLL	1.05	3.60	30.94	.001
C-M	1.40	3.55	38.56	.001
P-P	1.35	3.00	33.66	.001
TAX	1.40	3.27	25.95	.001

[a]n = 60.

The results indicated that, across age, 6-year-olds did significantly better on all 7 metaphorical types in the linguistic medium.

Criterion matches - summary of results. A criterion match reflected previously established adult criteria. For the main effect of medium, pictures facilitated the comprehension of perceptual and collectional matches and words facilitated the comprehension of cross-modal and taxonomic. For the age main effect, 6-year-olds did significantly better on all seven metaphorical types. For the task

main effect, the SPT task effect was nonsignificant overall, and on the perceptual, collectional and taxonomic matches the constructive play task, not the symbolic play task, had a small but significant effect. For the stage main effect, there was no sigilficant differences at the same chronological age except for collectional matches, when 4-year-olds were removed from the analysis, in order to avoid the confounding of stage and age. For the two-way interaction of age and medium, within age, 4-year-olds did significantly better on picture tasks for perceptual, physiognomic and collectional matches and performed equally well on both the picture and word tasks for cross-modal, psychophysical and taxonomic matches. 6-year-olds, within age, did significantly better on perceptual/color and collectional picture tasks and physiognomic, cross-modal, psychophysical and taxonomic word tasks. In the linguistic medium, across age, 6-year-olds did significantly better on all metaphorical types. In the picture medium, 6-year-olds did significantly better on perceptual, collectional and taxonomic picture tasks. Overall, there was a greater mean difference on word tasks over picture tasks for 6-year-olds as compared to 4-year-olds for all seven metaphorical subtypes.

Noncriterion matches - main effect/medium. The main effect of medium was significant, Pillai's $F(7, 102) = 22.61$, $p < .001$. Consequently, a one-way ANOVA was computed for each dependent variable to further assess the medium main effect. Table 15 presents mean scores and accompanying F values for the medium main effect.

Table 15

Mean Scores for the Medium Main Effect by Type - Noncriterion Matches

	Medium		ANOVA Results	
Type	Pictures	Words	F(1, 118)	Alpha
P/C	3.88	2.13	21.29	.001
P/S	6.08	3.38	25.84	.001
PHYS	3.47	3.52	ns	
COLL	4.17	2.75	17.96	.001
C-M	1.42	2.83	35.36	.001
P-P	2.02	2.45	ns	
TAX	2.02	2.65	5.76	.02

The results indicated that pictures facilitated the comprehension of perceptual and collectional matches and words facilitated the comprehension of cross-modal and taxonomic matches.

Noncriterion matches - main effect/age. The main effect of age was significant, Pillai's $F(7, 102) = 7.79$, $p < .001$. Consequently, a one-way ANOVA was computed for each dependent variable to further assess the age main effect. Table 16 presents mean scores and accompanying F values for the age main effect.

Table 16

Mean Scores for the Age Main Effect by Type - Noncriterion Matches

	Age		ANOVA Results	
Type	4-Year-Olds	6-Year-Olds	F(1, 118)	Alpha
P/C	2.85	3.09	ns	
P/S	3.13	5.54	17.24	.001
PHYS	2.28	4.10	38.09	.001
COLL	2.20	4.09	31.07	.001
C-M	1.30	2.54	21.88	.001
P-P	1.50	2.60	20.12	.001
TAX	1.40	2.80	29.88	.001

The results indicated that 6-year-olds did significantly better on all metaphorical types except for perceptual/color matches.

Noncriterion matches - main effect/task. The main effect of task was significant, Pillai's $F(7, 102) = 3.19$, $p < .005$. Consequently, a one-way ANOVA was computed for each dependent variable to further assess the task main effect. Table 17 presents mean scores and accompanying F values for the task main effect.

Table 17

Mean Scores for the Task Main Effect by Type - Noncriterion Matches[a]

	Task		ANOVA Results	
Type	SPT	CP	F(1, 118)	Alpha
P/C	2.68	3.33	ns	
P/S	3.82	5.65	10.66	.002
PHYS	3.40	3.58	ns	
COLL	3.07	3.85	4.97	.05
C-M	1.93	2.32	ns	
P-P	2.08	2.38	ns	
TAX	1.93	2.73	9.46	.005

[a]SPT = symbolic play task, CP = constructive play task.

The results indicated that the symbolic play tasks were not significant. A fuller discussion of the

implications of hypothesis H_3, given the nonsignificance of the symbolic play tasks, is taken up in detail in section VIII. The constructive play tasks, however, facilitated the comprehension of perceptual/shape, collectional and taxonomic matches.

Noncriterion matches - main effect/stage. The main effect of stage was significant, Pillai's $F(7, 102) = 2.36$, $p < .05$. Consequently, separate one-way ANOVAs were computed for each dependent variable for the stage main effect. When 4-year-olds were removed from the analysis, in order to avoid the confounding of stage and age, the only significant effect was for collectional matches in which concrete-operational children had an advantage, $F(1, 78) = 7.47$, $p < .01$. Table 18 presents mean scores for the stage main effect for 6-year-olds only ($n = 80$).

Table 18

Mean Scores for 6-Year-Olds for the Stage Main Effect by Type - Noncriterion Matches[a]

	Stage		ANOVA Results	
Type	PreOp	ConOp	F(1, 78)	Alpha
P/C	3.03	3.15	ns	
P/S	5.08	6.00	ns	
PHYS	3.83	4.38	ns	
COLL	3.58	4.60	7.47	.01
C-M	2.28	2.80	ns	
P-P	2.43	2.78	ns	
TAX	2.78	2.83	ns	

[a] $n = 80$.

The results indicated that the stage effect was not significant when 4-year-olds were removed from the analysis, in order to avoid the confounding of age and stage, except for collectional matches.

Noncriterion matches - age by medium interaction. The age X medium interaction was significant, Pillai's $F(7, 102) = 5.90$, $p < .001$. Consequently, a separate two-way ANOVA was computed for each dependent variable. Perceptual/color matches were significant, $F(1, 116) = 8.87$, $p < .005$; as

well as perceptual/shape matches, $F(1, 116) = 3.89$, $p < .05$; physiognomic matches, $F(1, 116) = 18.82$, $p < .001$; collectional matches, $F(1, 116) = 4.70$, $p < .05$; cross-modal matches, $F(1, 116) = 22.49$, $p < .001$; psychophysical matches, $F(1, 116) = 5.33$, $p < .05$; and taxonomic matches, $F(1, 116) = 3.71$, $p < .06$, indicating a significant age X medium interaction for all seven subtypes.

The above results indicated that 6-year-olds had larger mean differences on all 7 metaphorical types on both the picture and word tasks. The mean differences were larger, however, for the word tasks. Note, however, that the age X medium interaction was driven by the greater number of 6-year-old subjects. Therefore, in order to make greater sense of the significance tests, further analyses are reported below.

Separate one-way ANOVAs were computed for 4- and 6-year-olds in order to tease out the medium effect. Table 19 presents mean scores and accompanying F values for 4-year-olds for the medium main effect.

Table 19

Mean Scores for 4-Year-Olds for the Medium Main Effect by Type - Noncriterion Matches[a]

	Medium		ANOVA Results	
Type	Pictures	Words	F(1, 38)	Alpha
P/C	4.50	1.64	9.95	.005
P/S	5.15	1.92	11.53	.001
PHYS	3.05	2.12	ns	
COLL	3.35	1.68	11.69	.001
C-M	1.25	1.76	ns	
P-P	1.65	1.72	ns	
TAX	1.40	2.08	ns	

[a]n = 40.

The results indicated that 4-year-olds did significantly better on perceptual and collectional picture tasks. There were no differences in performance on physiognomic, cross-modal, psychophysical and taxonomic matches.

Table 20 presents mean scores and accompanying F values for 6-year-olds (n = 80) for the medium main effect.

Table 20

Mean Scores for 6-Year-Olds for the Medium Main Effect by Type - Noncriterion Matches[a]

Type	Medium		ANOVA Results	
	Pictures	Words	F(1, 78)	Alpha
P/C	3.57	2.60	14.63	.001
P/S	6.55	4.52	14.03	.001
PHYS	3.67	4.52	7.48	.01
COLL	4.57	3.60	6.69	.02
C-M	1.50	3.57	70.13	.001
P-P	2.20	3.00	9.75	.005
TAX	2.32	3.27	10.61	.002

[a]n = 80.

The results indicated that 6-year-olds did significantly better on perceptual and collectional picture tasks, like the 4-year-olds. Unlike the 4-year-olds, however, they did significantly better on physiognomic, cross-modal, psychophysical and taxonomic word tasks.

In order to test the age effect independent of medium, one-way ANOVAs were computed for pictures and words. Table 21 presents the mean scores and

accompanying F values for pictures (n = 60) for the age main effect.

Table 21

Mean Scores for Pictures for the Age Main Effect by Type - Noncriterion Matches[a]

	Age		ANOVA Results	
Type	4-Year-Olds	6-Year-Olds	F(1, 58)	Alpha
P/C	4.50	3.57	ns	
P/S	5.15	6.55	ns	
PHYS	3.05	3.67	ns	
COLL	3.35	4.57	9.19	.005
C-M	1.25	1.50	ns	
P-P	1.65	2.20	ns	
TAX	1.40	2.32	7.92	.01

[a]n = 60.

The results indicated that, across age, 6-year-olds did significantly better on collectional and taxonomic picture tasks.

Table 22 presents the mean scores and accompanying F values for words for the age main effect.

Table 22

Mean Scores for Words for the Age Main Effect by Type - Noncriterion Matches[a]

Type	Age		ANOVA Results	
	4-Year-Olds	6-Year-Olds	F(1, 58)	Alpha
P/C	1.20	2.60	25.78	.001
P/S	1.10	4.52	70.99	.001
PHYS	1.50	4.52	77.79	.001
COLL	1.05	3.60	30.94	.001
C-M	1.35	3.57	44.35	.001
P-P	1.35	3.00	33.66	.001
TAX	1.40	3.27	25.95	.001

[a]n = 60.

The results indicated that, across age, 6-year-olds did significantly better on all 7 metaphorical types in the linguistic medium.

Noncriterion matches - summary of results. A noncriterion match reflected an appropriate identification and explanation but inconsistent with previously established adult criteria. For the main effect of medium, pictures facilitated the comprehension of perceptual and collectional

matches and words facilitated the comprehension of cross-modal and taxonomic matches. For the age main effect, 6-year-olds did significantly better on the perceptual/shape, physiognomic, collectional, cross-modal, psychophysical and taxonomic matches. For the main effect of task, the constructive play task was significant for the perceptual/shape, collectional and taxonomic matches; the symbolic play task was not significant across any of the subtypes. For the stage main effect, there was no significant differences at the same chronological age except for collectional matches, when 4-year-olds were removed from the analysis, to avoid the confounding of stage and age. For the two-way interaction of age by medium, within age, 4-year-olds did significantly better on picture tasks for perceptual and collectional matches and performed equally well on both the word and picture tasks for cross-modal, psychophysical and taxonomic matches. 6-year-olds, within age, did significantly better on picture tasks for perceptual and collectional matches and on word tasks for physiognomic, cross-modal, psychophysical and taxonomic matches. Across age, 6-year-olds did significantly better on all metaphorical types in the linguistic medium and on collectional and taxonomic matches in the pictorial medium. Overall, there was a

greater mean difference on word tasks over picture tasks for 6-year-olds as compared to 4-year-olds for all seven metaphorical types.

Comparing the criterion and noncriterion results, they were nearly identical across stage, age, task, medium and the age X medium interaction. However, 4-year-olds had a higher number of perceptual matches for the noncriterion matches, whereas 6-year-olds had only a higher number of perceptual/shape matches (see Table 26).

Multiple regression analyses - criterion matches. A forced entry procedure (SPSSx, 1986, pp. 666-667)[1] was used with stage entered first followed by age, task and medium. The analysis was done for each dependent variable and is reported in Table 23. The multiple R is the correlation coefficient between the predicted and actual values and the values reported are relative and cumulative, not absolute. That is, Table 23 (and Table 24 below) is to be read from left to right, with the relative contribution of each between-subject factor accumulating across rows. As can be seen, the variables age and medium tended to contribute the most variance whereas stage and task contributed the least variance to the linear regression equation overall.

Table 23

Cumulative R2 of Variables for Criterion Matches[a]

	Effect			
Metaphor	Stage	Age	Task	Medium
Color	.20	.40	.47	.63
Shape	.32	.60	.63	.68
Physiognomic	.35	.51	.51	.51
Collectional	.40	.49	.53	.64
Cross-modal	.31	.41	.43	.64
Psychophysical	.29	.42	.43	.46
Taxonomic	.24	.45	.53	.57

[a]Values reported in table are the multiple R. Tabled values are to be read from left to right with the effect accumulating across rows.

Multiple regression analyses - noncriterion matches. A forced entry procedure was used with age entered first followed by medium, task and stage. The analysis was done for each dependent variable and is reported in Table 24. As can be seen, the variables age and medium tended to contribute the most variance followed by task and stage in the overall linear regression. Independent T-tests (n = 120) indicated that stage was only significant for the

collectional matches, $t(113) = 3.04$, $p < .005$ and cross-modal matches, $t(113) = 2.06$, $p < .05$.

Table 24

Cumulative R2 of Variables for Noncriterion Matches[a]

	Effect			
Metaphor	Age	Medium	Task	Stage
Color	.05	.39	.42	.42
Shape	.35	.55	.62	.65
Physiognomic	.49	.49	.50	.51
Collectional	.45	.58	.61	.65
Cross-modal	.39	.62	.63	.65
Psychophysical	.38	.41	.42	.44
Taxonomic	.44	.49	.56	.57

[a]Values reported in table are the multiple R. Tabled values are to be read from left to right with the effect accumulating across rows.

Symbolic play tasks. A Pearson product-moment correlation (SPSSx, 1986, pp. 638-646) was calculated for the amount of spontaneous metaphor produced during the symbolic play tasks and the amount of metaphor comprehended in the MCT tasks. There were three types of metaphors produced in the SPT tasks. Metaphors produced were of the perceptual/color and perceptual/shape variety, with a few physiognomic

attributions. Therefore the three categories of metaphor in the SPT tasks (PColor 1, PShape 1, Phygnom 1) were compared with the respective three categories in the MCT tasks (PColor 2, PShape 2, Phygnom 2). Table 25 presents the results of the Pearson product-moment correlations.

Table 25

Pearson Product-Moment Correlations of Symbolic Play and Metaphor Comprehension[a]

	SPT Tasks		
MCT Tasks	PColor 1	PShape 1	Phygnom 1
PColor 2	-.06	-.08	+.04
PShape 2	+.02	+.09	-.06
Phygnom 2	+.11	+.16	+.12

[a]None significant at $p < .05$.

As can be seen, there were no significant correlations between the amount and kind of metaphor produced in the SPT tasks and the amount and kind of metaphor comprehended in the MCT tasks.

A tabular presentation of the cumulative scores for both the 4- and 6-year-olds makes its clearer (see Table 26 below). Both 4- and 6-year-olds had a much greater number of perceptual and physiognomic responses

in the MCT tasks as compared to the SPT task. For 4-year-olds there was a substantially greater number of perceptual/color and perceptual/shape matches on the noncriterion (noncrit) over criterion (crit) matches. 6-year-olds had a greater quantity of noncriterion matches over criterion matches only on the perceptual/shape metaphors.

Table 26

Perceptual and Physiognomic Matches for the Symbolic Play and Metaphor Comprehension Tasks[a]

	Matches					
	4-year-olds			6-year-olds		
Task	P/C	P/S	PHYS	P/C	P/S	PHYS
SPT	6	42	2	24	218	13
MCT crit	79	73	93	259	283	338
MCT noncrit	114	123	90	247	441	332

[a]crit = criterion, noncrit = noncriterion.

The results indicated that there was little relation between the amount of metaphor produced in the symbolic play tasks and the quantity of metaphor comprehended in the MCT tasks. Moreover, the comparison loses its evidential force, given that the

tasks sampled metaphoric production and comprehension over varying time periods for individual subjects.

Semantic analysis. A semantic analysis was made of the words "real," "pretend," "make-believe" and "fake" used by 4- and 6-year-olds in the symbolic play tasks. Both groups defined "real" as meaning either alive or something one can see and touch. They both named either, respectively, living things (e.g., tiger, person) or everyday objects (e.g., table, house). 4-year-olds defined "pretend" as either not real, "can't move" or someone dressed up in a costume, and named inanimate things (e.g., socks, toys), or fantasy/imagination items (e.g., dreams, cartoons). 6-year-olds defined "pretend," in addition to the above named ways, as needing a representation of it to see it, appearing as one thing but really another, "can't eat it," and "made-up." They named representational things (e.g., drawings, TV, movies) in addition to the above. 4-year-olds explained "make-believe" as not real, "can't move," telling a story to another person, and wishing for things that aren't true. Most of them appeared to equate "pretend" and "make-believe." For "make-believe" they named things such as masks and movies. 6-year-olds explained the term "make-believe" as something one can think about in the mind, as not alive, appearing as one thing but really another,

"made-up" and not real. They also appeared to equate the terms. They named mental things such as dreams or representational things such as pictures. Four-year-olds defined "fake" as "not real but looks real" and "not moving." They named things such as wigs, make-up and haunted houses. Six-year-olds defined "fake" as "not real but looks real," "a lie," and "pretend," and named inanimate objects (e.g., stuffed animals, toys), and things such as robots, fake mustaches and masks. They appeared to equate "fake" with "pretend" and "make-believe" which all have very similar meanings.

The results indicated that for both 4- and 6-year-olds, the words "pretend," "make-believe" and "fake" have similar meanings and real world referents, in distinction to the word "real" and its real world referents.

Class inclusion/conservation tasks. An analysis of the percentage of children at the preoperational and concrete-operational level who passed the class inclusion and conservation tasks showed that 38 of 40 (95%) 6-year-old concrete-operational children passed all three tasks (conservation of solid and liquid quantity tasks, class inclusion task). Two of 40 (5%) 6-year-old concrete-operational children failed to pass the class inclusion task but passed both the

conservation of solid and liquid quantity tasks. Thirty-nine of 40 (97.5%) 6-year-old preoperational children failed to pass the conservation of liquid quantity task and 28 of 40 (70%) failed to pass the conservation of solid quantity task. However, 28 of 40 (70%) passed the class inclusion task. Thirteen of 40 (32.5%) of 6-year-old preoperational children passed only one conservation task and 4 of these children (10%) were considered transitional (invoking an inadequate justification) using standard Piagetian criteria (Golomb & Cornelius, 1977).

The results of the conservation of solid and liquid quantity tasks followed generally the findings of the Golomb and Cornelius (1977) and Golomb and Bonen (1981) studies. However, given the large amount of preoperational children who passed the class inclusion task, it is possible that subtle nuances of linguisitc phrasing affected the results. Some children were initially confused by the question. When it was slowly spoken to them again, and the relevant pieces pointed out as the question was re-presented, they often came up quickly with the right answer.

Semantic features task. Ninety-five percent of the individual pictures in the metaphor triads were correctly identified by a separate group of 5

4-year-olds and 98% were correctly identified by a separate group of 5 6-year-olds.

Word recognition task. Ninety-seven percent of the individual words in the metaphor triads were correctly identified and defined by a separate group of 5 4-year-olds and 99% were correctly identified and defined by a separate group of 5 6-year-olds.

Notes

[1]The forced entry procedure is the hierarchical method, in which variables are added to the regression equation in a predetermined order at the discretion of the researcher.

VIII. Discussion and Conclusions

In keeping with hypothesis H_2, the picture superiority effect was well evidenced in the 4-year-olds. They performed significantly better on the perceptual, physiognomic and collectional metaphors suggesting that the metaphoric relations of color, shape, physiognomic qualities and collectional relationships are best highlighted in the visual modality, at least for younger children. Six-year-olds also did significantly better on perceptual/color and collectional matches in pictures, but for more abstract matches, i.e., psychological-physical and taxonomic, the linguistic medium appeared to best convey their qualities. Across age, moreover, 6-year-olds did significantly better on perceptual, collectional and taxonomic matches in the visual modality suggesting a greater picture superiority effect for older children, but attenuated when compared to their categorical superiority across all seven types over the 4-year-olds in the linguistic medium. The medium main effect further strengthened the case that, for both 4- and 6-year-olds, metaphoric relations of color, shape and collectional relationships are best conveyed, from a semiotic perspective, in the visual modality. Likewise, cross-modal, psychophysical and taxonomic

metaphorical relationships manifested superior effects in the linguistic medium. One curious finding for the 6-year-old group is their significantly greater preference for physiognomic and cross-modal matches in the linguistic medium. It must be admitted that cross-modal matching is probably not well highlighted in the visual modality, particularly given the nature of the sensory cross-classifications used in the present study (visual-olfactory, auditory-haptic, and olfactory-auditory). In fact, the visual referents may throw off the older children. Gardner (1974) circumvented the problem by presenting sensory cross-classifications in the modalities of interest, e.g., color (visual), pitches (auditory), and objects felt while blindfolded (tactile). Their superior performance on physiognomic matches in the linguistic medium suggests that during the latter preschool and early school years there is an increasing preference for the linguistic medium, no doubt due to the influence of schooling and the cultural emphasis on written language. Language studies (Nathan & Hass, 1970) that have looked at age increases in physiognomic responding, report an increase from 4 to 10 years in consensus among children as to which line drawings represent given words. The result is attributed by Nathan and Hass (1970), to synesthetic tendencies to

touch the lines, to feel which are "softer," or to smell the drawings to determine which are more "fragrant." It is more likely, however, that during the preschool and early school-age years there is increasing integration of information from visual and verbal channels to account for the superior performance of older children (Reznick, 1977, p. 159). We see the same effect with the more abstract psychophysical and taxonomic matches where, again, the 6-year-olds show superior performance in the linguistic medium. For the younger children, performance on the psychophysical and taxonomic matches is not significantly different across the mediums of presentation, since the two semiotic channels are still quite autonomous.

If we look at the noncriterion matches, one finds a greater prevalence of perceptual/color and perceptual/shape matches among the 4-year-olds and perceptual/shape matches among the 6-year-olds. Both groups gave more perceptual-type responses on noncriterion matches. Except for these differences, the criterion and noncriterion results were strikingly, but not surprisingly, similar. Six-year-olds had a higher rate of perceptual/shape matching, but in the pictorial medium, both groups manifested near equal performance on perceptual/color matches. Only, decidedly, in the linguistic medium, did 6-year-olds

show a higher rate of perceptual/color matching. It would appear that the younger children show a preference for color as a perceptual feature that gives way, in older children, to a preference for form, as some other studies have also shown (e.g., Suchman & Trabasso, 1966).

Six-year-olds as a whole performed significantly better in all seven metaphorical modes, although the differences were unevenly distributed across the pictorial and linguistic media. That is to say, the older children did better across the board in the linguistic medium but significantly better only on the perceptual, collectional and taxonomic tasks in the pictorial medium. Consonant with hypothesis H_3, younger children performed better on the perceptual and physiognomic matches and worse on the psychophysical and taxonomic matches, as presented in Table 5. Again, the depressed effect on the cross-modal matches is undoubtably due to the limited mode of presentation. For older children, while they outperformed their younger counterparts on the perceptual and physiognomic matches, they also performed significantly better on the psychophysical and taxonomic matches, particularly when they were presented in the linguistic medium.

A broader theoretical perspective suggests that Plato's (Cornford, 1967) original distinction between

"physis" (nature) and "thesis" (convention), and Pavlov's demarcation of the primary and secondary signal systems, finds its systematic elaboration in Luria (1961). The "primary signal system" notes Luria, is concerned with direct perception of sensory stimuli and is heavily capitalized on by children under, roughly, 5 years of age (cf. Gardner, 1982). However, the "secondary signal system" is involved with systems of verbal elaboration, draws upon cultural knowledge, and is capitalized on by children over 5 years of age. Hence, "natural metaphors" (Gombrich, 1982) and "motivated signs" (Saussure, 1966), as in perceptual and physiognomic metaphors presented in pictures, are easily understood by younger children because they embody the characteristics of the "expressive sign," i.e., natural, motivated, analogical, subjective, affective and concrete (Guiraud, 1975). As children begin to evolve systems of verbal elaboration and acquire cultural knowledge--including domain-specific knowledge of language--the "unmotivated sign" (Saussure, 1966) or language proper (besides other conventionalized symbol systems) become significant media of expression and comprehension. The so-called "logical sign" embodies the characteristics of the referential or cognitive function (Jakobson, 1960), i.e., conventional, arbitrary, homological

(structurally analogical), objective, rational and abstract (Guiraud, 1975). As previous studies have clearly documented, the symbolic medium embodies unique as well as common properties, whether we are referring to nonverbal systems (Bellin, 1983; Kose, 1985; Kose, Bellin & O'Connor, 1983; O'Connor, Bellin & Kose, 1981; Seidman & Bellin, 1984; Seitz & Bellin, 1985) or to language proper (Olson, 1977; Olson, n.d.; Olson & Hildyard, 1980). Furthermore, these unique and common properties appear to be differentially understood over the course of development. The overall findings are relatively consistent with Goodman's (1976) approach in which he distinguishes between notational (e.g., language, dance notation, music) and non-notational symbol systems (e.g., painting, sculpture) and the implications for each.

If we peruse Peirce's (1955) trichotomy of signs, i.e., icon, index and symbol, we note that perceptual, physiognomic, cross-modal and collectional metaphors are primarily indexical and iconic in function by virtue of a factual or causal connection with some object or property of an object, or in so far as they resemble it, respectively. Psychophysical and taxonomic metaphors are primarily symbolic in function. That is, the physical stands in place of the psychological and an abstract relation stands in place

of another, respectively. All 3 functions stand in an epistemic relation between the knower, the "interpretant," and the known (some objective world). The indexical and iconic functions, like Pavlov's primary signal system, are immediate and concrete, whereas the symbolic function is arbitrary and abstract and requires much more of the interpretant to make a signifying connection. Hence, younger children capitalize first on the indexical and iconic functions of signs (cf. de Laguna, 1963) and this knowledge is subsequently elaborated upon in the development of the symbolic function. This, at least, would seem the thrust of Peirce's theory if applied to cognitive development.

A similar kind of conceptual bifurcation is evident in Barthes (1972) discussion of myth. Denotation involves the use of language to mean what is said whereas connotation involves the use of language to mean something other than what is said. With development, children learn to go beyond the immediate and symbolic function of language--language as a first-order semiotic system--to the level of myth which functions as a second-order semiotic system. That is, "the sign of a prior signifier-signified relationship becomes the signified of a further one" (Hawkes, 1977). The mythic level draws extensively on linguistic

facility and sociocultural knowledge in understanding the meaning in a semiotic system, a painting or a poem, for example. As McLuhan (1964) has long noted, the medium, a fortiori, significantly affects the message.

Turning to the question of operativity, it can be stated reasonably well given the relatively large sample size used that, in general, operativity does not significantly contribute to the comprehension of metaphor, as predicted by hypothesis H_1, under the task conditions examined. The regression analyses indicate that stage contributed little to the overall regression equation. The only significant advantage that concrete-operational children had was with the collectional matches. However, given the 95% success of the concrete-operational children on the class-inclusion task as compared to the 70% success rate of the pre-operational 6-year-olds, one could conclude that the effect is due to a substantive relationship between the class inclusion and collectional matches of the metaphor comprehension tasks. As noted previously in Markman's research (Markman, 1983), collections are an intermediate stage on the road to the understanding of class inclusion, which is criterial for operativity. Concrete-operational children may do better on collectional metaphorical relationships because they

have mastered class-inclusion relationships, which give them a distinct advantage, but only in a narrow parameter of relationships where operativity is contributive. Of course, it may simply be that it is not operativity, per se, but intellectual competence, broadly construed, that contributes to metaphor comprehension. There is every reason to believe that it has important relevance (e.g., Kogan et al., 1980; Seitz & Bellin, 1985). Recent studies (e.g., Humphreys et al., 1985) have shown that Piagetian tasks are highly correlated with standard IQ tests of intellectual functioning. Since an independent IQ measure was not obtained, it is impossible to gauge the significance of this effect.

Notably, the symbolic play tasks were not significantly facilitative in promoting increased performance on the metaphor comprehension tasks, as had been predicted by hypothesis H_4. There are at least two possible reasons for this that should be explored in future studies. For one, it may simply be that two 10-15 minute sessions in symbolic play were insufficient to stimulate metaphorical processing. Guthrie and Hudson (1979) in a partial replication of Golomb and Cornelius (1977) found that Golomb and Cornelius' symbolic play training was insufficient in stimulating conservation, therefore lacking

generalizability, and that the effect may have been due to the testing situation alone because of the limitation of using a single experimenter. A more recent study (Smith & Whitney, 1987), suggests that the results of previous studies that have found play experience linked with associative fluency were, in fact, due to unconscious experimenter effects and attest to either their lack of ecological validity or a significant relation between play and creative abilities. Therefore, it is possible that symbolic play and metaphoric comprehension are relatively autonomous psychological functions and that, at least in the preschool and early school years, do not manifest themselves in a general metaphoric or cognitive style. Kogan and Mills (1985) did not find evidence of a generalized metaphoric style in 1st and 3rd graders, roughly 6 and 8 years of age, when given a barrage of metaphoric triads tasks, sentence completion tasks, synesthetic-physiognomic matching and divergent-thinking indices. Nonetheless, as noted previously (e.g., Billow, 1981) creativity, as evidenced in metaphoric production, readily occurs in the context of spontaneous play. However, from the standpoint of content, the two tasks were very different. The SPT task involved vicarious production of metaphor in a constrained fashion with a set of

materials rather different from the ones subsequently encountered in the metaphor comprehension task. There is evidence that in young children production, comprehension and preference are not significantly linked (e.g., Kogan and Mills, 1985) or proceed at different rates (e.g., Gardner, Kircher, Winner and Perkins, 1975) insofar as production precedes comprehension. The Pearson product-moment correlations indicate very clearly that the two tasks are not well linked at least on some level, presumably content and the task mode, i.e., whether a production or comprehension task. Moreover, even though in some instances the constructive play task contributed to the comprehension of metaphor (perceptual, collectional and taxonomic matches), the significance levels were relatively small, overall. The regression analyses indicate that the task between-subject variable contributed very little to the linear regression equation (Tables 23 and 24).

If the symbolic play data had been significant, the semantic analysis of children's use of the words "real," "pretend," "make-believe" and "fake" might have been more illuminating. Overall, preschool children tend to collapse the meanings of the words "pretend," "make-believe" and "fake," with some small differences. All three words tend to convey a similar meaning and in

opposition to the word "real." Given that some children used one of the three words without necessarily understanding the others in the symbolic play tasks, it appears that for the children the words had the same meaning. For both groups, "real" connotes something alive. Moreover, 6-year-olds invoked representational objects (e.g., TV, drawings) in explaining and defining the meanings of the three words or the concept of the mental, i.e., as something one can think about in the mind.

One could ask what theory of metaphor emerges from the overall study. Winner, Levy, Kaplan & Rosenblatt (in press) suggest that the distinguishing characteristic of nonliteral language is that the speaker means something different from what she or he says. Metaphor's function is to "clarify, illuminate, or explain" (p. 3) and hence, because it has great descriptive power, it is able to shape and reshape our knowledge of the world. Literal use of language is not always up to the task because often metaphor is the only way to express what we mean. As they note, "metaphor may reflect a focus on the external world, the attributes of things, what they are like . . . but it is the particular genius of metaphor to inform vividly about unexpected and unappreciated attributes" (p. 22). The present study suggests, however, that

metaphor is not an exclusive property of the linguistic medium but is embodied in other representational media as well, or what Goodman (1976) refers to as symbol systems. Therefore, if the process of metaphor making is considered as an agency of thought or cognition, then, from a semiotic perspective, different symbol systems possess differential abilities to highlight similarity because of their inherent differences. Hence, we can speak of nonliteral dance (e.g., Turner, 1971), non-representational painting (e.g., Stella, 1986), or the rhetorical aspects of film (e.g., Harrington, 1973). Obviously, then, perceptual features of color and shape are more easily highlighted in the visual modality and more easily understandable or produced by younger children, because they draw on natural relationships in the world that are largely a product of biological constraints (perceptual and affective). More complex, i.e., conceptual, relationships are better highlighted in the linguistic medium, such as nonliteral psychophysical and taxonomic similarity. They derive from sensory, conceptual and linguistic experience, the latter two a partial result of social factors, the psychophysical realm, in particular, and are thus understood at later ages. The ability to cross conventional boundaries of experience is based on prior category abilities, not the

attainment of concrete operations, which prefigure later developing abilities. Metaphor's important function is creating similarity not highlighting existing similarity, since similarity is not found in the world but is the effect of thinking.

Appendix A

List of Metaphor Task Items[ab]

1. ice cream, clouds, scoop (P/C)
2. long haired girl, hanging plant, hat (P/S)
3. stick of butter, school bus, bread (P/C)
4. building, giraffe, window (P/S)
5. sad girl, weeping willow tree, park bench (PH)
6. tired runner, dry plant, shoes (PH)
7. angry man, storm, coat (PH)
8. marching men, flock of birds, gun (CL)
9. family, blocks, house (CL)
10. train, string of beads, track signal (CL)
11. sweet perfume, bright sunshine, bottle top (CM)
12. soft sound, pillow, ear (CM)
13. smelly trash, noisy tires, paper (CM)
14. unfriendly man, rock, shoes (PP)
15. happy man, sun, car (PP)
16. kind mother, heater, purse (PP)
17. violin, singing bird, music stand (T)
18. baby, rosebud, diapers (T)
19. fish on hook, plane on fire, ocean (T)

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[a] P/C perceptual/color
P/S perceptual/shape
PH physiognomic
CM cross-modal
CL collectional
PP psychological-physical
T taxonomic

[b] The order of the items in each triad is target, nonliteral match, literal match.

Appendix B

List of Symbolic Play Tasks

Game 1:	"child-initiated"	Examiner asks child to teach him a make-believe game.
Game 2:	"adult-initiated"	Subject asked to prepare some "food" (hamburger and a pickle) to take on a picnic (playdough).
Game 3:	"adult-initiated"	Subject asked to pick a "kitten" from an array of objects: a ball of yarn, a fluffy beany cap, and two different kinds of kitchen sponges, in a "pet store."
Game 4 & Game 5:	"adult-initiated"	Subject and examiner play with an animal hand puppet (a green frog) named "Wally," engaging him in various activities: (a) picking strawberries (pebbles) (b) boating (shoebox)

Appendix C

List of Semantic Features Questions by Triad

1. What's white? What has the same shape?
2. What's long?
3. Which are the same color? Which are the same shape?
4. What's tall?
5. What is bent over? Who's sad?
6. Who is tired? What needs water?
7. Who is angry? What are these? (points to "runes")
8. Who's marching? What is grouped together?
9. What are these? (points to "runes")
10. What's this? How are they connected?
11. What smells? What shines? What are these? (points to "runes")
12. What rings? Soft or loud? Is this soft or hard? What are these? (points to "runes")
13. What smells? What's noisy? What are these? (points to "runes")
14. Who's angry? What's hard?
15. Who's happy? What's bright? What are these? (points to "runes")
16. Warm or cold? What's warm?
17. What makes music?
18. What's young?
19. Who's in trouble? What's this? (hook, fire)

Appendix D

Statistical Program (Facsimile)

```
// JOB          REGION=500K
// EXEC SPSSX
// SYSIN    DD *
//UNNUMBERED
DATA LIST  FIXED
  /1 TYPE1 TO TYPE7 1-7 STAGE 8 AGE 9 TASK 10
     MEDIUM 11
VARIABLE LABELS TYPE1 'PERCEPTUALCOLOR'
                TYPE2 'PERCEPTUALSHAPE'
                TYPE3 'PHYSIOGNOMIC'
                TYPE4 'COLLECTIONAL'
                TYPE5 'CROSSMODAL'
                TYPE6 'PSYCHOPHYSICAL'
                TYPE7 'TAXONOMIC'
VALUE LABELS STAGE 1 'PREOP' 2 'CONOP'/
             AGE 1 '4 YEARS' 2 '6 YEARS'/
             TASK 1 'SPT' 2 'NO SPT'/
             MEDIUM 1 'PICTURES' 2 'WORDS'
MANOVA TYPE1 TO TYPE7 BY STAGE(1,2), AGE(1,2),
       TASK(1,2), MEDIUM(1,2)/
              TRANSFORM=DIFFERENCE/
              PRINT=CELLINFO(MEANS)/
              PRINT=HOMOGENEITY(BARTLETT,COCHRAN)/
              PRINT=SIGNIF/
              PRINT=OMEANS(TABLES(STAGE,AGE,TASK,
                    MEDIUM,AGE BY MEDIUM)/
              PRINT=TRANSFORM/
              DESIGN/
```

Appendix E

Explanations of Metaphorical Types[a]

4-Year-Olds

P/C	1.	"Both white." "Same color, that's vanilla (ice cream) and that's vanilla (clouds)" (points).
P/S	4.	"Both big." "The building is tall and the giraffe has a tall neck."
PHYS	6.	"The flowers are dying and the man is tired."
	7.	"He's mad and the thunder is mad."
COLL	9.	"Because this is the mommy, this is the daddy and this is the baby."
C-M	11.	"Bright sunshine is sweet and so is perfume." "That's spraying and the sun is shining" (an inadequate explanation).
	12.	"Both are soft."
P-P	14.	"The rock is ahhhhh!" (gestures with hands and face). "Rocks are hard and an unfriendly man pushes you" (both inadequate explanations).
	16.	"Both are warm. The radiator is warm and makes her warm" (inadequate explanation).
TAX	17.	"Birds sing music and this does too (violin)."
	19.	"Man got the fish and the plane got burned."

6-Year-Olds

P/C	1.	"Vanilla ice cream looks like clouds because they're the same color."
P/S	2.	"She has long hair and this has long leaves."
	3.	"Same shape."
PHYS	5.	"It has hair all over it and the stem is like a body and the branches are like arms." "Both are weeping."
	6.	"Both of them are weak."
COLL	8.	"Alot of people and alot of birds."
	9.	"They are a family and these are a bunch of boxes."
C-M	11.	"Both are sweet." "The sun is brightening and there is perfume coming out" (inadequate explanation).
	12.	"Both are soft but in different ways."
P-P	14.	"He's as hard as a rock, he can hurt you."
	16.	"Both warm but in different ways." "They give the baby heat so it won't be cold" (inadequate explanation).
TAX	17.	"The bird sings sometimes and you can use it (violin) to make music."
	19.	"Both kind of trapped."

---

[a]For both age groups, numbers and abbreviations correspond to metaphorical types as indicated in Appendix A. Explanations are not inclusive but

were selected from those given for their typicality from the total universive of 120 subjects.

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