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Modes of Representation, the Epistemic Subject and Developmental Word Association Phenomena

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MODES OF REPRESENTATION, THE EPISTEMIC SUBJECT AND DEVELOPMENTAL WORD ASSOCIATION PHENOMENA

by

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Abstract

MODES OF REPRESENTATION, THE EPISTEMIC SUBJECT

And DEVELOPMENTAL WORD ASSOCIATION PHENOMENA

by

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This study was devised to investigate the developmental syntagmatic-paradigmatic word association shift. In syntagmatic associations the stimulus and associative response are of different grammatical form classes and appear to be grammatically continuous, as response may follow stimulus in an utterance (e.g. cat-meows). These are the predominant responses of children before the ages of six to eight. Older children and adults shift to making paradigmatic associations in which stimulus and response are from the same form class and may be substituted for one another in an utterance (e.g. cat-dog). This shift was explained in terms of underlying symbolic mediational processes and the epistemic subject, the child's interpretation of the unstated task demands of the word association test.

The central hypotheses were:

1. The syntagmatic-paradigmatic shift occurs because younger children use verbally-evoked images to generate their word associations and so produce syntagmatic responses. Older children, on the other hand, rely less on verbally-evoked images and more on knowledge of unstated task demands to generate their word associations. Older children can accomplish this because they have acquired explicit or potentially articulated knowledge of hierarchic semantic organization (abbreviated HSO) of

words (e.g. cats and dogs are animals), which younger children have only tacit, unarticulated knowledge of. On the basis of other studies (e.g. Mansfield, 1977; Steinberg & Anderson, 1975) it was assumed that all age groups have comparable implicit knowledge of hierarchic semantic organization and that therefore this would not play a significant role in the shift to paradigmatic responding.

2. The ability to change deliberately the mode of representation (i.e. imaginal or linguistic) through which word association responses are mediated depends on the acquisition of two kinds of metaknowledge: a) metalinguistic knowledge and b) explicit knowledge of imagery.

To test these hypotheses, twenty kindergarteners, twenty second graders and ten college students were presented with 48 words, consisting of high and low imagery nouns, verbs and adjectives under five different word association instruction conditions: 1) the standard "first-word"; 2) paradigmatic, in which Ss were trained to give an association which could substitute for the stimulus in a sentence; 3) syntagmatic in which Ss were trained to give an association which together with the stimulus would complete a phrase; 4) imagery, in which the subject was asked to obtain a "picture" of the stimulus word in her head before responding and 5) time delay, which required that the subject wait three seconds before responding. The purpose of this last condition was to determine whether the delay in responding was responsible for a possible increased frequency of syntagmatic associations in the imagery condition. One half the kindergarteners and second graders also received: 1) two convergent measures of metalinguistic knowledge, which tap the child's understanding

of words as arbitrary, interchangeable units; 2) two convergent measures of explicit knowledge of imagery, which tap the child's understanding of the distinction between (a) images and words and (b) images and objects; 3) the hierarchic semantic organization and 4) word-word relationship tasks. The latter two tasks respectively tap the child's tacit and explicit understanding of the hierarchic semantic organization of words.

A control group consisted of the remaining ten kindergarten and second grade children who received only the five word association tests. The purpose of this control group was to determine if administration of the metalinguistic and other cognitive tasks influenced subsequent word association responding.

The results showed that there appears to be a developmental progression in the way children approach the word association task. First, very young children seem to produce responses based only on the phonological form of the word; i.e., they produce clang responses, which rhyme with the stimulus, or negated responses, generated through an "negation" rule which consists of prefixing "not" or "un" to the phonological form of the stimulus word to produce a response. Later, children begin to consider the meaning of the stimulus word. At the start, this may be confined to considering the imagery which the stimulus word evokes. Evidence indicates that stimulus imagery mediates the generation of syntagmatic associations. Gradually, as tacitly known hierarchic semantic organization becomes more filled-in,* and the child gains explicit access to it, it is possible for her to produce paradigmatic responses. But in order to do so spontaneously, she must also understand that words are arbitrary, manipulable units. On the other

* As determined by absolute number of correct responses.

hand, if she is explicitly directed to produce paradigmatic responses, she will be able to do so, as long as she has explicit access to a filled-in hierarchic semantic structure. Metalinguistic knowledge does not play a role in this case since the explicit directions replace its function as an aid to the spontaneous production of paradigmatic responses.

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CHAPTER I - INTRODUCTION AND OVERVIEW

The free word association test is used to tap various cognitive and affective phenomena within theoretical frameworks as diverse as behaviorism and psychoanalysis. The test merely requires the subject to "say the first word that comes to mind" in response to a verbal stimulus. In testing children, researchers note qualitative changes with age in response commonality and the conceptual and grammatical relationships which obtain between stimuli and their corresponding responses (Cramer, 1968). This paper is mainly concerned with the changes in the grammatical relationships, often referred to as the syntagmatic-paradigmatic word association shift (Brown & Berko, 1960; Ervin, 1961; Entwisle, 1966, 1970; McNeill, 1966, 1970).

In syntagmatic associations the stimulus and associative response are of different grammatical form classes and appear to be grammatically continuous, as response may follow stimulus in an utterance (e.g., dog-bark). These are the predominant responses of children before the age of six to eight. Older children and adults shift to making paradigmatic associations in which stimulus and response are from the same form class and may be substituted for one another in an utterance (e.g., dog-cat). There are two major conceptual classifications of paradigmatic associations: a) logical and b) functional. In logical paradigmatic associations, the stimulus and response word are related to one another

through some categorization or class inclusion relationship. For example, the stimulus word may be a category name and the response an example of that category (e.g., animal-dog). In functional paradigmatic associations, the stimulus and response word denote entities between which there is an explicit functional relationship (e.g., car-gas).

The characterization of the developmental shift as syntagmatic-paradigmatic is often gross and even misleading, however, since its manifestation varies with grammatical class (e.g., Entwistle, 1966; Sharp & Cole, 1972). For example, very young children produce a preponderance of nouns to all grammatical classes of stimuli, with the result that the shift is more pronounced for adjectives, verbs and adverbs than for nouns.[1] Even adults produce paradigmatic responses to nouns, adjectives and verbs in that order. In addition, certain syntagmatic associations (e.g., verb-adverb; adjective-noun) actually increase with age, while miscellaneous responding (e.g., multiword and rhyming responses) decreases. This will be discussed in greater detail later. Further, sentence substitution and completion criteria for determining whether an association is paradigmatic and syntagmatic respectively are often not adhered to and similarity of form class is the only rule used to classify responses even though the response labels do not so indicate.

Despite the descriptive shortcomings of the syntagmatic-paradigmatic dichotomy, a rather large body of literature discusses developmental word

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[1] Young children do not only produce nouns as associative responses, but other form classes as well. For example, four year olds produce adverb-verb pairs 41.3% of the time and adverb-noun pairs only 26.9% of the time. In addition, noun responses are made with varying frequencies to various form class stimuli, indicating that even very young children are sensitive to form class. Further, even four year olds produce paradigmatic responses with appreciable frequency (e.g., verb-verb pairs - 18.8%; adjective-adjective - 17.5%) (Entwistle, 1966).

association behavior in these terms as it constitutes a concise, conceptually useful terminology which is largely descriptively valid. Hence, the terminology will be retained here.

The shift has been interpreted as having significance for a variety of psychological phenomena such as a) associative learning; b) linguistic-syntactic organization; c) semantic-organization; d) cognitive, conceptual or logical operational organization. All of these widely divergent interpretations, however, share one assumption; that word associations are made without the subject's consideration of the task demands and culturally learned values. Further, none of them approaches the problem in terms of the symbolic mediational process which may be said to represent the production of word associations.

The position taken here is different from these in two ways. First, it views word association responses as a reflection of the child's perception of the task demands and culturally learned values as follows: The word association task is an open-ended unstructured one. Because of its openendedness, it is meaningless to a young child. To attempt to make sense of and comply with the experimenter's demand to say a word in response to a stimulus the child at first responds with clang (rhyming responses; e.g., fruit-moot) or multiword (e.g., fruit-I eat fruit) associations. She also makes other responses such as syntagmatic ones, but it is only with exposure to formal education and the modes of responding it prefers that the child comes to produce a preponderance of paradigmatic associations based on mechanisms to be discussed shortly.

Second, the present position differs from others in that it analyzes the problem in terms of underlying symbolic mediational processes. I

postulate that there are two major representational systems, linguistic and imaginal, which provide the symbolic mediators to generate word association responses. Further, there are two types of linguistic mediators: a) hierarchic semantic organization and b) syntactic.

Hierarchic semantic organization, one form of linguistic representation, refers to the structure (as opposed to the content) of class inclusion relationships among words (e.g., animal-cat-dog). At first the child has only implicit[2] access to hierarchic semantic organization and it is tapped only by tasks which do not require the child to apply it deliberately to task situations (e.g., Nelson, 1974; Steinberg & Anderson, 1975; Mansfield, 1977). Gradually, with exposure to abstract categorization systems, the knowledge becomes more and more explicit and may be used in tasks which call for its increasingly deliberate application.

Linguistic syntactic mediators refer to linguistic structures which generate syntactic sequences. Substantial evidence indicates that syntagmatic responses are produced by imaginal symbolic mediators. But they may

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[2] Implicit knowledge of a phenomenon cannot be articulated, in contrast to explicit knowledge which has at least the potential to be articulated. Certain cases of release from proactive inhibition demonstrate this distinction quite clearly. Proactive inhibition refers to the decline in performance on successive short term memory tests which involve stimuli from the same category. For example, if three sets of three numbers are presented, recall of the third set will be much lower than that for the first set. If a set of three letters is presented on the fourth trial, however, performance on that set will be equivalent to that on the first set of numbers. This demonstrates release from proactive inhibition. Such release also occurs if old and new sets are respectively drawn from the opposite poles of the potency, evaluation and activity dimensions of the semantic differential. Direct examination and comparison of these two different sets of words does not permit them to be grouped into two separate categories, however. The knowledge which distinguishes them and allows release from proactive inhibition to occur is tacitly or implicitly, rather than explicitly held (Turvey, 1974).

also be produced by linguistic syntactic mediators. Paradigmatic associations, on the other hand, are assumed to be produced only by hierarchic semantic mediators.

Developmental changes in the differential use of the imaginal and linguistic representational systems hypothesized to partially account for the syntagmatic-paradigmatic shift. At first, the child bases her word association responses mainly on the properties of her stimulus-evoked images. Consequently, the young child produces a preponderance of syntagmatic responses. Gradually, through education and practice in overt abstract categorization, class inclusion relationships between words or "hierarchic semantic organization" become available for application to the word association task. The child exploits that structure to produce responses, for in addition to providing her with explicit access to it, her education has also taught her that such responses are highly valued.

Hence it is hypothesized that as the child acquires explicit access to hierarchic semantic organization, as manifested by her articulated knowledge of class inclusion relationships among words, she produces logical paradigmatic responses. But this does not imply that the reasons for her preference for making paradigmatic responses can be articulated. It also does not imply that she is able to voluntarily switch her mode of responding from one type of linguistic representational basis to another (i.e., from hierarchic semantic to syntactic) or from a linguistic basis to an imaginal one. It is hypothesized that two types of metaknowledge are required to do so: knowledge of a) words and b) images as entities distinct from one another and from the objects they represent. Once this knowledge is acquired, the child is able to control flexibly the type

of symbolic mediator she uses to generate her word association responses so that they consist of either a) the properties of stimulus evoked images or b) linguistic mediators (e.g., hierarchic semantic organization or syntactic factors). Until this occurs, the child only automatically rather than consciously and deliberately, accesses this hierarchic organization to produce logical paradigmatic associations.

Note on Associative Structure

It has often been assumed that overt verbal associations reflect semantic or cognitive organization in memory. Associationist theory, the simplest and oldest one attempting to account for the relationship between overt association and inner mental organization, holds that contiguity is not only descriptive of the associative sequence, but that it also is its cause. More recently, various structural principles have been introduced to provide a rather more complicated and at the same time, simpler mechanism to explain the occurrence of an infinite number of possible association sequences. These structural principles, which are meant to describe semantic memory specifically, are not necessarily isomorphic with linguistic or logical structures.[3] Clark (in Nelson, 1977), for example, uses the notion of conceptual or semantic features or "atoms of meaning" which are gradually arranged in a hierarchy as development proceeds. Still others use the notion of propositional or functional relationships instead of hierarchically arranged semantic features or sentence structure mechanisms to represent semantic memory (Nelson, 1977).

I have assumed that semantic memory may at least be partially isomorphic with logical structure and that memory is organized in

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[3] Logical structure refers to the hierarchy of class inclusion relationships among words (e.g., animals include mammals, reptiles, amphibians, etc.; mammals include dogs, cats, humans, and so on).

essentially the same logical structure in both young children and adults. The difference between these groups, however, is in the ability to exploit that latent structure and use it to generate responses in tasks that call for a more explicitly produced solution. Of course, it is also assumed that word association is such a task.

In the following chapter the normative evidence and the data pertaining to previously proposed explanations of the syntagmatic-paradigmatic shift are examined. This will permit us to more fully explore the one put forth here.

CHAPTER II - REVIEW OF THE LITERATURE

A. Normative Studies

1. Developmental Data

The first major word association study with children was performed in 1916 by Woodrow and Lowell. They tested 1,000 nine to twelve year olds with 100 words, 90 of which had been used by Kent and Rosanoff (1910) in an earlier study of 1,000 "men-in-industry." Children were found to differ from adults in both the frequency and content of their associations. Children gave fewer contrast, superordinate, coordinate, part-whole, noun-abstract attribute, participle and cause-effect (e.g., fire-hot) responses. Children also gave more verbs, verb-object, noun-adjective, adjective-noun, pronoun, sound similarity, contiguity and whole-part responses. As Woodworth & Schlosberg (1954) noted,

> "Children tend to stay by the thing mentioned; they tell something about the thing, complete or enlarge upon the idea conveyed by the stimulus word; whereas adults jump to a related, parallel idea."[4]

Palermo & Jenkins (1963) using a word list identical to that of Woodrow & Lowell, found that compared to Woodrow & Lowell's norms paradigmatic responding of nine to thirteen year olds had increased by ten percentage points or more for both nouns and adjectives. This was especially true of superordinate responses. Hence, since 1916, children had become more "adultlike" in their responses. The authors attributed

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[4] R. S. Woodworth and H. Schlosberg, Experimental psychology (rev. ed.). New York: Holt, Rinehart & Winston, 1954, p. 54.

this chronological-cultural change to the homogenizing influence of the mass media and urbanization.

Numerous studies have shown that the shift manifests itself to different degrees depending on the form class of the stimulus. It is generally most apparent for adjective and verb stimuli and least for noun stimuli. For example, Kagan, Rosman, Day, Albert & Phillips (1964) found that first through fourth graders produced paradigmatic responses to nouns, adjectives and verbs in that order. Palermo (1972) presented a 100 item list to 100 children in first to fourth grade and found that there is little change in paradigmatic responding to nouns, but significant shifts to adjective, adverb, verb, pronoun and prepositions, with the greatest shift occurring between first and second grade. Superordinate and contrast responding also increased over this time. Palermo (1963) also noted that paradigmatic responses to adjectives increased earlier than other grammatical classes. All grammatical classes elicited more paradigmatic responses from twelfth grade subjects than from fourth grade, except adjectives which elicited as many paradigmatic responses from both groups. Indeed, Palermo (1965) found that paradigmatic responding to adjectives peaked at grade two and remained constant thereafter.

Entwisle, Forsyth & Muuss (1964) tested 500 four to ten year olds and found that there was little increase in paradigmatic noun responses throughout childhood. Paradigmatic responses to adjectives however, underwent an accelerating increase between kindergarten and third grade and a further slight increase from third to fifth grade, amounting to a total increase of 500%. Changes in responses for verbs proceeded at a slower pace than for other form classes, but paradigmatic responding was

strongly established by the fifth grade.

Entwisle et. al. attribute these results to the young child's "primitive noun response," the tendency to respond with nouns to all types of stimuli regardless of form class. They summarized their findings as follows: Four to five year olds make many multiple word and clang (rhyming) responses in addition to a preponderance of noun as opposed to other form class responses. With five to six year olds, there is a decrease in noun responding, and paradigmatic responding to adjectives and verbs is observed. Syntagmatic responding is evident. In six to eight year olds, noun and syntagmatic responses drop sharply, while paradigmatic responses increase markedly. From eight to ten, paradigmatic verb responses increase and the percentage of syntagmatic responses declines to the adult level.

In a subsequent study, Entwisle (1966) varied the frequency as well as the form class of the stimuli. The findings of the earlier study were basically reiterated with some additional observations. First, frequency accounted for only a relatively small percentage of the variance in paradigmatic responding. Second, contrast verbs (e.g., add-subtract; buy-sell) and adjectives (e.g. black-white) show a sudden shift toward paradigmatic responding between first and third grade. Non-contrast adjectives and verbs on the other hand, (e.g., yellow, thirsty) show a gradual pattern of increase in paradigmatic responding. Third, although syntactic responding is generally at its peak at kindergarten or first grade, it still exists and even increases in some cases to college.

Entwisle claims that adult syntactics are enlargements in meaning and a richer interpretation of the concept, while children's syntactics are

based merely on grammatical contiguity. It is interesting to recall at this point that Woodworth & Schlosberg (1954) claimed that children's rather than adults' syntactic responses represented an enlargement of the stimulus idea. These contradictory interpretations of the same phenomenon highlight the difficulty of deciphering the developmental significance of various stimulus-response relationships, a point which will be elaborated upon in the discussion of cognitive frameworks.

In sum, the normative data for children shows that the frequency of syntagmatic and paradigmatic responding is determined at least by form class, frequency, and the particular characteristics of the words sampled (e.g., contrast vs. noncontrast). The shift is observed more dramatically for high frequency adjectives, while nouns tend to be paradigmatic at all ages and verbs tend to be more strongly syntagmatic.

2. Adult Data

Several investigators have examined the syntagmatic-paradigmatic phenomenon exclusively with adults. Fillenbaum and Jones (1965) tested adult undergraduates and summarized the results to other studies. They found high variation in paradigmatic responding among the various form classes, ranging from 79% for nouns to 23% and 29% for articles and conjunctions respectively. Deese (1962) found a surprisingly low level of paradigmatic responding for all classes but nouns for 100 adults. Deese also found that in adults, syntagmatic responses were correlated with Thorndike-Lorge word frequency only for adjectives. The high frequency adjectives generated contrast paradigmatic responses. Verbs, adverbs and low frequency adjectives generated about as many paradigmatic as syntagmatic responses. Syntagmatic responses were more often elicited by adverbs followed by adjectives and verbs and then by nouns. In some contrast

however, Glanzer (1962) found that the responses of army enlisted men tended to be of the same grammatical category as the stimuli.

Thus, the adult and childood data are consistent in that nouns elicit more paradigmatic responses than adjectives and verbs. But for adults verbs seem to elicit more paradigmatic responses than adjectives, while for children the reverse is true.

3. Conceptual Stimulus-Response Relationships

Several studies have analyzed the stimulus-response relationship in conceptual (e.g., contrast : black-white; superordinate : black-color) rather than in grammatical terms. For example, Palermo (1971) found that superordinate and contrast responding increased over grades one to four. Palermo & Jenkins (1963) compared their data to that of Kent & Rosanoff (1910) and Woodrow & Lowell (1916). They found that while frequency of superordinate responding had decreased for adults from 1910-1961, it remained the same for fourth and fifth graders with children now giving more superordinate responses than adults. Palermo & Jenkins (1965), however, determined that the increase was partly only an apparent one and was partly a function of the different methods of stimulus administration, with oral rather than written stimuli producing more paradigmatic responses for nouns. But only time made a difference for adjective stimuli with 1961 and 1963 testing yielding more paradigmatic responses than the Woodrow & Lowell (1916) administration. Contrast responding also appeared to have clearly increased in 1961 compared to 1916 children.

Koff (1965) found that both adults of 1954 and children of 1963 had a heightened level of contrast responding compared respectively to adults of 1910 and children of 1916. In sum, it seems that cultural changes occurring between the 1910's and the 1950's and 1960's have

generally resulted in an increasing sophistication of word association responding in both children and adults. This may be attributed to the homogenizing effect of mass media and urbanization and perhaps also to different task interpretations and practice in test taking by the different populations.

To sum up these findings, in both children and adults nouns elicit more paradigmatic responses than any other form class, with adjectives and verbs following in that or the reverse order. Contrast and superordinate responding increases throughout childhood, while superordinate responding declines thereafter. Various hypotheses have been offered to explain these findings and these will now be examined.

B. The Interpretative Frameworks

1. The Associationist Framework

The associationist framework has historically been most widely used to interpret word association data (e.g., Galton, 1879; Cattell, 1887). Most recently, Ervin (1961) applied associationist principles in an attempt to explain the syntagmatic-paradigmatic word association shift. She claims that associations are learned as the listener anticipates the words not yet spoken as she processes the flow of speech. Words which can be substituted for one another, paradigmatically related words, come to be associated as the listener makes incorrect guesses about the word to come. Syntagmatically related words are more easily and obviously associated through their actual contiguity. Hence, recall mechanisms (i.e., recall of associated words) are assumed to underlie the production of both syntagmatic and paradigmatic associations.

Support for this hypothesis came from a correlation of .87 between the transitional probabilities of five grammatical classes in actual

syntagmatic word associations and those of the same five classes in texts. Further, first, second, third and sixth graders exhibited earlier increases in paradigmatic responses for words which frequently appear in the final as opposed to medial position in a sentence, as predicted from the theory. Final words present a more efficient means of establishing substitutive as opposed to grammatically contiguous associations, since no word follows the final word and, therefore, no word is grammatically contiguous with it. Only substitutive associations can be learned for final words, as the subject makes erroneous anticipations.

In a subsequent study, Ervin (1963) administered a free word association test to high school and college students and then asked them to use each stimulus word in a sentence. Subsequently they were to provide four words which could be substituted for the original stimuli in their sentences. For most stimuli the greatest predictor of associative response frequency was the response's rate of substitution in the sentences. Similarly, syntagmatic associative frequency was predicted by contextual frequency if the response followed rather than preceded the stimulus in the sentence, as is predicted from the theory.

To further test Ervin's (1961) hypothesis McNeill (1963) constructed sentence frames such that nonsense syllables occurred only if the two nonsence syllables had been learned in the same context. If they occupied the same grammatical position in a different sentence their occurrence as paradigmatic responses did not increase with learning. This was interpreted as strong empirical support for the Ervin hypothesis, since it predicts that paradigmatic responses occur only after two words sharing the same context are erroneously anticipated for one another, thus becoming associated. As McNeill noted, however, these results can just as easily

be explained by a standard mediated association theorem; i.e., any two words that share associates become associated. In this case the two noun nonsense syllables shared the adjective nonsense syllable, becoming associated through its mediational effect.

Indeed, in a later study, McNeill (1966) presented evidence which refuted Ervin's position. Since Ervin's hypothesis assumes that word associations are produced through recall, more training of overt erroneous anticipations should result in a greater number of paradigmatic responses, as these pairs should more efficiently recall or elicit one another. This was not the case, however. Further, subjects who had training in constructing sentences using nonsense syllables and replacing them with other "grammatically correct" nonsense syllables made significantly more paradigmatic responses than Ss who just received erroneous anticipation training. This indicated that sentence production mechanisms themselves play an important generative role in word association rather than the reverse associationist claim that associative mechanisms play an important role in sentence production.

In a study with adults, Glucksberg & Cohen (1965) used nonsense syllable trigrams in noun and verb positions in sentences which were purportedly constructed to preclude specific referential meanings. They were then used as stimuli in a free word association test. Paradigmatic word associations were obtained as a function of the nonsense syllable's syntactic usage and approximated the levels found with regular words in other studies. These results cannot be attributed to the stimulus having frequently occurred in the context of identical other stimuli as Ervin claims is necessary. Instead the authors concluded that paradigmatic

responses in adults are the result of a substitution process based solely on grammatical category, as this was the only cue they claim their subjects had to the significance of the nonsense syllable stimuli.

Thus, both McNeill (1966) and Glusksberg and Cohen (1965) did not provide experimental support for Ervin's hypothesis. But even if such studies using adult propulations and nonsense syllables had been supportive, it is questionnable whether such findings could be generalized to developmental phenomena in children who are tested with actual words. In addition, it is unlikely that children could acquire the vast amount of experience required for developing the appropriate associations which would be necessary to accomplish the paradigmatic shift. There is also no evidence that either children or adults process the flow of speech in an anticipatory manner (McNeill, 1966). Hence, it appears that a simple associative account does not constitute an adequate explanation of the syntagmatic-paradigmatic word association shift.

2. The Linguistic Syntactic Framework

The linguistic-syntactic approach to developmental word association behavior was primarily adopted by Brown & Berko (1960). It is derived from Chomsky's (1965) generative transformational grammar and makes certain developmental psycholinguistic assumptions; namely that the child learns language through an unspecified inductive process whereby the function of various parts of speech become known through direct contact with the language's sentences and the words which compose them. Onee the child "appreciates" syntactic similarity of various words belonging to different parts of speech, she is able to form meaningful and grammatical sentences. As this appreciation of syntactic similarity of words develops, it becomes an increasingly important determinant of word association. The

syntagmatic-paradigmatic shift (which, rather significantly, Brown & Berko call the heterogeneous-homogeneous shift) is therefore one manifestation of the acquisition of syntax. Hence, within this framework both word associations and sentences are produced by the same mechanism; i.e., "appreciation" of syntactic similarity.

To test their hypothesis, Brown and Berko presented first, second and third graders and adults with a word association test consisting of 36 items from six grammatical categories; count and mass nouns, adjectives, transitive and intransitive verbs and adverbs, and a grammar usage test which required subjects to make up new sentences using nonsense syllables which functioned as the same six parts of speech as used in the word association test. These syllables were introduced to the S by the E who appropriately used each one in two sentences.

A heterogeneity/homogeneity dichotomy rather than the syntagmatic-paradigmatic one was used to classify word associations. The discrepancy between heterogeneity and syntagmatic categories of the two respective scoring systems constitutes the main difference between them. While a syntagmatic response is always heterogeneous, a heterogeneous response is not always a syntagmatic one, as for example in the pair "difficulty-hard." While these two words are of different grammatical classes they do not follow one another in a sentence.

Performance on the grammatical usage test was highly correlated with that on the word association test by word class; the order of accurate performance on the former and the proportion of homogeneous responses on the latter was similar, except that the order for nouns and verbs was reversed. On this basis the authors conclude that the syntagmatic-paradigmatic shift is a consequence of the child's gradual organization

of her vocabulary into syntactic classes.

As McNeill (1966) points out, however, children form correct grammatical sentences and obviously are well acquainted at least implicitly with English syntax long before the shift occurs. Hence Brown and Berko's position can justifiably be rejected outright. Yet a closer more critical look at their grammar usage test reveals some useful information nonetheless. In this task the child becomes acquainted with the nonsense syllable test item in just two contrived sentence presentations. This can be assumed to be too few and too removed from supporting ongoing context for the child to arrive at an implicit understanding of its grammaticality as quickly as the task demands her to. Yet she nevertheless possesses these intuitions with respect to other words in her vocabulary. It seems likely that this discrepancy in performance can be attributed to the child's inability to use various rather subtle surface structure elements like word endings which must be isolated from the rest of the word, as quick and efficient cues to play the experimenter's game. It would appear then that Brown and Berko's grammar usage test explores the child's explicit and potentially articulated (as opposed to implicit and unarticulated) knowledge of syntax. Since the task requires that not only words, but also parts of words, such as word endings are understood as isolable units, explicit knowledge of words as words, or metalinguistic knowledge, would seem to be a prerequisite for adequate performance.

3. Semantic Organization Framework

There are several accounts of word association in terms of semantic organization. For example, McNeill (1966) specifically proposed an alternative to the Ervin (1961) and Brown & Berko (1960) hypotheses to

explain the syntagmatic-paradigmatic word association shift. Like Brown & Berko he used transformational generative grammar as a starting point, but emphasized its semantic rather than syntactic aspects, taking an interpretive semantic position and adopting the selectional restrictive and semantic feature system derived from Chomsky (1965) and Katz & Fodor (1963). In this system, lexical items are specified by features which determine their syntactic status and meaning. In addition, McNeill made two assumptions: a) that verbal associates are produced generatively and b) that the response chosen as the associate is one whose features contrast minimally with those of the stimulus. For those with complete semantic systems, this word is of the same form class as the stimulus. But for young children, this word is often not of the same form class, since their lexicons are not characterized by as many features as adults' and their semantic categories extend across grammatical categories. Thus, McNeill claims that paradigmatic responding occurs at all ages and that syntagmatic responding is merely an artifact of the young child's incomplete semantic system.

Clifton (1967) elaborated upon McNeill's position by more clearly distinguishing between aspects of the feature system which contribute to syntagmatic and paradigmatic associations respectively. A syntagmatic association occurs when the contextual, selectional-restrictive features (e.g., one selection restriction for "good" is [Eval: (——)]) of a lexical item are matched to the (semantic and syntactic) inherent features of another. A paradigmatic association occurs when features of one lexical item are more generally matched with those of other lexical items.

Clark (1970), on the other hand, suggests that in children and adults different types of associates are generated by different rules which

operate according to a general principle of simplicity of production and least change of the stimulus' syntactic and semantic features, which Clark does, but McNeill does not order in a hierarchy. Since young children's lexicons lack semantic features lower down on the hierarchy, they can apply fewer rules to generate associations than older children and adults. For example, paradigmatic responses may be generated by rules such as the minimal contrast rule (which is McNeill's only one) in which the response is a word whose features contrast minimally with those of the stimulus. There is also a marking rule, in which a marked word elicits its unmarked[5] opposite; a feature deletion or addition rule, which generates subordinate or superordinate responses respectively, and category preservation rule which generates coordinate responses. Syntagmatic associations are generated by a selectional feature realization rule, similar to Clifton's and an idiom completion rule (e.g., table-cloth).

This formulation has the advantage of accounting for idiosyncratic differences in response production (e.g., Moran, Mefferd & Kimble, 1964; Moran, 1966) in adults if it is assumed that different people tend to rely on different production rules.

In order to account for young children's predominantly syntagmatic associations, both Clark and McNeill claim that they lack certain semantic features. But McNeill simply claims that when young children

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[5] 'Marked' and 'unmarked' are terms used to describe members of pairs of relational and antonymic adjectives and nouns. The unmarked form of the pair is the one which not only refers to a particular pole on the dimension, but also is the more general and ambiguous of the two. For example, in the pair man-woman, man refers not only to the male of the species, but also the species as a whole. In this case, woman is the marked form, the more specific and less ambiguous term of the pair (McNeill, 1970).

attempt to invoke the minimal contrast rule, they must match on fewer semantic features than older children and adults and therefore their associations sometimes extend across grammatical categories, incidentally implying that even syntactic features which are high on Clark's hierarchical order are not necessarily acquired first. Clark, on the other hand, claims that children do not even possess the minimal contrast rule until they acquire the hierarchically lower binary features to which the rule can be applied. Instead, very young children use one of the syntagmatic response rules which operate upon the selectional feature system they already have for use in producing utterances.

On the other hand, Miller (1969) contrasts the functional with the structural aspects of language to account for the shift. The functional aspect of language operates to actually produce syntactic sequences such as phrases or sentences. Structure, on the other hand, represents the syntactic sequence and/or the mechanisms which produce the sequence (the function) but the structure does not refer to the actual operation of the production process. Miller (1969) advanced a general predicate hypothesis in which sentences and word associations are said to be produced by the same functional (as opposed to structural) mechanisms; i.e., predication. Since the basic propositional content of any elocutionary act (e.g., a sentence) is a subject-predicate relation, this too is the basis for a word association. The basic predicate relation "is a" is a case in point. It imposes a subordinate or inclusion organization upon the constituents of a sentence (e.g., dog is an animal), while the predicate relation "has a" imposes a part-whole organization upon them (e.g., a dog has a bark). Thus certain stimulus words tend to evoke certain other responses

in a word association test as a result of the functional sentence production mechanism of predication. This implies that the syntagmatic-paradigmatic shift may be correlated with the frequency with which different types of predications are made. But since there is no evidence bearing on this correlation, it remains an open question.

The positions of Miller, McNeill, Clifton and Clark differ in rather subtle ways. While the hypotheses of McNeill, Clifton and Clark all derive from structural linguistic theories, McNeill assumes that sentences and word associations are produced by different mechanisms, the latter by a minimal contrast rule. Clifton and Clark, on the other hand, state that at least syntagmatic word associations and sentences may be produced by the same mechanisms. Miller's predicate hypothesis also assumes that word associations and sentences are produced by the same mechanisms but unlike the others, it claims these are functional rather than structural in nature.[6]

Several different investigators at least claim to provide experimental support for different aspects of the semantic feature hypothesis. For example, Anderson & Beh (1968) tested McNeill's assumption that although at first words are directly listed in memory, this type of coding system is later replaced by a more efficient feature coding system. They used a false recognition technique[7] with first and second graders and adults,

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[6] Miller (1969) qualifies his statements and specualtes that in fact some hypothesis combining semantic features and predications is probably necessary to account for linguistic abilities in general and we may assume, word association phenomena in particular.

[7] In a false recognition paradigm, the S is presented with a set of stimuli. These are removed and the subject is again presented with a set of stimuli which contain items different from, identical to and/or similar to the original stimulus items according to certain criteria. The S's task is to choose from among them which items were in the original stimulus set.

who determined whether each word in a list of 70 had been presented before. Paradigmatic and syntagmatic associates of old words were embedded in the list as distractors. First graders generally made fewer errors than the older groups, but theirs were syntagmatic, while the older groups' were paradigmatic. These findings were interpreted as support for McNeill's hypothesis that additional semantic features are acquired with age.

Also in accord with McNeill's semantic feature hypothesis, Stolz & Tiffany (1972) reasoned that familiarity or frequency of contact with (as determined by frequency in the Thorndike-Lorge word count) and acquisition of knowledge about words and their relationships would correlate with the shift from distant (response semantically unrelated to the stimulus) or syntagmatic to what they called logical responses, which were paradigmatic and included synonyms, coordinates, contrasts and superordinates. Hence, it was expected that the shift be observed in adult responses to infrequent adjectives and their frequent synonyms.

While indeed paradigmatic logical responding was found to increase with familiarity, so too did syntactic responding, while unrelated or distant responding decreased, a finding similar to that of Entwisle (1966) with children. On this basis the authors concluded that the cause of the developmental shift is the acquisition of additional lexical material rather than maturation of new or more sophisticated mental processes, in accord with McNeill's hypothesis. But it is questionable whether these findings with adults can be generalized to developmental phenomena, which may be governed by very different laws. Indeed, almost all studies with children have been careful to use only highly frequent and therefore familiar words as test stimuli and yet the shift occurs. Thus, Stolz & Tiffany's findings cannot be said to either refute or confirm the

semantic feature or cognitive interpretations of the syntagmatic-paradigmatic shift.

To determine if the shift corresponded to the learning of superordinate semantic features, Lippman (1971) presented children with a word association test and with noun-noun and adjective-adjective contrasting word pairs, asking them for reasons why the words go together. She found that a developmental increase in paradigmatic word association responding correlated with an increase in nominal justifications (e.g., they're both animals) for noun pairs, and dimension (e.g., they're both times) or opposite (e.g., they're opposites) justifications for adjective pairs.

Lippman argued that indeed these findings may be attributed to the learning of superordinate semantic features in accord with McNeill's (1966) hypothesis. Yet many studies (e.g., Flavell & Stedman, 1961; Reigel, 1970; Francis, 1972; Hall & Halperin, 1972; Nelson, 1974; Steinberg & Anderson, 1975; Manfield, 1977) indicate that very young children at least implicitly or tacitly understand superordinate-subordinate class relations and that younger children's lexical information is not different from that of older children and that Lippman's explanation of her findings cannot be accurate. Further, while researchers (i.e., Masters, 1968; Shepard, 1970) find that children's definitions of words may become more sophisticated with age, they are slightly or not at all correlated with word associative responding. Thus, it appears that children's own definitions of words cannot account for the developmental changes in word associative responding, and that the semantic feature hypothesis attributes too little semantic knowledge to the young child, who also, it must be remembered, uses words correctly in context.

In sum, an extension and elaboration of McNeill's hypothesis may account for certain idiographic word association phenomena. But a large body of evidence indicates that by the time the syntagmatic-paradigmatic shift occurs, children have long before acquired at least implicit knowledge of the classificatory semantic features of familiar, frequent words. Hence, the semantic organization framework also does not provide a satisfactory account of the syntagmatic-paradigmatic word association shift.

4. The Cognitive Interpretive Framework

A cognitive interpretation of developmental word association phenomena entails characterizing stimulus-response relationships in conceptual rather than grammatical terms, thereby distinguishing several types. These types may be ordered on an a priori basis to represent a developmental hierarchy (e.g., functional or nonlogical responses are lower down on the hierarchy than logical ones such as contrast and superordinate associations). To provide support for this position, these ordered response types must be shown to correspond to different levels of cognitive maturity. While this diverges somewhat from the syntagmatic-paradigmatic dichotomy, this rather different perspective may contribute to an adequate explanation of developmental word association processes.

The problem of interpreting and assigning a cognitive value to particular kinds of responses is highlighted by Jung (1918) who found that adults who responded with predicate or syntagmatic associations to verbal stimuli exhibited marked imagery, more complex thinking and were remarkably resistent to distraction. Thus, adults who emitted syntagmatic responses, a response type presumed to be less developmentally advanced, exhibited other highly valued cognitive abilities.

Recall also the contradictory interpretations of children's and adults' syntagmatic responses made by Woodworth & Schlosberg (1954) and Entwisle (1966) respectively, with the former claiming that children's syntagmatic responses indicated an enlargement upon the concept and the latter, that they represented merely syntactic considerations.

Further, superordinate responses, presumed to be a developmentally sophisticated response type, are produced even by kindergarteners (Reigel, 1970), increase to a maximum at grade six and decline thereafter (Palermo & Jenkins, 1963), and are more often produced by maladjusted than normal adults (Peters, 1952, 1958). Hence, superordinate responding does not seem to necessarily represent a more mature level of functioning.

Despite these difficulties, a strong cognitive interpretation of the syntagmatic-paradigmatic shift can be made from the Piagetian point of view, which assumes that the logical operational cognitive structure serves as a foundation for linguistic or lexical structure. The shift occurs coincidentally with the shift from preoperational to concrete operational logical functioning. A hallmark of the concrete operational stage is the understanding of class inclusion relationships. Within this framework it may be hypothesized that cognition-dependent lexical structure is reorganized at the time of the preoperational-concrete operational shift into a classification hierarchy. This would result in a corresponding change in the types of word association responses made.

Moran (1973) adopted this Piagetian approach and assumed that at the earliest ages, "action upon" is the central organizational cognitive principle to which linguistic input is ordered. To test this assumption, Japanese and American (Moran, 1973) and Taiwanese (Moran & Huang, 1974,

1975) four- to six-year-olds and adults were administered word association tests. A largely Brunerian (1966) classification scheme was used (i.e., enactive, ikonic and logical categories, the latter being symbolic) to type responses. The Piagetian hypothesis was partially supported since all children responded enactively, while the Japanese adults responded iconically and the American and Taiwanese adults responded logically. But there was no explanation of why the adults of different cultures responded differently or how they shifted from enactive responding.

Moran, Meffert & Kimble (1964) investigated individual sets to respond according to a characteristic associative principle on word association tests. Moran (1966) constructed lists which carefully controlled for the tendency of the individual words to elicit different response types and administered them to adults. He found four response sets: 1) functional or object referent, indicating a concrete denotative attitude towards words; 2) predication set, consisting of a tendency to give noun responses to adjective stimuli, 3) conceptual referent (synonym-superordinate), indicating abstract conceptual attitude and 4) a speed set (contrast and coordinate responses), indicating a set to respond as fast as possible.

Despite the fact that all four response sets were represented in adults, Moran (1966) hypothesized that they constituted a developmental hierarchy corresponding to Piagetian cognitive stages. To test this hypothesis, Penk (1971) used Moran's (1966) word list with seven through eleven-year-olds. He found that the functional or object referent set did not decrease with age, while dimensional words increased at age 11, though they had been present at all ages. On this basis he concluded that different response types did not correspond to differentially sophisticated cognitive structures.

In addition, other studies have not found a relationship between word association responses and performance on closely related tasks. This also runs counter to the hypothesis that different response types represent different levels of cognitive maturity. For example, Cramer (1974) found that kindergarteners falsely recognized coordinates more often than functional associates, although they spontaneously produced more functional than coordinate free word associations. Second and sixth graders showed no difference in the types of words they falsely recognized, yet sixth graders produced more coordinate than functional free word associations. Anderson & Beh (1968) found that the false recognition of superordinate associates occurred before the paradigmatic shift occurred. Further, seven-year-olds justified both syntagmatic and paradigmatic forced choice matches between words by very similar kinds of explanations (Francis, 1970). Riley & Fite (1974) constructed lists of syntagmatic and paradigmatic paired associates for second and fourth graders and found that the syntagmatic and paradigmatic lists were learned more quickly by second and fourth graders, respectively. This occurred despite the fact that both second and fourth graders would presumably respond paradigmatically on a word association test. These results do not support the a priori assumption that class category or logical responses represent a more advanced level of cognitive functioning.

Finally, substantial evidence indicates that both young preoperational preparadigmatic children (from four- to seven-years) and older concrete operational paradigmatic children (over seven-years) possess similar linguistic hierarchic semantic organization; i.e., the structure (as opposed to the content) of the class inclusion relationships among her words are arranged in a hierarchical classification system (e.g., animal

cat-dog). This is indicated by younger children's at least implicit knowledge of the class inclusion relationships embedded in the meanings of words (e.g., Nelson, 1974; Steinberg & Anderson, 1975; Mansfield, 1977).

While it appears that the lexicons of both younger and older children are arranged in similar hierarchic semantic systems, both younger and older children cannot apply this knowledge to task situations with equal facility. Indeed, it appears that while this hierarchy is present in young children and is reflected by tasks measuring a more automatic level of processing, these children fail to invoke it when they are confronted with tasks requiring its more deliberate application. For example, when asked to classify words or objects, younger children use functional or perceptual relationships instead of the logical (hierarchic classification) relationships between them as a basis for their classification, (e.g., Vygotsky, 1962; Olver & Hornsby, 1966; Denney, 1974). Older children, on the other hand, are trained in school to overtly categorize phenomena according to criteria which are not directly perceptible (i.e., abstract categories). This appears to make the semantic knowledge which formerly operated only unconsciously and automatically available for more deliberate implementation in task situations (e.g., Lippman, 1971; Sharp & Cole, 1972; Denney, 1974). As shall be elaborated upon shortly, this factor is hypothesized to play an essential role in the syntagmatic-paradigmatic shift.

In sum, except for four-year-olds whose responses are analyzed in terms of their enactive relationship to stimuli, there is relatively little evidence suggesting that an a priori ordering of response types corresponds to a developmental cognitive one, indicating that the cognitive interpretive framework, like the associationist syntactic and semantic framework cannot adequately account for the syntagmatic-paradigmatic word association shift.

Thus it appears that none of the previously proposed views adequately accounts for the syntagmatic-paradigmatic shift and an alternative must be sought. A heretofore unconsidered factor, an analysis of the mode of the representational system involved in the production of word associations may aid in our search.

CHAPTER III - THE ALTERNATIVE

Factor 1: Developmental Differences in the Use of Imaginal and Linguistic Representational Systems

The Representational Systems

Recent studies indicate that meanings of verbal items such as sentences are represented in an abstract, amodal format or representational system (Marschark & Paivio, 1977; Potter, Valian & Falconer, 1977). In addition to this amodal system, there are two modality specific systems; imaginal and linguistic. At present, the nature of the amodal representational system and its relationship to linguistic and imaginal modes are unclear. But the distinction between linguistic and imaginal modes is more fully elucidated and is retained to account for cognitive performance differences on materials varying in concreteness. Hence, this distinction will be discussed without further reference to the more general underlying amodal representational system.

Relationship Between Representational Systems and Word Association Processes

Neobehaviorist theory offers a schematic representation of the word association process as follows: $S_{initiating}$-$r_{mediating}$-$s_{mediating}$-R terminating. In this scheme the S represents the presented stimulus, the r represents a symbolic organismic response to a class of relevant enviromental events of which S is an instance, s represents the feedback from the symbolic response and R represents the overt measurable behavior (Kendler, 1972; Reese & Lipsitt, 1970; Stevenson, 1970). In the case of word association, both the $S_{initiating}$ and the $R_{terminating}$ are words,

verbal items. The mediating responses and stimuli, however, may be either images or verbal items, a function of either imaginal or linguistic representational systems. Thus, the imaginal or ikonic symbolic mediator is assumed to consist of a cognitive item which pictorially resembles the referent of the stimulus word. This does not imply that the image is merely a reembodiment of a stored sensation. Rather, it is the product of higher level cognitive and perceptual activities (Kosslyn & Pomerantz, 1977). Space limitations prevent us from more fully exploring various issues concerning imagery here (see Kosslyn & Pomerantz, 1977, for a fuller discussion of imagery issues). Suffice it to say that we adopt the position that images have emergent properties which cannot be derived from or reduced to the processes that produce the image. Hence, they serve a distinct cognitive function and cannot be summarily dismissed as mere epiphenomena.

On the other hand, a verbal-symbolic mediator is assumed to consist of a cognitive item which in no way sensorially or pictorially resembles the referent of the stimulus word. Rather, it is arbitrarily related to its referent and mediates the word association process by accessing the conceptual classification hierarchy in which the stimulus word is embedded (i.e., hierarchic semantic organization) or linguistic syntactic characteristics.

The Developmental Implications and the Relationship between Symbolic Mediators and Word Association Responses

Bruner (1966) suggests that imaginal and symbolic representational systems undergo developmental change; that the young child's cognitive processes are predominately ikonic or imaginal, while the older child's and adult's processes are predominately symbolic or verbal in nature. This permits

them to organize the world in terms of the semantic and syntactic structure underlying their language. Following Bruner, Paivio (1971) suggests that the young child's verbal processes and word association responses may more often be mediated by stimulus-evoked imagery, rather than by verbal-symbolic items as are the older child's or adult's responses. Indeed, this may partially account for the syntagmatic-paradigmatic shift.

We claim that there are two bases for the production of syntagmatic associations: (1) Linguistic Representation, which utilizes syntactic features (e.g., selectional restrictions; cf. Chomsky, 1965). This seems reasonable since if in a syntagmatic association the two words can follow one another in a sentence, then the response word should be produced by sentence production principles. (2) Imaginal Representation, which does not access the conceptual frameworks in which the stimulus words are embedded. Rather, it accesses specific perceptual attributes of the stimulus word (Fodor, 1975). The existing evidence for this position will be reviewed shortly.

Logical paradigmatic associations, on the other hand, are assumed to be primarily produced by linguistic representation, by hierarchic semantic organization in particular.

Clarification of this Position Vis A Vis Bruner

Before the evidence relating to (1) and (2) above is examined, I must clarify that my position differs from Bruner's in two ways. First, Bruner claims that children sequentially acquire the ikonic and then the symbolic mode of representation. I claim, however, that both these modes are present even at the early age of four, since children are sensitive to grammatical form class as shown by the fact that they produce paradigmatic responses with appreciable frequency and noun responses with varying

frequencies to different grammatical categories. (See Note 1, Entwisle, 1966.) Second, unlike Bruner, I do not claim that the young child's thought consists of imaging, as this is highly implausible (Fodor, 1975). Rather, I claim that while images do not constitute the stuff of thought, the child more often thinks about properties which are imageable; the child's thoughts center on properties of her images more often than do the adult's or older child's.

Some Evidence for this Position

There is substantial evidence to support this view. For example, children often categorize things by form, color or even mere proximity (e.g., Vygotsky, 1962; Olver & Hornsby, 1966). Further, children's vocabulary contains a preponderance of concrete as opposed to abstract or relational words (Brown, 1970). A more direct piece of evidence suggesting that young children use predominately visually or ikonically oriented cognitive processes as opposed to those which are verbally oriented comes from Cramer (1976). She presented first and fourth graders with 15 items in either word, picture or word and picture form. The subject's task was then to identify the 15 original items from among a 45 item list which included 15 distractors, which were the most common associates of the 15 original stimuli. First graders made more associative errors in the picture condition, while fourth graders made more errors in the word than in the picture condition, though for them the difference was not significant. Cramer interpreted these findings as indicating that first graders tended to encode the material visually, while fourth graders were as likely to encode verbally as visually. She concluded on the basis of this and other studies that a clear preference for verbal memory organization is predominant for children just beginning school.

In sum, there is substantial empirical evidence to support the claim that younger children rely more heavily on properties of images as a basis for cognitive processing than do older children or adults, who more directly access verbal-conceptual properties of hierarchic semantic organization.

This does not imply that older children and adults do not produce images. It simply means that they more often use cognitive abilities which do not rely upon properties of images than younger children do.

Response Latencies

It is assumed that the type of representational system used to produce the word association responses results in different response latencies. Word associations are obviously linguistic items. It is predicted that remaining within the linguistic mode throughout the entire word association process and producing verbal responses by accessing linguistic factors consumes less processing time than producing verbal responses by accessing an additional representational system, such as the imaginal one. Hence it is predicted that: a) logical paradigmatic associations produced by accessing hierarchic semantic knowledge are correlated with shorter response latencies than imagery based syntagmatic associations; b) syntagmatic associations based on sentence production principles (cf. Chomsky, 1965) are correlated with shorter response latencies than imagery based syntagmatic associations.

Experimental Support for Response Latency Predictions

Only the first prediction can be supported by existing experimental evidence. The contention that paradigmatic responses are produced by accessing hierarchic semantic knowledge is supported by Lippman (1971).

The contention that linguistically mediated logical paradigmatic responses have shorter response latencies than imaginally mediated ones is supported by Shaw (1919) who found that the word associative reaction time of adults who were described as verbal, was much faster than for adults described as concrete-imaginal. Davis (1932) found that self reports of stimulus imagery were associated with noun responses. Karowski, Gramlick & Arnott (1944) measured the reaction times and types of free association responses of adults to 25 items presented as words, line drawings and objects. Objects and pictures elicited a preponderance of responses in terms of associated actions (syntagmatic responses), while words elicited more responses in terms of associated objects (paradigmatic responses) and clang responses, than objects and line drawings. Further, reaction time for words was faster than for either objects or drawings. Siipola, Walker & Kolb (1955) found that subjects who reported concrete visual stimulus images responded more slowly and with more nouns, than subjects who responded very quickly and with many paradigmatic contrast (e.g., dark-light) associations and had no complex intervening cognitive processes to report. My pilot study also found that when adults are instructed to base their word associations on stimulus-evoked images, they have longer reaction times and many more syntagmatic responses than when they provide "the first word that comes to mind."

In sum, when adults use images as symbolic mediators, or pictures or concrete objects as stimuli, they behave much like children in the word association task, producing more noun responses and more syntagmatic responses in general and taking longer to do so. This provides support for the hypotheses that the young child's syntagmatic responses are the result of imaginal rather than verbal mediators and that imagery based syntagmatic

associations take longer to produce than paradigmatic associations based on linguistic hierarchic semantic organization.

In short, we claim that younger children rely on properties of their images more than older children. Hence, younger children produce more syntagmatic associations than older children.

Remaining Question

This position accounts for the existence of predominately syntagmatic associations in younger children, but it does not explain how older children come to produce paradigmatic associations. For example, why, if both younger and older children possess similar hierarchic semantic structures, do only older children apply them to the word association task? The next section attempts to provide an answer to this question.

Factor 2: Acquisition of a Response Mode

The answer to this question may lie in the acquisition of a response mode by an epistemic subject. All previously proposed accounts of the shift assume that word associations are produced in the absence of the subject's perception of task demands and knowledge of culturally valued responses. However, studies varying word association instructions and cross-cultural studies suggest the contrary assumption is more appropriate.

Instructional Studies

Adult Studies. Horton, Marlowe & Crowne (1963) found that instructions to respond either "differently from" or "like most people" modified adults' associative responses accordingly. Similarly, numerous other studies which instructed adults to give responses that "most people" would give showed significant gains in commonality over those who are instructed to simply

give the first word that comes to mind (e.g., Jenkins, 1959; Wynne, 1964) or to respond as quickly as possible (Horton, Marlowe & Crowne, 1963).

Using somewhat different instructions, Wild (1965) tested art students, public school teachers and schizophrenics. They were presented with character sketches of a) a regulated conventional person and b) an unregulated unconventional person and instructed to respond as each of these people would. Art students shifted to greater originality under unregulated instructions than teachers and schizophrenics combined. The ability to shift was concluded to be a general cognitive approach which was a more pervasive ability in certain types of populations than others, suggesting that certain cognitive dispositions are required to induce a particular word associative strategy. This is substantiated by findings that normals, as opposed to schizophrenics, more frequently modify their responses to accord with instructions to respond like "most people" (Herr, 1957; Wynne, 1964).

Maltzman, Bogartz & Berger (1958) instructed adults to respond originally and then gave some of them practice in originality responding. Of these, one-half received verbal reinforcement and half, no reinforcement. An additional group received no special instructions, but was verbally reinforced for original responses on additional trials.

Instruction greatly increased the number of original responses, but the training effect was greater under the influence of instructions than in their absence, although training without instructions also increased the number of original responses. This suggests that explicit awareness of the strategy to be adopted in word associative responding promotes its more efficient use.

Developmental Studies. In a study investigating instructional effects on children, Milgram & Goodglass (1961) presented second through eighth graders with a free word association test and with a multiple choice word association test in which they were to judge which of two words went with a third word. One word was concretely related to the third, exemplifying a lower order or peripheral relationship such as part-whole (e.g., bird–wing), while the other word was abstractly related to the third, exemplifying a conceptual, generic relationship such as superordinate-subordinate or synonym. Different groups of children within each age level were asked either to choose the word young children in the first or second grade would think of to go with the stimulus word, or the word adults would think of, or were given no special instructions.

Starting with the fourth grade, children modified their responses to accord with test instructions and generally chose fewer abstract responses for the children role and more for the adult role that in the uninstructed condition, although even adults were unable to articulate the principle underlying their choice.

Routh & Tweney (1972) bears specifically on the hypothesis that paradigmatic responding is associated with strategy acquisition. They used a reinforced training procedure to attempt to provide preparadigmatic children with a paradigmatic response strategy by teaching them the meaning of different grammatical classes. While it slightly increased kindergartener's level of paradigmatic responding to verbs and adjectives, it decreased it for nouns, and in no way closed the gap between kindergarten and fifth grade children. Hence, Routh & Tweney concluded that a strategy difference alone cannot account for the behavior of preparadigmatic children. This indicates that an

additional factor, such as mode of representation, as proposed earlier, may be required to account for the syntagmatic-paradigmatic shift. Further, Routh & Tweney used grammatical form class as the key element in attempting to promote paradigmatic responding. This may account for its poor results as I claim, on the other hand, that explicit access to hierarchic semantic organization is far more important.

Cross-Cultural Studies

Ervin & Landar (1963) tested Navaho subjects aged 17-70 and found a small but reliable tendency for subjects who had schooling and who were English dominant (judged by their picture naming latencies) to give more paradigmatic responses than those who were Navaho dominant. Sentence responses appeared in 9/11 subjects who were either Navaho dominant or had had no schooling, but only 3/15 English dominant or educated subjects gave such responses.

Ervin & Landar suggest that the prevalence of sentence responses in the uneducated group may be attributed to the possibility that the concept

of a "word" as a short, discrete unit is acquired through reading. They also suggest that in the English or educated population, the task may more often be interpreted as one of returning like for like. Indeed, in testing third grade children, Ervin had encountered children who asked if their associative responses were right, as though they were searching for a rule to follow.

Sharp & Cole (1972) also present evidence that formal education is related to paradigmatic responding. They tested African Kpelle subjects attending the first or second grade of the government elementary schools, aged eight and nine; fourth and fifth graders, aged twelve to fourteen and eleventh and twelfth graders, aged eighteen to twenty-one; and unschooled subjects of equivalent ages. They found that paradigmatic responding to verbs and adjectives was low by European and American standards and that there is an increase in paradigmatic responding both as a function of age and educational level, but that the increase is greater if the subject has attended school.

Sharp & Cole suggest that changes in the taxonomic language prompted by schooling result in associative, as well as classificatory changes. However, Masters (1968) and Shepard (1970) provide little if any experimental support for this conjecture, as the types of definitions dhildren constructed (presumably an indication of their taxonomic language) correlated only weakly or not at all with their word association responses. Further, there is rather substantial evidence that children are at least implicitly aware of classification hierarchies embedded in the meaning of words, as was reviewed earlier (see section on semantic interpretative framework). Rather, it seems more likely that the change is from implicit to explicit knowledge of the taxonomy, which when explicit, can be used to generate word association responses.

Even within Western culture itself, education appears to influence paradigmatic responding. French construction workers respond syntagmatically, like French and American children on a free word association test, while French college students respond paradigmatically (Rosenzweig, 1964).

In sum, these studies suggest that rather than involving an unmonitored process as has been historically assumed, word association responding may typically involve a strategy or set, deliberately or unconsciously chosen by the subject to accord with perceived task demands. In this way, the syntagmatic-paradigmatic word association shift may be partially accounted for. It may simply reflect the developing child's changing definition of the word association task and consequently her changing response strategies.

The Response Mode

Paradigmatic associations are hypothesized to be produced through a response mode which is acquired through categorization experience obtained through education. This makes the implicit knowledge of hierarchic semantic organization available for explicit application to task situations which also concomitantly teaches the child that responses based on hierarchic semantic organization are desirable. But because it is the categorization knowledge and not the knowledge of the symbolic mediators, (words and images per se), that is explicit, the child is unaware of and unable to voluntarily control the mediational basis of association responses. Thus, at first, logical paradigmatic associations are produced automatically and unconsciously, just as her earlier syntagmatic associations were, through the unconscious and unplanned reliance upon sentence

production principles or the properties of her images for further cognitive processing.

Lippman's (1971) study, mentioned earlier, provides evidence for this view. She presented children with a free word association test and with noun-noun and adjective-adjective contrasting word pairs and asked them for reasons why the two words "go together." She found that a developmental increase in paradigmatic responding correlated with an increase in nominal justification (e.g., they're both animals) for noun pairs and dimension (e.g., they're both times) or opposite (e.g., they're both opposites) justifications for adjective pairs.

Lippman argued that this was a result of the child's learning of superordinate semantic features in accord with McNeill's (1966, 1970) explanation of the shift. But along with Nelson (1977), I suggest that it is more reasonable to interpret these results as an indication of the child's growing ability to use the knowledge which had long ago been acquired and implemented in everyday utterances but was not explicitly conceptualized.

Routh & Tweney (1972) bears specifically on the hypothesis that paradigmatic responding is associated with strategy acquisition. They used a reinforced training procedure to attempt to provide preparadigmatic children with a paradigmatic response stragety by teaching them the meaning of different grammatical classes. While it slightly increased kindergartener's level of paradigmatic responding to verbs and adjectives, it decreased it for nouns, and in no way closed the gap between kindergarten and fifth grade children. Hence, Routh & Tweney concluded that a strategy difference alone cannot account for the behavior of preparadigmatic children. This indicates that indeed additional factors such as mode of

representation, as proposed earlier, are also required to account for the syntagmatic-paradigmatic shift. Also, Routh & Tweney used grammatical form class as the key element in attempting to promote paradigmatic responding. This may account for its poor results, for as claimed above explicit access to linguistic hierarchic semantic organization is far more important.

The previously discussed cross-cultural and instructional studies also provide indirect evidence for this view. While the instructional studies discussed seem to indicate that the subject is self-consciously aware of the strategy, it is important to note that these situations differ from that of the free word association test in a small but very important way. In instructional studies the strategy is externally imposed by the experimenter. But the response mode involved in the production of paradigmatic associations in the free word association test is subject imposed; it originates within the individual and therefore may operate without the subject's explicit awareness of her behavior. Only when the child acquires metaknowledge of words and images, when she becomes aware of the symbolic mediators themselves as distinct entities apart from their referents is she able to self-consciously control her word association process to accord with externally imposed explicit instructions. It is this factor which I shall now discuss.

Factor 3: Metaknowledge of Language and Images

Gaining deliberate control over word association responding, a language phenomenon, means that the child can willfully base her word association responses on either a) stimulus evoked imagery or b) linguistic factors, hierarchic semantic organization or syntactic features. It seems

likely that in order to do this, the child must acquire the explicit and self-conscious understanding that language itself is a distinct entity possessing its own unique characteristics. In other words, it seems reasonable that the self-conscious and deliberate control and choice of word association processes, a language phenomenon, is contingent upon the acquisition of metalinguistic knowledge. Metalinguistic knowledge is knowledge that language is an arbitrary symbol system in which words are conceived of as interchangeable, grammatical, nonphysical units. At first, children believe that words possess the physical properties of their referents and do not understand that sentences are composed of individual units or words. Later they understand the arbitrary relationship between the verbal symbol and its referent and know that words are systemic elements possessing distinct grammatical properties. They recognize language as an entity in its own right (Piaget, 1951; Papandroupoulou & Sinclair, 1974; Osherson & Markman, 1975).

It seems likely that in addition to this, the child must acquire explicit knowledge of imagery, knowledge that their images are distinct from a) the objects they represent and b) the corresponding words. At first children may not distinguish their images from the corresponding objects and words, but rather think they are one and the same thing. Later, children believe that images are distinct from objects and words as well.

Evidence gained from contrasting pictures with words indicates that children may acquire explicit knowledge of imagery before metalinguistic knowledge (Markman, 1976). This may occur since children may correctly answer that images are distinct from objects and seemingly understand that images are distinct from words, but only because they do not distinguish words and objects. Hence, if the object is distinct from the

image, and the word is considered to be the object, the word will be distinct from the image as well. In this case the child must acquire metalinguistic as well as explicit knowledge of imagery in order to have completely voluntary control over her cognitive processes.[8]

Experimental Evidence for this Position

Experimental evidence supports the view that children develop the ability to voluntarily control their cognitive processes in general. For example, Appel, Cooper, Knight, McCarrell, Yussen & Flavell (1972) found that while older children can, very young children cannot appropriately modify their cognitive behavior in response to instructions to either merely "look at" or "memorize" experimental materials.

More specifically, Osherson & Markman (1975) found that metalinguistic knowledge level was correlated with children's ability to understand tautologies and contradictions, to treat them as nonempirical statements. Gerschitz & Glick (Note 1) found that nominal realism level, an indication of metalinguistic knowledge, was correlated with children's propensity to spontaneously use color labels as mnemonic devices. Hence, empirical evidence supports the view that voluntary control of language-related cognitive processes is correlated with if not contingent upon the acquisition of metalinguistic knowledge.

In Brief

In brief, it is hypothesized that the syntagmatic-paradigmatic shift is accounted for as follows: At first the child bases her word association responses on properties of her images, and so she produces syntagmatic associations. But exposure to education and practice in overt, abstract categorization makes hierarchic semantic knowledge (which

[8] When considered together, both metalinguistic knowledge and explicit knowledge of imagery shall be referred to as "metaknowledge."

previously functioned unconsciously and automatically) available for application to tasks requiring its more deliberate use. Hence, she now produces paradigmatic associations. Yet even once this type of responding occurs, the child is not able to voluntarily switch her mode of responding from one type of linguistic basis to another, i.e., from hierarchic semantic knowledge to syntactic factors, or from a linguistic basis to an imaginal one. Only with the acquisition of metaknowledge is the child able to flexibly control the type of symbolic mediators she uses to generate her word association responses so that they consist of either (a) properties of stimulus evoked images or (b) different types of linguistic factors such as hierarchic semantic knowledge or syntactic sentence production principles.

The Experiment

In order to test these hypotheses, kindergarten and second grade children and adults were administered a word association task in which the stimuli were low and high imagery nouns, verbs and adjectives. This list was administered to each subject five times, each time with different instructions as follows: (a) the standard "first word" instructions; (b) syntagmatic instructions; (c) paradigmatic instructions; (d) imagery instructions; and finally (e) time delay instructions. Kindergarten and second grade subjects received two convergent measures of metalinguistic knowledge, two convergent measures of explicit knowledge of imagery, a test of hierarchic semantic knowledge, and a test of word-word relationships.

While there are several components of metalinguistic knowledge, only two were measured: the distinction between meaning and reference, and the distinction between words and referents. These had analogues in

explicit knowledge of imagery tasks; the distinction between (a) images and objects and (b) images and words. These two types of metaknowledge sub-tasks were chosen as they have at least face validity in terms of measuring whether words, images and objects are subjectively considered to be separate and distinct entities. Further, other investigators (e.g., Osherson & Markman, 1975; Markman, 1976) and my pilot study show that children perform somewhat inconsistently at least on metalinguistic knowledge tasks. Therefore, probably no one task can be said to definitively measure metaknowledge. Consequently performance on both subtasks will be considered to determine if the child has metaknowledge of language or images.

The test of hierarchic semantic knowledge was used to insure that both younger and older children possess equivalent semantic organizational structures. The particular task chosen does not require strategic application of knowledge to solve a problem, but rather reflects implicit categorization knowledge. In this task children are shown drawings of common objects. Following their removal the child is asked whether she saw a picture which made her think of a _____, where the blank is one of five retrieval cues which is related to the target picture in one of five class inclusion relationships. For example, if the target picture is 'car' the retrieval cue might be 'bus'. Thus, it is assumed that this task reflects processes which function automatically, without the subject's deliberation or forethought.

The test of word-word relationships was used to determine whether overt and explicit conceptualization of linguistic-semantic organization, assumed to be an indication of the child's experience with abstract categorization, is correlated with increased paradigmatic responding. In

this test children are asked to articulate why two words (which are related to one another in superordinate, coordinate, contrast or synonym relationships) go together. In order to perform this task, it is obvious that the hierarchic semantic knowledge the child possessed earlier (as is indicated by the test of hierarchic semantic organization) must be used in a more self-conscious and deliberate fashion. Hence, if such self-conscious possession of semantic knowledge underlies paradigmatic responding, knowledge of word-word relationships would be correlated with incidence of paradigmatic responding.

Summary of Hypotheses

Imagery and Word Association

1. The preponderance of syntagmatic responses produced by young children is the result of the fact that their word associations are mediated by stimulus-evoked images, rather than by hierarchic semantic organization.

To confirm this hypothesis, (a) high imagery words should evoke more syntagmatic responses than low imagery words in the 'first word' and 'imagery' word association tests, for all age groups, and (b) second grade children and adults should provide more syntagmatic responses in the imagery condition than they do in the 'first word' condition.

2. When an image is not readily available to mediate word associations, linguistic factors should mediate the association instead.

To confirm this hypothesis, low imagery words should elicit more logical paradigmatic associations (which are presumed to be mediated by hierarchic semantic organization, a linguistic factor) than high imagery words.

Response Latencies

3. It is assumed that:

   (a) The early syntagmatic responses of younger children (in all word association tests) are based on properties of stimulus-evoked imagery;

   (b) The later syntagmatic responses of older children and adults in the first word and imagery conditions are also imagery based;

   (c) In the syntagmatic test, in which Ss are instructed to give syntagmatic responses based on sentence production principles (and therefore the syntactic factors of linguistic organization), syntagmatic responses are based on sentence production principles;

   (d) Logical paradigmatic responses are based on hierarchic semantic organization, another linguistic factor.

It is further hypothesized that responses made on the basis of stimulus-evoked images take longer to occur than those based on linguistic factors. In order to confirm this hypothesis, the response latencies produced as a result of (a) and (b) should be longer than those produced in (c) and (d).

Cognitive Variables and Word Association

4. Both young children and adults possess similar hierarchical semantic organization (Steinberg & Anderson, 1975).[9] This finding is replicated to insure that this factor does not contribute to the

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[9] Presumably Steinberg & Anderson's task does not require the child to apply her knowledge strategically to solve a problem. Rather, it accesses processes and knowledge which operate automatically and unconsciously.

syntagmatic-paradigmatic shift. To replicate this finding there should be no significant difference in the semantic organization of younger and older children on this task. To infirm it, older children should have a different kind of structure than younger children.

5. As children gain experience in explicitly using the hierarchic categorization system they are able to apply that knowledge automatically to task situations such as word association, and to produce paradigmatic responses. When this first occurs, it need not be accompanied by the ability to articulate the fact that one is responding paradigmatically, since it is assumed that this requires a certain level of metaknowledge.

To confirm this hypothesis, explicit knowledge of hierarchic semantic relationships should be correlated with an increased level of paradigmatic responding on the 'first word' test. Also, early increased paradigmatic responding should not necessarily be correlated with the explicit, verbal awareness that one is producing paradigmatic responses. Rather, such awareness should be accompanied by a higher level of metaknowledge.

6. Children must acquire a higher level of metalinguistic knowledge and explicit knowledge of imagery (metaknowledge) in order to willfully change the basis of their word associations to accord with task demands.

To confirm this hypothesis, children with higher levels of metaknowledge will modify their word associations in different instruction conditions more successfully than children with lower levels of metaknowledge. Thus, only children who have higher levels of metaknowledge should produce more paradigmatic responses in the paradigmatic word association test than in the 'first word' test.

Three basic stages in the development of the voluntary modification of word association behavior are predicted:

(a) The child produces predominantely syntagmatic responses in all word association tests. She is using properties of her images as symbolic mediators for her word association responses.

(b) The child produces predominately paradigmatic responses in all word association conditions. She has gained experience with the hierarchic semantic categorization system and while she has explicit access to it, she does not yet have a high enough level of metaknowledge to be able to control voluntarily her word association process. This is the result of the fact that only her categorization knowledge is explicit, but not her knowledge of symbolic mediators, such as words or images. Both are needed to control cognitive processes voluntarily.

(c) The child has attained full control and self-conscious understanding of the cognitive processes governing word association responding and appropriately modifies her responses to accord with overt task demands. She has gained a high enough level of metaknowledge to permit this understanding and control, as well as explicit knowledge of hierarchic semantic organization.

CHAPTER IV - METHOD

Subjects The subjects were 40 children, 20 kindergarteners (aged 58-69 mos.; 7 males and 13 females) and second graders (aged 80-92 mos.; 8 males and 12 females). The kindergarteners were drawn from the Hunter College Elementary School, and were heterogeneous in race, but homogeneously high in academic ability and were generally from middle and upper class homes. The second graders were attending a Manhattan summer day camp and were mainly from middle and upper middle class homes. Many attended private grammar schools during the regular school year. This group was also racially heterogeneous and comparable to the kindergarten group in socio-economic background, and presumably academic ability.

There were also 10 volunteer college age adults, 2 males and 8 females who were attending introductory and child psychology courses at the summer session of Hunter College.

Design All Ss were tested individually by the same female experimenter who led them to a private quiet testing room. Testing was accomplished in five sessions administered within a space of two weeks. In the first session, the standard free word association test was administered first to all children and adults to avoid the influence of practice effects on this measure. Ten kindergarteners and ten second graders also received: 1) two convergent measures of metalinguistic knowledge (which tap the child's understanding of words as arbitrary, interchangeable, grammatical units); 2) two convergent measures of explicit knowledge of imagery, which tap the child's understanding of the distinction between a) images and words and b) images and objects; 3) the hierarchic semantic organization and 4) the word-word relationship task. The tests were administered in a different randomized order for each subject. Some of

these tests were administered to a few of the kindergarten subjects in the second session, as their attention span was not long enough to permit full administration in one session.

A control group consisted of the remaining ten kindergarten and ten second grade children who received only the standard free word association test and no other task in the first session. The purpose of this control group was to determine if administration of the metalinguistic knowledge and other tasks influenced subsequent word association responding. The adults also received only the word association tasks, on the assumption that they would perform at or near ceiling level on the others. In the second through fifth sessions all Ss received the same stimulus word list as used in the first free word association test, each time with different associative instructions; paradigmatic, syntagmatic, imagery and time delay instructions, respectively. The time delay condition required that the subject wait three seconds before responding. Its purpose was to insure that it was not simply the delay in responding in the imagery condition that was responsible for a possible increase in syntagmatic responding. (See Table 1 for an outline of the design.)

Approximately one-fourth of the word association responses and all of the cognitive tasks were scored by two independent raters and an interrater reliability Pearson-product moment correlation obtained.

Experimental Tasks

1. Word Association Tasks

Stimuli. The word list consisted of 48 words from three grammatical form classes - nouns, verbs and adjectives. One-half of the words in each class evoked imagery with lesser difficulty and one-half with greater

TABLE 1

THE DESIGN OF THE STUDY

FIRST SESSION

Experimental Tasks	Age Groups	5 year old	7 year olds	Adults
	Subject #	1 ... 20	21 ... 40	41 ... 50 n=50
		RESPONSE MEASURES		
	1. Free Word Association Test administered first	Response latencies and proportions of syntagmatic paradigmatic, logical and miscelleaneous response types for high and low imagery nouns, verbs, and adjectives.		
	Subject #	1 ... 10 only	21 ... 30 only	None n=20
	2. Convergent measures of metalinguistic knowledge; A. Meaning and Reference (Markman,1976).	Proportion of correct responses		
	B. Distinction between word & referent (Markman, 1976)	Proportion of correct responses		
	3. Convergent measures of explicit knowledge of imagery. A. Object and Image	Proportion of correct responses		
	B. Nonphysical properties 1. Image and object 2. Image and word	Proportion of correct responses		
	4. Word-word relationship task	Proportion of correct logical justifications		
	5. Hierarchic Semantic Organization (Steinberg & Anderson, 1975	Proportion of correct logical justifications		
		SECOND, THIRD, FOURTH AND FIFTH SESSIONS		
	Subject #	1 ... 20	21 ... 40	41 ... 50 n=50
	6.Paradigmatic, syntagmatic, imagery & time delay word association tests (administered in random order over the second,through fifth sessions.	As in "First Word" Association Test		

difficulty, according to norms in Paivio, Yuille & Madigan (1968), Spreen & Schultz (1966) and Paivio (unpublished norms). Following the procedure of Brown & Berko (1960) all verbs were preceded by the word "to" to insure certainty as to their part of speech. (See Appendix A for complete list specifications.) There were ten different constant random orders of words, five of which were administered to any one subject.

Procedure

A. Standard Free Word Association Instructions (Adopted from Entwisle, 1966)

This task was administered first to all subjects. Adults were informed that these instructions were also meant for children and would therefore sound a bit juvenile. The subject was told, "I'm going to play a game with you. You may not have played this game before so let me tell you what it's about. I'm going to read you some words one at a time. Each time I read a word I would like you to tell me the first word you think of. When you tell me the word, I'll write it down and then read you another word. To make sure you understand the game let's try a few practice words. I'll say a word and then you tell me the first word you think of. O.K.? The first word is 'cat'. That's fine. Now let's try another practice word and then we'll start the regular game. The next word is 'grass'. That's right. Now we'll play the game and see if you can think of a word to tell me for every word I read to you. All right?"

E then read the list one word at a time and recorded the S's responses and latencies by use of a stopwatch which was started immediately following the utterance of the stimulus word and stopped immediately upon the subject's response. E then asked, "Did you try to say only certain kinds of words? How did you think of the words that you said?"

Four subsequent questions were "Did you get a picture of the word in your head first and then say a word?, Did you try to make up part of a sentence? Did you look around the room to get ideas? Did you try to give a word like my word, a word that meant the same thing as my word, or a word that meant something different, the opposite?" E recorded the S's responses.

B. Paradigmatic Instructions

This task was administered in one of the four subsequent sessions. The subject was told, "We're going to play a word game again just like the first game we played last time. I'm going to read a list of words out loud to you one at a time and I would like you to say the first word you think of after I say my word. But this time we're going to do something special. This time I'd like you to try to think of a word that is like my word, that could be used in a sentence the same way as my word. Just to make sure you know what I mean, let's try an example. Suppose my word was 'boy'. I'm going to use the word 'boy' in a sentance, "The little boy ran down the street." E says, "Now suppose we take the 'boy' out of the sentence and put another word in instead. What word could we put in?" If S did not reply correctly, E provided the example, "girl". E then said, "O.K., now we're going to do another example. I'm going to use the word 'brown' in a sentence. "The ugly brown truck drove away." Now, suppose we take the word 'brown' out of the sentence and put another word in instead. What word could we put in?" If S did not reply correctly, E provided the example, "red". E then said, "Just to make sure you know what I'd like you to do, now let's try a couple of practice words before we begin the regular list. The first practice word is 'cat'. What word do you think of when I say the word 'cat'? If S provided a syntagmatic

response, she was corrected by the E who said, "No, that is not what I mean. The kind of word I'd like you to think of when I say 'cat' is 'dog'." This procedure was repeated with the second practice word, 'happy', for which the E's correction example was 'said'. After both practice words were administered E said, "O.K. we're ready to begin. Just say the first word you think of after I say my word but try to find a word like mine, like the one I say so that it could be used like mine in a sentence."

The word list was then read, the S's responses recorded and latencies measured with a stopwatch as in the first test. After every tenth word, or as necessary, the subject was reminded that she must give a word like the experimenter's.[9]

C. Syntagmatic Instructions

The subject was told, "We're going to play a game again just like the first game we played last time. I'm going to read a list of words out loud to you one at a time and I would like you to say the first word you think of after I say my word. But this time I'd like you to do something special. I'd like you to try to think of a word that is different from the word I say, that would come right after or right before the word in a sentence so that the two words together make up part of a sentence. Just to make sure you know what I mean, let's try a couple of examples. Suppose the word was 'boy'. I'm going to use the word 'boy' in a sentence. "The little boy ran down the street." Now what word comes right after the word 'boy' in the sentence? What word comes right before the

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[9] Pilot study results indicated that children forgot the original instructions as the list was presented and had to be reminded of them.

word 'boy' in the sentence? O.K. So 'ran' and 'little' come after and before the word 'boy' in the sentence. They are not like the word 'boy'. Let's try another example now. Suppose the word was 'brown'. I'm going to use the word 'brown' in a sentence. "The ugly brown truck drove away." What word comes right after the word 'brown' in the sentence? O.K. So 'truck' is not like the word 'brown'. It comes after the word 'brown' in the sentence. O.K. We're ready to begin the list, but before we do let's try a couple of practice words to make sure you know what I'd like you to do and what I'd like you to do is say a word that would come before or after my word in a sentence. You're not supposed to say a whole sentence, just one word that would come before or after my word in a sentence. O.K. The first practice word is 'cat'. What word do you think of when I say 'cat' that is not like the word 'cat'?" If the S responded appropriately she was reinforced. If not, E said, "An example of the kind of word I'd like you to think of when I say 'cat' is 'meow' or 'black'." This procedure was repeated with the second practice word 'happy', for which the E's example of an appripriate response was 'child'. E asked S if she now understood what she must do and then said "O.K. Now we're ready to begin the regular list. Remember, say the first word you think of after I say my word, but try to give a word that is different than mine, different than the one I say so that it could be right before or right after mine in a sentence.

The word list was read, the S's responses recorded and latencies measured with a stopwatch as in the first test. After every tenth word, or as necessary, the subject was reminded that she must give a word different from the experimenter's.

D. Imagery Instructions

The subject was told, "We're going to play a word game again just like the first game we played last time. I'm going to read a list of words of out loud to you one at a time, and I would like you to say the first word you think of after I say my word. But this time, I'd like you to do something special. I'd like you to get a picture of my word in your head first. Then, once you have the picture of the word in your head, I'd like you to try to say the first word you think of. Just to make sure you know what I mean, let's try a couple of practice words. Now I'd like you to close your eyes and get a picture of this word. When you have the picture, then I'd like you to say the first word you think of. The first practice word is 'cat'. Get a picture of a cat in your head and then tell me the first word you think of." After the S responded E asked her if she had gotten a picture of a cat in her head first, verbally reinforced her if she said that she had and repeated the instructions to obtain the picture before responding if she said she hadn't. The second practice word 'happy' was then administered and this procedure repeated. After this E said, "Now we're ready to begin the regular list. Remember to say the first word you think of after I say my word, but first get a picture of my word in your head."

The word list was read, the S's responses recorded and latencies measured as in the first test. After every tenth word or as necessary, the subject was reminded to close her eyes and that she must get a picture of the word in her head before she says her word.

E. Time Delay Instructions

The S was told, "We're going to play a game again just like the first game we played last time. I'm going to read a list of words out loud to

you one at a time, and I would like you to say the first word you think of after I say my word. But this time, I'd like you to do something special. This time I'm going to tap my pen on the desk like this when I'd like you to say your word. Just to make sure you know what I mean, let's try a couple of practice words. Now, when I say my word, you wait until I tap my pen on the desk to say your word. The first practice word is 'cat'." The E then started the stopwatch, and at the end of three seconds tapped her pen on the desk. The S was either corrected or verbally reinforced, depending on whether she waited for the tap or not. This procedure was repeated for the second practice word 'grass' and the regular list was then administered, the S's responses recorded and latencies measured in the usual fashion, with the stopwatch being started immediately following the utterance of the stimulus word, and a tap at three seconds thereafter. The watch was stopped upon the S's utterance of her response. Thus the latencies included the three second waiting interval. As necessary, the S was reminded that she must wait for the tap before she could say her word.

Scoring Procedure

Word association responses were classified according to their grammatical relationship to the stimulus word, as paradigmatic-syntagmatic. Only major grammatical classes were used to categorize stimuli and responses (e.g., noun, verb, adjective, adverb, article, etc.).

Paradigmatic responses were also conceptually classified into logical responses as outlined below. The proportion of the total number of responses of the following four major response types for high and low imagery nouns, verbs and adjectives was used in statistical analyses:

1) paradigmatic, 2) syntagmatic, 3) logical and 4) miscellaneous.

Grammatical Classifications

1. Paradigmatic. Stimulus and response are of the same grammatical form class and have similar privileges of occurrence in discourse (e.g., apple-fruit).

2. Syntagmatic. Stimulus and response are of different form classes and may follow one another in a sentence (e.g., apple-red).

Conceptual Classifications

Logical Classifications for Paradigmatic Associations only

3. Superordinate. The stimulus word denotes an immediate member of the class or category denoted by the response word (e.g., apple-fruit) (Sullivan & Moran, 1967).

4. Subordinate. The response word denotes an immediate member of the class or category denoted by the stimulus word (e.g., time-hour).

5. Synonym. The response word has exactly the same meaning as the stimulus word in one or more ordinary and appropriate contexts (e.g., car-auto) (Sullivan & Moran, 1967).

6. Coordinate. The stimulus word and response word separately denote immediate members (of equal logical order) of the same class or category (e.g., red-green) (Sullivan & Moran, 1967).

7. Contrast. The response word negates or contrasts with the meaning of the stimulus word in one or more ordinary and appropriate contexts (e.g., dark-light) (Sullivan & Moran, 1967).

8. Negation. The response word is preceded by not (e.g., proud-not proud) or the prefix un, where it is inappropriate (e.g., dark-undark). (Entwisle (1966) also classified these responses as paradigmatic.)

Miscellaneous

9. Clang Associates. Are those which rhyme with or are in any way based upon the phonetic characteristics of the stimulus (Sullivan & Moran, 1967).

10. Multiword Associates. Consist of more than one word, excluding not (Sullivan & Moran, 1967).

11. Blank. No response within 20 seconds.

12. Unscorable Responses. Are those which do not fit into any of the listed categories. This includes a repetition of the stimulus word or a derivative of it (to hope-hope; hoping; hopes; am hoping), or a response which appears to be totally unrelated to the stimulus (e.g., car-ate; dress-nose) and which could not be classified as syntagmatic or paradigmatic on the basis of sentence completion or substitution criteria.

Articulation of Response Pattern

Answers to the questions, "Did you try to say only certain kinds of words?, etc." were scored on a pass/fail basis. Subjects were scored as passing if they said they responded with opposites or a word like the experimenter's, or in some way indicated that their responses were paradigmatic, assuming, of course that a majority of their responses were in fact paradigmatic. Any other type of response was scored as a failure, whether they deliberately tried to produce such responses was also noted, but not considered when determining the status of the answer.

Experimental Tasks

2. Metalinguistic Knowledge

A. Knowledge of the Distinction Between Meaning and Reference (Adapted from Markman, 1976)

Procedure

The subject was told, "Now we're going to talk about some words." The word 'word' was emphasized whenever it appeared in the instructions. The S is asked, a) "Do you know what the word 'giraffe' means? (Subject responds.) b) Suppose for some reason all of the giraffes in the whole world disappeared. There is not one giraffe left in the whole world. What has disappeared, the word 'giraffe' or the giraffes? c) Has the word 'giraffe' disappeared? d) Now that all the giraffes are goen, does the word 'giraffe' mean 'nothing' or does it mean 'an animal with a long neck'? e) Can you give me a word for something you cannot find anywhere in the world?"

This procedure was repeated for the word 'apple' with the exception of (e).

B. Distinction Between Word and Referent (Adapted from Markman, 1976)

Procedure

The subject was told, "Now I'm going to ask you some more questions.

1. a) What is made of steel, the word 'car' or a car? b) Is the word 'car' made of steel?
2. a) What will make you wet, the word 'rain' or rain? b) Will the word 'rain' make you wet?

3. a) What is made of feathers, the word 'bird' or a bird? b) Is the word 'bird' made of feathers?
4. a) What can you buy a piece of bubble gum with, the word 'penny' or a penny? b) Can you buy a piece of bubble gum with the word 'penny'?
5. a) What is made of rubber, the word 'ball' or a ball? b) Is the word 'ball' made of rubber?

Scoring Procedures

A. Meaning and Reference (Adapted from Markman, 1976)

Each correct answer received one point and the total number of correct responses was obtained.

Ss were scored as correct if they said that the giraffes disappeared in (b), denied that the word 'giraffe' had disappeared in (c), choose 'animal with a long neck' in (d), and provided an invented word or a word which truly had no extant referent (e.g., dinosaur) in (e). Scoring is the same for the 'apple' item.

B. Distinction Between Word and Referent

(Adapted from Markman, 1976)

Each correct answer received one point and the total was obtained. To be counted as correct, both parts (a) and (b) of each question had to be answered correctly.

C. Summary Score

The total number of correct answers on parts A and B was obtained.

3. Explicit Knowledge of Imagery Tasks

(Parts A, B and B' always administered together, although in counter-balanced order.)

A. Distinction Between Objects and Images (Comparable to A in Metalinguistic Tasks)

a) Can you close your eyes and get a picture of a zebra in your head? Do you have it? What does it look like? b) Suppose for some reason all of the zebras in the whole world disappeared. There is not one zebra left in the whole world. What has disappeared, the picture of the zebra in your head or the zebras? c) Now that all the zebras are gone, is the picture of the zebras in your head gone too? What does it look like? Is it 'nothing' or does it look like a striped animal?

This procedure is repeated for the picture of a tomato.

Scoring Procedure

Each correct answer received one point and the total was obtained.

Ss were scored as correct if they choose 'the zebras' in (b) and denied that the picture had disappeared in (c) and described it in much the same way as in (a). Scoring is the same for the tomato item.

B. Distinction Between Image and Object (Parts B and B' are Comparable to Part B of Metalinguistic Knowledge Tasks)

Procedure

The child was asked to close her eyes and to get a picture of a car in her head, to think of what a car looks like. The following questions were then asked: a) What is made of steel, is the picture of the car in your head made of steel, or is a car on the street made of steel? b) Is

the picture of the car in your head made of steel? Is there really steel in your head?

The child was then asked to get a picture of a bird in her head and was asked? a) What is made of feathers? Is the picture of a bird in your head made of feathers or is a bird outside in a tree made of feathers? b) Is the picture of the bird in your head made of feathers? Are there really feathers in your head?

B'. Distinction Between Image and Word

1. Let's change the picture again. Get a picture of rain in your head. Do you have it? a) What will make you wet? Will the picture of rain in your head make you wet or will the word 'rain' make you wet? b) Will the picture of rain in your head make you wet?

2. Now get a picture of a penny in your head. Do you have it? a) What can you buy bubble gum with, the picture of a penny in your head or with the word 'penny'? b) Can you buy bubble gum with the picture of the penny in your head?

Scoring Procedure for B and B'

Each correct answer received one point and the total was obtained. To be counted as correct both parts (a) and (b) of each question had to be answered correctly.

C. Summary Score

(Comparable to Metalinguistic Knowledge Summary Score.)

D. Metaknowledge Summary Score

The proportion of correct responses on all metalinguistic and elicit knowledge of imagery tasks of the total number of responses was obtained and used in further analyses.

4. Test of Hierarchic Semantic Organization

(Adapted from Steinberg & Anderson, 1975)

Stimuli. There were eight 5 x 5 black and white line drawings which depicted the target nouns listed in Appendix B. Four of these were also high imagery noun word association stimuli. There were also two distractors (bird and book) and two practice items (pencil and house). These drawings were compiled in an eight page booklet, one drawing per page.

Figure 1 presents the hierarchic semantic relationships among the various types of words used as retrieval cues. There were four different randomizations of retrieval cues to which Ss were randomly assigned. It was predicted that the probability of recalling the target noun as a function of administration of the various retrieval cues differs depending on how many notches away the retrieval cue is from the target noun. For example, the probability of retrieving the target noun given the close superordinate as the retrieval cue is greater than if the close cohyponym is the retrieval cue. The five comparisons that were tested for each subject are given below, where the term P(N/CC), for example, is read as the probability of naming (N) the target noun, given the close cohyponym as the retrieval cue. In every case the first probability is predicted to be higher than the second.

1. P(N/CS), P(N/RS)
2. P(N/CS), P(N/CC)
3. P(N/RR), P(N/RC)
4. P(N/CC), P(N/RC)
5. [P(N/RS) - P(N/RC)], [P(N/CS - P(N/CC)]

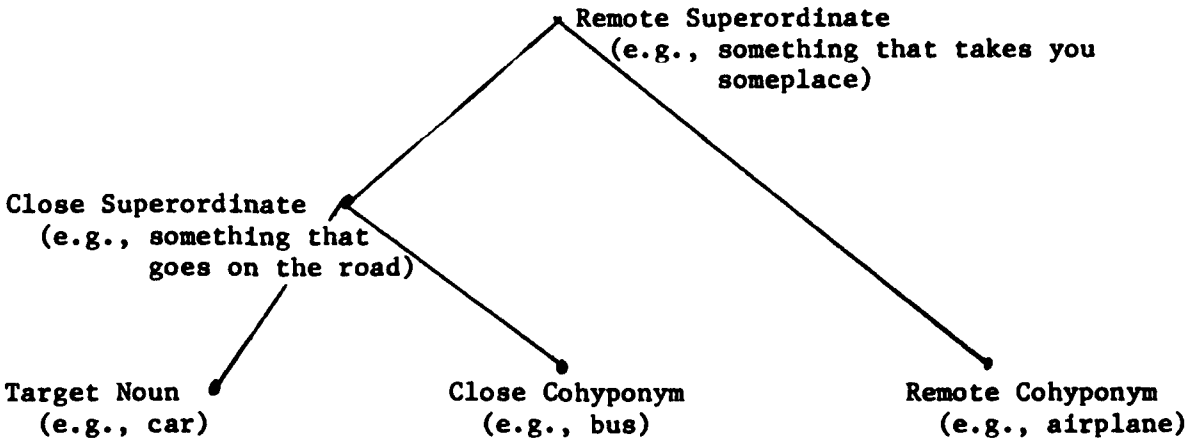

Fig. 1. Relationships among words in a class inclusion tree.

Procedure. The subject was told, "We are going to play a picture remembering game. First we will look at the pictures in my book. Then, I will close the book and tell you some words. You tell me which picture the word makes you think of. Let's try some and see how it goes."

After asking the S to name each of the practice pictures on the first two pages, the E said, "Which picture did you see that makes you think of a _____?" where the blank is one of the five practice retrieval cues. The E corrected the S's misunderstandings or praised her for knowing the rules of the game. When the E was sure the procedure was understood, the S was directed to turn the pages and name each of the drawings in the set at her own rate. Then the E closed the book and read each cue. The S named the

picture she was most reminded of or indicated that she could not remember any.

Scoring Procedure. Responses were counted as correct if and only if they matched the target noun in the same category as the cue. The proportions of target pictures recalled were calculated for each S as a function of the type of retrieval cue administered. The performance of each S was also examined to determine if it confirmed or infirmed the five predictions of relative ease of recall of targets as a function of retrieval cue (see stimuli for a complete list of predictions), and the total number of confirmations and infirmations were obtained for each age group.

5. Word-Word Relationship Task

Stimuli. There were four noun, four verb and four adjective paradigmatic word pairs. Within each grammatical class, superordinate, logical coordinate, contrast and synonym relationship types were exemplified by one pair. One word of each pair was a word association stimulus item. (See Appendix C for complete stimulus list.)

Procedure (Adapted from Lippman, 1971). The E said, "Now we're going to read two words out loud to you and I would like you to tell me why these two words might go together. If you don't think the words go together at all, you can say so." As each word pair is read, the child is asked in sequence, "Can you think of any reason why these two words might go together? Is there anything that these two words both are? How are they alike or different? Can you think of any other reason why _____ and _____ might go together?" There were four different constant random orders of problems, of which one was presented to each subject. The order of mention of the two items in each pair was counterbalanced.

Scoring Procedure (Adapted from Lippman, 1971). The children's reasons for why the two words 'go together' were scored as follows:

1. Contrast - Child states that the two items are opposite in meaning.
2. Hierarchical - Child states that the two items are in a super-ordinate-subordinate relationship (e.g., a dress is one type of clothing; red is one kind of color).
3. Synonym - Child claims that both items mean the same thing or refer to the same object.
4. Coordinate - Child refers to a category which both items belong to (e.g., they're both food, fruit, actions, colors).
5. Functional Equivalence - Both items are related to an action (e.g., you can do both of them while you're playing; you can eat both of them), without reference to the category which both items belong to.
6. Perceptual - Items are related to one another through a common sensory attribute (e.g., look alike, taste alike).
7. Examples - No mention is made of a common category and both items are simply mentioned as modifying the same object (e.g., red paper-green paper).
8. Comparative - The two items are directly compared (e.g., for rich-poor, one's better than the other).
9. Fiat - No attempt at a coherent reason is made (e.g., one's rich, the other's poor).
10. Other - An entirely irrelevant response is given (e.g., stop-go).
11. No response
12. Discordance - The two items are said not to go together at all because of their difference or some incompatibility due to some

difference in a perceptual attribute or because they are opposites.

Summary Score. The proportion of the total (12) correct logical justifications (Nos. 1, 2, 3 and 4) and discordance justifications, in which the child indicates the two words are opposites, was calculated for each subject and used in further analyses.

CHAPTER V - RESULTS

Interrater Reliability

The interrater reliability varied from .94 for the word association responses to .98 for the metaknowledge tasks.

General Method

First it was important to determine whether the various word association tests and imagery values elicited different proportions of the various response types. To accomplish this, 5 way (2-condition x 3-grade x 5-test x 2-imagery x 3-part of speech) repeated measures analyses of variance were performed on the proportions[12] of the response types described in the previous chapter (i.e., paradigmatic, syntagmatic, miscellaneous, and logical responses, which were a subset of paradigmatic responses) given for each test, in response to high and low imagery words.

In cases where the test main effect was significant, test treatment means (i.e., the paradigmatic, syntagmatic, imagery and time delay test means) were compared to that of the first free word association test using Dunnett's tests,[13] which are appropriate to compare treatment means to a control group (Winer, 1971). In this case the control or standard was the first word association test against which all other tests were compared to assess the effects of special instructions. All other main effects (i.e., imagery, speech, grade) and other comparisons among the tests themselves were investi-

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[12] All analyses of word association data were rerun on raw scores with equivalent results.

[13] Although the groups were not independent, Dunnett's tests are a conservative indication of significant differences between "treatment" and control groups (Weinstock, personal communication).

gated using Duncan's procedure, a more conservative post hoc test (Winer, 1971). These post hoc analyses were performed both on the proportions of each response type for each test and on the change scores.

Effect of Condition

Four separate five way (2-condition X 3-grade X 5-test X 2-imagery X 3-part of speech) analyses of variance were performed, one each on the proportions of paradigmatic, syntagmatic, miscellaneous and logical responses. There were no significant effects for condition for any of the response types. Unless otherwise specified, all findings are derived from these analyses.

Effect of Time Delay Test

The five way (2-condition X 3-grade X 5-test X 2-imagery X 3-part of speech) repeated measures analyses of variance performed on the latencies of response for all response types combined showed that the latencies of the imagery ($\bar{X}$ = 4.22), the syntagmatic ($\bar{X}$ = 4.25), and the time delay ($\bar{X}$ = 4.117) tests did not differ significantly from one another, although these three were significantly slower than either the paradigmatic ($\bar{X}$ = 3.529) or the first word ($\bar{X}$ = 2.952) tests ($p < .01$). Yet the time delay condition did not differ from the first word tests on proportions of any of the response types. Hence, any differences in proportions of response types among the first word, paradigmatic, syntagmatic and imagery tests cannot be attributed merely to differences in latency of response. Time delay alone does not influence word association responding.

Effect of Test Instruction on Response Type

There were significant test main effects for the paradigmatic (F = 62.688; df = 4,188; $p < .001$), syntagmatic (F = 52.474; df = 4,188; $p < .001$) and logical (F = 50.161; df = 4,188; $p < .001$) responses but not for the miscellaneous responses (see Table 2 for mean proportions). The various test instructions appropriately changed S's level of responding as follows:

(a) Paradigmatic Responses. The paradigmatic test elicited significantly more paradigmatic responses than any other test, followed by the first word test and then by the imagery and syntagmatic tests. All test mean proportions differed significantly from one another ($p < .01$). As a subset of paradigmatic responses, logical responses followed exactly the same pattern as paradigmatic responses.

The grade X test interaction (F = 8.075; df = 8,188; $p < .001$) indicated that the kindergarteners' level of responding remained much more even throughout the different tests than did older subjects (see Table 3 for mean proportions), suggesting that kindergarteners were less able to comply with test instructions than the older groups.

(b) Syntagmatic Responses. The imagery test was successful in eliciting more syntagmatic responses than the first word test ($p < .01$) but the syntagmatic test was even more successful than the imagery test in increasing syntagmatic responding. These were followed by the first word and finally the paradigmatic tests, which elicited fewest syntagmatic responses. All test mean proportions were significantly different from one another. These findings suggest that a deliberate verbal strategy to generate sentence fragments is more successful in generating syntagmatic responses than is a strategy to

TABLE 2

Mean Proportions of Response Types as a Percentage of Total Responses by Type of Test

Response Type	TESTS: First Word	Paradigmatic	Syntagmatic	Imagery	Time Delay	All Responses Combined
Paradigmatic*	.606	.715	.208	.413	.588	.506
Syntagmatic*	.294	.165	.678	.434	.316	.377
Miscellaneous	.100	.120	.114	.153	.096	.127

* Significant test main effect at .001 level.

TABLE 3

Mean Proportions of Response Types as a

Percentage of Total Responses for Each Grade and Test

Response Type	Kindergarten	Second	College
First Word Test			
Paradigmatic	.549	.608	.662
Syntagmatic	.210	.354	.317
Miscellaneous	.241	.038	.021
Paradigmatic Test			
Paradigmatic	.525	.709	.913
Syntagmatic	.215	.201	.078
Miscellaneous	.260	. 09	.009
Syntagmatic Test			
Paradigmatic	.361	.134	.130
Syntagmatic	.385	.782	.868
Miscellaneous	.254	.084	.012
Imagery Test			
Paradigmatic	.476	.392	.371
Syntagmatic	.306	.431	.566
Miscellaneous	.218	.177	.063
Time Delay Test			
Paradigmatic	.521	.629	.614
Syntagmatic	.254	.326	.368
Miscellaneous	.225	.045	.033

produce stimulus-evoked images.

The grade X test interaction for syntagmatic responses (F = 6.684; df = 8,188; $p < .001$) showed that all the second graders and college students increased their level of syntagmatic responding in the syntagmatic and imagery tests much more than did the kindergarteners (see Table 3 for mean proportions). This suggests that kindergarteners were much less able to follow the imagery and other instructions than older subjects.

Changes With Age Over All Tests

The five way (2-condition X 3-grade X 5-test X 2-imagery X 3-part of speech) analysis of variance performed on responses of all five tests showed a significant grade main effect for syntagmatic (F = 5.745; df = 2,47; $p < .006$) and miscellaneous (F = 9.133; df = 2,47; $p < .001$) responses but not for paradigmatic or logical responses. (See Table 4 for mean proportions.) Second graders and college students made significantly more syntagmatic responses than kindergarteners over all tests ($p < .01$). Kindergarteners made more miscellaneous responses than college students or second graders, who did not differ significantly from one another ($p < .01$). Hence it appears that kindergarteners made fewer syntagmatic but more miscellaneous responses than older subjects, while levels of paradigmatic responding over all the tests were comparable for all age Ss.

Changes With Age in the First Word Association Test Only: Evidence Relating to the Syntagmatic-Paradigmatic Shift

The proportion of paradigmatic and syntagmatic responses for the first word association test only were submitted to a three way (3-grade

TABLE 4

Mean Proportion of Each Response Type as a Percentage of Total Responses Grade

Response Type	Grades		
	Kindergarten	Second	College
Paradigmatic	.486	.494	.538
Syntagmatic*	.274	.419	.439
Miscellaneous*	.240	.087	.023

* Significant Grade Main Effect

X 2-imagery X 3-part of speech) repeated measures analysis of variance. There were no significant grade main effects for either paradigmatic or syntagmatic responses. All grades made an equivalent number of syntagmatic and paradigmatic responses, contrary to the expectation that syntagmatic responding decreases while paradigmatic responding increases with age. (See Table 3 for mean proportions.)

In order to compare the proportions of paradigmatic and syntagmatic responses made, a four way repeated measures analysis of variance (3-grade X 2-response type X 2-imagery X 3-part of speech) was also performed for the first word test only. There was a significant main effect for response type ($\underline{F}$ = 13.196; df = 1,47; $p < .001$). All grades made more paradigmatic responses ($\bar{X}$ = .606) than syntagmatic ($\bar{X}$ = .294) ($p < .01$).

Negation Responses Eliminated from Paradigmatic Responses

Many kindergarteners stereotypically provided paradigmatic "negation" responses, while very few of the second graders and virtually none of the college students did so. To determine whether the lack of a grade effect for paradigmatic responses might be accounted for solely by the preponderance of negation responses by kindergarteners, the proportions of negation responses were subtracted from the corresponding proportions of paradigmatic responses for all the tests. A five way (2-condition X 3-grade X 5-test X 2-imagery X 3-part of speech) repeated measures analysis of variance was performed on the remainder of paradigmatic responses.

This analysis showed a significant grade main effect ($\underline{F}$ = 15.644; df = 2,47; $p < .001$). Kindergarteners ($\bar{X}$ = .266) produced fewer

paradigmatic responses than second graders ($\bar{X}$ = .422) and college students ($\bar{X}$ = .521) who did not differ significantly from one another ($p < .01$).

A three way (grade X 2-imagery X 3-part of speech) repeated measure analysis of variance was performed on the remainder of paradigmatic responses for the first word association test only. Here too there was a significant grade effect (F = 19.01; df = 2,47; $p < .001$). Kindergarteners ($\bar{X}$ = .251) made fewer paradigmatic responses than second graders ($\bar{X}$ = .521) or college students ($\bar{X}$ = .656) ($p < .01$) who did not significantly differ from one another.

In sum, when negation responses were excluded from the paradigmatic category, a shift with age from lower to higher levels of paradigmatic responding was shown.

Imagery Value and Syntagmatic Responses

High imagery words ($\bar{X}$ = .419) produced more syntagmatic responses than low imagery words ($\bar{X}$ = .336) across all tests as revealed by the significant main effect for imagery (F = 23.65; df = 1,47; $p < .001$). This provides support for the hypothesis linking syntagmatic responses and imagery.

The significant test X imagery interaction (F = 5.294; df = 4,188; $p < .001$) also showed that the differential elicitation of syntagmatic responses by high and low imagery words was most pronounced in the imagery condition, and then in the FW condition. In the paradigmatic and syntagmatic tests, both high and low imagery words elicited almost the same number of syntagmatic responses (see Table 5 for mean proportions). This indicates that stimulus imagery value has its greatest effect when it is not superseded by deliberate verbal

TABLE 5

Mean Proportion of Syntagmatic Responses as a Percentage of Total Responses for High and Low Imagery Value Words By Type of Test

	TESTS					
Imagery Value	First Word	Paradigmatic	Syntagmatic	Imagery	Time Delay	All Tests Combined
High	.340	.182	.698	.527	.350	.419
Low	.247	.148	.659	.341	.282	.336

strategies used in the paradigmatic and syntagmatic tests.

There was also a significant grade X imagery interaction for syntagmatic responses (F = 3.961; df = 2,47; p = .026) which showed that the high imagery words elicited many more syntagmatic responses for second graders and college students but that kindergarteners did not differentially respond to the imagery value of the words. (See Table 6 for mean proportions.)

Imagery Value and Other Response Types

There was a significant main effect for imagery value for miscellaneous responses (F = 48.162; df = 1,47; $p < .001$). Low imagery words ($\bar{X}$ = .185) elicited significantly more miscellaneous responses than high imagery words ($\bar{X}$ = .113). Thus, subjects did not respond at all when given a low imagery word as a stimulus.

There was no significant main effect for imagery for paradigmatic or logical responses whether or not negation responses were categorized as paradigmatic. Contrary to prediction, low imagery words did not produce significantly more logical responses than high imagery words in any of the tests. Hence, the data did not support the hypothesis that responses to low imagery stimuli would be more often mediated by hierarchic semantic organization and be correlated with logical paradigmatic associations.

Response Latencies: Across All Responses

A five way (2-condition X 3-grade X 5-test X 2-imagery X 3-part of speech) analysis of variance was performed on the mean latency of response across all responses. It showed that high imagery words ($\bar{X}$ = 3.6) elicited responses more quickly than low imagery words

TABLE 6

Mean Proportions of Syntagmatic Responses as a Percentage of Total Responses for High and Low Imagery Words By Grade Across all Tests

	Grade		
Imagery Value	Kindergarten	Second	College
High	.285	.465	.509
Low	.264	.373	.370

($\bar{X}$ = 4.25) F = 37.223; df = 1,47; $p < .001$).

The significant test effect (F = 12.014; df = 4,188; $p < .001$) showed that responses in the first word test ($\bar{X}$ = 2.95) were significantly quicker than in the paradigmatic test ($\bar{X}$ = 3.52) ($p < .01$), which in turn was faster than the syntagmatic ($\bar{X}$ = 4.25), imagery ($\bar{X}$ = 4.22) and time delay ($\bar{X}$ = 4.11) tests ($p < .01$), the three of which did not differ significantly from one another.

There was a significant grade effect for the mean latencies of all responses combined (F = 6.169; df = 2,47; $p < .005$). College students and kindergarteners on the one hand, and kindergarteners and second graders on the other, did not differ from one another. But college students responded significantly more quickly than the second graders ($p < .01$). The significant grade X test interaction (F = 3.415; df = 8,188; $p < .002$), however, showed that college students were quicker than both the younger groups in the first word test, and that in the time delay test all groups responded at the same speed. In the paradigmatic, imagery and especially the syntagmatic tests, however, second graders were much more slow to respond than either kindergarteners or college students, who responded equally quickly. (See Table 7 for mean latencies.)

Response Latencies of Imagery and Linguistically Mediated Associations

It was hypothesized that imagery mediated response (i.e., syntagmatic responses in the first word and imagery test) would be produced more slowly than linguistically mediated responses (i.e., syntagmatic responses in the syntagmatic test and logical paradigmatic responses). To test this hypothesis a five way (3-grade X 2-response type X 5-test X 2-imagery X 3-part of speech) repeated measures analysis of variance

TABLE 7 -

Mean Latencies of Response in Seconds Across All Response Types for Each Grade and Test and for all Tests Combined

	TESTS					
Grade	First Word	Paradigmatic	Syntagmatic	Imagery	Time Delay	All Tests Combined
Kindergarten	3.41	3.17	4.03	4.22	4.27	3.82
Second	3.37	4.28	5.63	4.94	4.08	4.46
College	2.06	3.12	3.07	3.48	3.99	3.18

was performed on the mean response latencies of logical paradigmatic and syntagmatic associations. The significant main effect for response type (F = 13.562; df = 1,47; $p < .01$) showed that logical paradigmatic responses ($\bar{X}$ = 3.74) were faster than syntagmatic responses ($\bar{X}$ = 4.49). The latter responses in fact were slower than any of the paradigmatic responses in any of the tests (see Table 8 for all the means). Further, latencies of syntagmatic associations in the imagery test ($\bar{X}$ = 4.57) did not differ significantly from those in the syntagmatic test ($\bar{X}$ = 4.49).

Hence, the hypothesis that imagery mediated responses would have longer latencies than linguistically mediated ones was infirmed. Rather, all syntagmatic responses ($\bar{X}$ = 4.49), including those in the syntagmatic test, were significantly slower than all paradigmatic responses ($\bar{X}$ = 3.74).

Cognitive Variables and Word Association

There were several hypotheses relating to the cognitive variables [i.e., knowledge of word-word relationships, metaknowledge of language and images, Steinberg and Anderson's (1975) hierarchic semantic organization and ability to recognize one's own paradigmatic response pattern (articulation)] to word association responding. Pearson product-moment correlations were computed for each of the proportions of correct answers on the cognitive tasks and age. All but two intercorrelations between the cognitive tasks and articulation reached significance (see Table 9). This suggests that these scores are valid indications of some aspect of cognition. (See Table 9a for mean scores by grade.)

Hierarchic Semantic Organization (Abbreviated HSO). As previously

TABLE 8

Mean Latencies of Response in Seconds of Logical Paradigmatic and Syntagmatic Associations for Each Test Across all Grades and Parts of Speech

Response Type	TESTS					
	First Word	Paradigmatic	Syntagmatic	I	TD	All Tests Combined
Logical Paradigmatic	2.65	3.48	4.42	4.05	4.10	3.84
Syntagmatic	3.53	4.01	4.49	4.57	4.29	4.49

TABLE 9

Correlations Between the Cognitive Variables and Age

	Hierarchic Semantic Knowledge	MetaKnowledge	Word-Word Relationships	Age	Articulation
Hierarchic Semantic Knowledge	1				
MetaKnowledge	.551**	1			
Word-Word Relationships	.690***	.494**	1		
Age	.616***	.540**	.775***	1	
Articulation	.256	.313	-.397*	.333	1.

*Significance at least at the .05 level.

**Significance at least at the .01 level.

***Significance at least at the .001 level.

TABLE 9a

Mean **Scores** on Cognitive Tasks By Grade

	TASKS									
	Metalinguistic Knowledge (13)*		Explicit Knowledge of Imagery (12)		Metaknowledge Summary Score (25)		Word-Word Relationships (12)		Hierarchic Semantic Organization (20)	
Grade	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Kindergarten	.770	.267	.81	.218	.83	.134	.378	.273	.685	.2
	(10.02)	(3.471)**	(9.72)	(2.616)	(20.75)	(3.35)	(4.536)	(3.276)	(13.7)	(4.)
Second	.98	.042	.89	.129	.93	.082	.59	.208	.875	.089
	(12.74)	(.546)	(10.68)	(1.548)	(23.25)	(2.05)	(7.08)	(2.496)	(17.5)	(1.78)
College	1	0	1	0	1	0	1	0	1	0
	(13)	(0)	(12)	(0)	(25)	(0)	(12)	(0)	(20)	(0)

* Numbers in parentheses refer to the total number of possible correct responses.

** Numbers in parentheses refer to the mean raw scores. Other numbers are mean proportions of correct responses.

described, Steinberg & Anderson (1975) tested and confirmed predictions concerning the probability of recalling target nouns given various retrieval cues. (See section in Method on HSO for elaboration.) The present results also confirmed those predictions (see Table 10 for predictions and results) for both second graders and kindergarteners, indicating that these two groups have comparable hierarchic semantic organizations. However, a one way (3-grade) analysis of variance performed on the total number of correct responses showed a significant main effect for grade ($F = 15.742$; $df = 2,27$; $p < .001$). Further, post hoc tests showed that all the grades differed significantly from one another ($p < .05$). Thus, while all grades had similar hierarchic semantic structures, there was a quantitative difference in the degree to which the structure was present.

Difference Scores: Their Limitations and a Solution

To evaluate the hypotheses it was necessary to assess whether subjects of different ages and cognitive levels differentially changed their level of responding to accord with various word association instructions. To do this, difference scores were obtained by subtracting each subject's proportion of responses for a particular response type on each of the four special instruction tests (i.e., paradigmatic, syntagmatic, imagery and time delay) from the corresponding proportion given on the first word association test.[14] For example, there were four difference scores for each subject for the proportion of paradigmatic responses elicited by high imagery

[14] All analyses of word association data were rerun on raw scores with equivalent results.

TABLE 10

Frequency with Which Comparisons Confirmed Predictions

By Subjects

Comparison	Subjects (N=20) Confirm K	2	Equal K	2	Infirm K	2
p(N/CS),p(N/RS)	2	6	7	3	1	1
P(N/CS),P(N/CC)	4	7	6	1	0	2
P(N/RS),P(N/RC)	7	8	3	2	0	0
P(N/CC),P(N/RC)	8	7	2	3	0	0
[P(N/RS)-P(N/RC)] [P(N/CS)-P(N/CC)]	8	5	2	4	0	1
Total	29	33	20	13	1	4

nouns, high imagery verbs and so on. Repeated measures analyses of variance and covariance were then performed on these scores.

These difference scores were misleading, however, as they only measured absolute amount of change and did not take the starting point, the level of responding on the first word test, into account, and thereby concealed ceiling effects. For example, a subject who responded with many paradigmatic responses in the first word test and then equally as many appropriate paradigmatic responses in the paradigmatic test did not change her response pattern. On the other hand, a subject who had a low level of paradigmatic responding in the first word test and many appropriate responses in the paradigmatic test did change. But both subjects may have equally as many of the appropriate paradigmatic responses in the paradigmatic test. Thus, since difference scores did not take the starting point on the first word test into account, they did not truly reflect the differences in response patterns among the grades.

Indeed, when four way (3-grade X 5-test X 2-imagery X 3-part of speech) analyses of variance were performed on the difference scores, there were no significant grade effects for any of the response types. The grades did not differ significantly from one another in the absolute amount of change in level of responding from the first word to the special instruction tests for any of the response types. Yet the significant grade by test interactions discussed earlier showed that the different grades did differ in the extent to which they changed their level of responding over the various tests. Absolute amount of change in responding, which difference scores measured, was not indicative of the differential success with which the grades

complied with the instructions.

In still other analyses of variance the subjects were divided into two groups on the basis of the median split of the proportion of correct hierarchic semantic organization responses. Hierarchic semantic organization then acted as the independent grouping variable in four way (2-hierarchic semantic organization X 5-test X 2-imagery X 3-part of speech) repeated measures analyses of variance performed on the difference scores of the various response types. Here too there was no significant main effect for hierarchic semantic organization for any of the response types.

The median splits of the word-word relationship and the metaknowledge scores were also used as the independent grouping variables in three way (2-metaknowledge X 2-word-word X 5-test) repeated measure analyses of variance performed on the difference scores for each of the three response types. Again there was no significant main effect for either metaknowledge or word-word relationship scores on any of the response types. Hence, in order to attempt to determine whether the cognitive variables played a role in changes in word association responding another kind of analysis of covariance was designed to account for the level of responding in the first word test.

In these analyses the independent variables were the proportions of the appropriate responses on the paradigmatic, syntagmatic and imagery tests respectively. The covariates were the corresponding proportions of responses on the first word test. In an additional set of ANCOVAS, age was the second covariate. To illustrate, in the paradigmatic test the subjects were divided into three groups, low,

medium and high, on the basis of a trichotomy of the number of the paradigmatic responses they gave. The number of paradigmatic responses on the first word test acted as the covariate in order to control for the starting point from which change in paradigmatic responding was to be measured. In the syntagmatic and imagery tests the Ss were similarly divided into three groups on the basis of a trichotomy of the number of syntagmatic responses given in each of them. The number of syntagmatic responses on the first word test was the covariate in both cases. In all of these one way analyses of covariance (3-response type levels) the subjects' scores on: (a) metalinguistic knowledge, (b) explicit knowledge of imagery, (c) metaknowledge summary score, (d) hierarchic semantic organization, (e) word-word relationships and (f) articulation of response pattern, were the dependent variables. It was then possible to determine whether those who responded with a high, medium or low proportion of appropriate associations on the special instruction tests differed in their scores on metaknowledge, word-word, hierarchic semantic organization or ability to recognize their response pattern.

Metaknowledge and Change in Responding to Accord with Test Instructions

In the analyses of covariance described above, there were no significant effects for either the metaknowledge summary score, or its components; metalinguistic knowledge and explicit knowledge of imagery. High, medium and low responders of paradigmatic and syntagmatic associations did not differ significantly in terms of metaknowledge scores. (See Table 11 for F tests.)

TABLE 11

F Tests for Main Effects for Cognitive Variables with Response Level on the First Word Association Test as the Only Covariate

Cognitive Variable	F	df	p
Trichotomy for Paradigmatic Responding in the Paradigmatic Test			
Hierarchic Semantic	3.831	2,26	.035
MetaKnowledge	2.660	2,26	.089
Word-Word	3.729	2,26	.038
Articulation	4.186	2,26	.622
Trichotomy of Syntagmatic Responses in Syntagmatic Test			
Hierarchic Semantic Organization	4.779	2,26	.018
MetaKnowledge	1.193	2,26	.32
Word-Word	6.889	2,26	.004
Articulation	2.312	2,26	.111
Trichotomy of Syntagmatic Responses in Imagery Test			
Hierarchic Semantic Organization	.469	2,26	.5
MetaKnowledge	.085	2,26	.5
Word-Word	4.782	2,26	.01
Articulation	3.105	2,26	.055

Word-Word Relationship Scores and Change in Responding to Accord with Test Instructions

For all the changes in responding, the low, medium and high groups differed in terms of their knowledge of word-word relationship when level of responding on the first test acted as the only covariate. Ss who responded with the highest proportion of appropriate responses also had higher word-word scores than those who responded with fewer appropriate responses (see Table 11 for F tests). When age acted as the second covariate, however, only low ($\bar{X}$ = .410), medium ($\bar{X}$ = .810) and high ($\bar{X}$ = .67) paradigmatic responders on the paradigmatic test differed in terms of word-word scores (F = 3.499; df = 2.25; $p < .046$). Thus, both explicit knowledge of hierarchic semantic relationships and age were equally good predictors of the ability to change to syntagmatic responses to accord with task demands. But explicit knowledge of hierarchic semantic organization was a better predictor of ability to change to paradigmatic responding than age.

Explicit and Implicit Knowledge of Semantic Organization and Paradigmatic Responding in the First Word Test

In order to determine whether explicit knowledge of word-word relationships was correlated with paradigmatic responding in the first word test, subjects were divided into three groups, low, medium and high, on the basis of a trichotomy of the number of paradigmatic responses given in the first word test (abbreviated PRF). One way (3-PRF level) analyses of variance and covariance with age as the covariate were performed on word-word and hierarchic semantic organization scores. The analysis of variance (F = 5.078; df = 2,27; p = .015) showed that high ($\bar{X}$ = .633) and medium ($\bar{X}$ = .81) paradigmatic

paradigmatic responders indeed had higher word-word scores than those who were low ($\bar{X}$ = .378) paradigmatic responders ($p < .01$). But when the effect of age was controlled, high, medium and low paradigmatic responders no longer differed significantly in their word-word scores ($F = 2.897$; df = 2,24; $p = .075$). Yet the level of paradigmatic responding was significant in both the analyses of variance ($F = 8.669$; df = 2,25; $p = .002$) and covariance ($F = 5.907$; df = 2,24; $p = .009$), for hierarchic semantic organization, presumed to be a measure of implicit knowledge of word-word relationships. High ($\bar{X}$ = .883) and medium ($\bar{X}$ = .955) paradigmatic responders scored higher on hierarchic semantic organization than low responders ($\bar{X}$ = .683) even when age effects were controlled. Contrary to prediction, low, medium and high paradigmatic responders on the first word test differed in terms of implicit, rather than explicit hierarchic semantic knowledge, even when the effect of age was controlled.

Ability to Recognize One's Own Paradigmatic Response Pattern and Frequency of Paradigmatic Responding in the First Word Association Test

A one way (3-grade) analysis of variance on pass/fail scores on the ability to recognize one's own paradigmatic response pattern in the first word association test showed a significant main effect for grade ($F = 4.119$; df = 2,47; $p = .023$). In a code in which "1" indicates a pass and "2" indicates a failure, kindergarteners ($\bar{X}$ = 1.55) were better able to recognize their paradigmatic responses than second graders ($\bar{X}$ = 1.75) or college students ($\bar{X}$ = 2.0) ($p < .05$). Kindergarteners were able to say they had said the opposite or had affixed "not" or "un" to all stimulus words for their responses and in fact said they had deliberately tried to do so. Older Ss were not aware

that they had responded in any special way and had not consciously tried to produce certain kinds of associations. This infirms the prediction that young children who respond paradigmatically will not be able to articulate that they are doing so.

There was no significant correlation between articulation and metaknowledge, also contrary to prediction. Kindergarten children were able to report that they had deliberately monitored their word association responding to produce negated paradigmatic responses without having higher levels of metaknowledge. (See Table 9 for correlations.)

Negation Responses Eliminated from Paradigmatic Responses in the First Word and Paradigmatic Test

To determine whether different cognitive variables influenced the production of the remainder of paradigmatic responses after negation responses were removed from the total, subjects were divided into three groups, low, medium and high, on the basis of a trichotomy of the remainder of paradigmatic responses given in the first word test (abbreviated PRng). One way (3-PRng) analyses of variance and covariance, with age as the covariate, were performed on the proportion of correct (a) metalinguistic knowledge responses, (b) explicit knowledge of imagery responses, (c) the metaknowledge summary score, (d) implicit and (e) explicit hierarchic semantic organization scores and (f) articulation of response pattern scores. As in the corresponding analyses of paradigmatic responses including negation associations, low ($\bar{X}$ = .69), medium ($\bar{X}$ = .94) and high ($\bar{X}$ = .93) paradigmatic responders differed significantly in terms of their implicit knowledge of hierarchic semantic organization (F = 6.177; df = 2,26; p = .007)

even when age was controlled. But in contrast to the analysis of the total, three levels of responders also differed in terms of metalinguistic knowledge (low $\bar{X}$ = .78; medium $\bar{X}$ = .98; high $\bar{X}$ = .99) (F = 3.681; df = 2,26; p = .04) and explicit knowledge of hierarchic semantic organization (low $\bar{X}$ = .33; medium $\bar{X}$ = .76; low $\bar{X}$ = .8) (F = 6.303; df = 2,26; p = .006) even when age was controlled. All other findings were non-significant, as in the analyses for the total number of paradigmatic responses.

Paradigmatic responses in the paradigmatic test were also analyzed with negation responses eliminated from the analyses. These analyses of variance and covariance corresponded to those performed on paradigmatic associations including negation responses. Results showed no differences between the two sets of analyses in the influence of cognitive variables upon paradigmatic responding in the paradigmatic test.

Summary of Results

(1) Test instructions appropriately modified paradigmatic and syntagmatic responding. Miscellaneous responding remained the same over the tests. Kindergarteners appropriately modified their level of responding to a lesser extent than the older groups.

(2) When negation responses were categorized as paradigmatic responses, all grades made the same number of paradigmatic responses over all tests and in the first word test only. When negation responses were not categorized as paradigmatic, second graders and college students made more paradigmatic responses than kindergarteners. There was also an increase in syntagmatic responding with age over all

tests. When only the first word test was considered, there was no developmental change in syntagmatic responding. Miscellaneous responding decreased with age over all tests and in the first word test alone.

(3) High imagery words produced more syntagmatic responses than low imagery words over all tests, but this was especially apparent in the imagery and first word tests; it was also true in second graders and college students. Kindergarteners did not differentially respond to the imagery value of words. While high imagery words elicited more syntagmatic responses than low imagery words in the first word test alone, the difference was not significant.

(4) Low imagery words produced more miscellaneous responses than high imagery words.

(5) Low and high imagery words did not differentially elicit logical paradigmatic responses.

(6) Response latencies in the first word test and for high imagery words were shorter than those for any other test and low imagery words respectively. Second graders responded more slowly than college students and kindergarteners in the special instruction tests, but college students responded more quickly than the two younger groups in the first word test. All syntagmatic responses, including those in the syntagmatic test, had longer latencies than all logical paradigmatic responses.

(7) The present findings replicated those of Steinberg & Anderson (1975) with respect to relative probabilities of correct responses to various retrieval cues, indicating that kindergarten and second-grade children had similar implicit semantic structures. But the structure

was more completely filled in for second graders than for kindergarteners.

(8) Implicit, rather than explicit knowledge of hierarchic semantic organization, was related to higher levels of paradigmatic responding in the first word test when negation responses were categorized as paradigmatic. When negation responses were not so categorized, explicit, as well as implicit knowledge of hierarchic semantic organization, and metalinguistic knowledge, were related to higher levels of paradigmatic responding in the first word test. But explicit knowledge of word-word relationships was related to the ability to increase paradigmatic responding willfully, whether or not negation responses were categorized as paradigmatic.

(9) Implicit knowledge of hierarchic semantic organization was no better a predictor than age of ability to change paradigmatic and syntagmatic responding in the paradigmatic, syntagmatic and imagery tests, whether or not negation responses were categorized as paradigmatic. But explicit knowledge of word-word relationships was more important than age in determining paradigmatic responding in the paradigmatic test. This effect occurred whether or not negation responses were categorized as paradigmatic but did not extend to syntagmatic response changes in the syntagmatic or imagery tests.

(10) Contrary to expectation, neither metaknowledge nor either of its components (i.e., metalinguistic knowledge and explicit knowledge of imagery) was related to amount of change in syntagmatic and paradigmatic responding (whether or not negation responses were categorized as paradigmatic) in the syntagmatic, imagery and paradigmatic tests. The ability to understand that words and images are entities distinct

from their referents does not seem important in determining the voluntary manipulation of these cognitive entities in this context.

In the first word test alone, however, metalinguistic knowledge was a concomitant of high levels of paradigmatic responding when negation responses were not categorized as paradigmatic, even when the effect of age was controlled. When negation responses were categorized as paradigmatic, no effect of metaknowledge or either of its components was found.

(11) Kindergarteners were better able to recognize their paradigmatic (negation) responses than second graders or college students. This ability was not accompanied by higher levels of metaknowledge.

CHAPTER VI - DISCUSSION

Several hypotheses were advanced to account for the syntagmatic-paradigmatic word association shift. The central hypothesis was that the syntagmatic responses of young children are mediated by stimulus evoked images. Syntagmatic associations are later superseded by paradigmatic responses, mediated by hierarchic semantic organization structure. This structure was hypothesized to be present even in young syntagmatic responders, who do not use it to mediate associations mainly because they do not know they are supposed to. With exposure to a formal educational system, however, they explicitly learn hierarchic relationships among words and that paradigmatic responses, especially logical ones, are more valued by their culture. They then automatically exploit their hierarchic semantic structure for that purpose. But young paradigmatic responders are unable to willfully and consciously change their word association response patterns at first. It is only with the acquisition of metaknowledge, as well as explicit category knowledge that they can consciously change their word association responding to accord with task demands.

Before discussing these hypotheses, it is important to examine the similarity of the present study's findings and other studies of the syntagmatic-paradigmatic shift. The most glaring difference is that this study failed to find a developmental shift from syntagmatic to paradigmatic responding. On the first word test alone, miscellaneous responding decreased with age, a finding like Entwisle's (1966). Level of syntagmatic responding, however, did not decrease or, as Entwisle found, increase with age. But most importantly, Ss of all grades responded

with high levels of paradigmatic associations which did not differ statistically from one another, when negation responses were categorized as paradigmatic. When such responses were excluded from the paradigmatic category, a shift with age to paradigmatic responding was shown. Other investigators (e.g. Entwisle, 1966) also have considered negation responses to be paradigmatic, but nonetheless found developmental shifts in paradigmatic responding. The inability to find one in the present study when negations were categorized as paradigmatic may be due to the fact that more kindergarteners stereotypically produced them in this study than in others. This in turn may be explained by the fact that the kindergarteners in this study were gifted, selected for attendance at their school on the basis of an intelligence test and an interview, and had acquired the concept of "opposite" in the classroom. In fact, their teacher was drilling them on this concept during the period that they were acting as experimental subjects. Their classroom training simply may have transferred to the word association test situation. Hence, it is probably not misrepresenting matters to discount these responses as paradigmatic, especially since many of the associations (e.g. "unidea") are not acceptable words in English. Rather, they, like clang (rhyming) associations, are stereotyped responses, which the child can produce without even considering the stimulus meaning.

Imagery and Syntagmatic Responding

The central hypothesis concerning the relationship between stimulus-evoked imagery and syntagmatic responses was supported by three findings. First, high imagery words elicited significantly more syntagmatic responses over all grades, tests and parts of speech. Second, all

grades and not only second graders and college students produced more syntagmatic responses in the imagery test than in the first word test. Third, while high imagery words elicited more syntagmatic responses than low imagery words in all tests, this was especially true in the imagery test.

This indicates that imagery value has its greatest influence on word association responding in situations which emphasize its use. Together, these findings provide substantial indirect support for the hypothesis that syntagmatic responses are mediated by stimulus-evoked imagery. However, the strength of these findings is somewhat mitigated by two findings: First, while young children responded with more syntagmatic association to high imagery words than to low, the difference was not as great for them as for the older groups. Second, though high imagery words elicited more syntagmatic responses than low imagery words on the first word test alone the difference was not statistically significant. The first finding may be explained in either of two ways:

1) Young children may not differentially process high and low imagery words as do older children and adults; adult ratings of imagery values of the words may not correspond to the ease with which the same words evoke images in young children. High and low imagery words may induce either images (or syntactic factors) with the same facility in the young child, thereby eliciting syntagmatic responses to the same extent. This argument is mitigated by the fact that low imagery words elicited more miscellaneous responses than high imagery words for all tests and grades, including kindergartners.

2) Alternatively, adults' ratings of imagery values may hold true for children, but the mediation of word associations may occur differently for the two groups, so that imagery value may not play as great a role for younger as for older children. There is some evidence for this.

Negation and clang responses of very young children occur without consideration of the stimulus word's meaning. This in turn may have influenced the imagery effect in younger children by creating a basement effect: Since relatively few syntagmatic responses were made in the first word test alone by young children, there was less opportunity for high and low imagery words to differentially elicit syntagmatic responses. This appears to be a reasonable explanation of the fact that young children did not differentially respond to high and low imagery words to the same extent that older groups did.

The second finding may be explained by the fact that while the difference between high and low imagery words in the first word test was in the right direction, it would have to be greater than that for all tests combined, in order to obtain statistical significance. This is because differences between means in smaller data samples must be greater than that in larger samples in order to obtain statistical significance. That significance was not reached may be more a function of statistical testing conventions than indicative of real differences between the means in question.

Imagery and Logical Paradigmatic Responding

It was predicted that low imagery words would elicit more paradigmatic responses than high imagery words. This prediction was not confirmed. While low imagery words elicited blanks (no response at all) and other miscellaneous responses more often than high imagery words, high and low imagery words did not differentially elicit logical paradigmatic responses for any of the tests, whether or not negation responses were categorized as paradigmatic. Apparently the lack of a

readily available image does not foster the use of hierarchic semantic organization to mediate word association responding. Hence logical associations are not the only alternative response type in cases where imagery is not readily available for response mediation. Logical semantic structure is only one type of semantic organization available for mediation of word association. This is reasonable especially since logical and semantic structure generally have not been equated (e.g., Clark, 1972; Nelson, 1977).

Response Latencies

The prediction that imagery mediated associations (i.e., syntagmatic associations in the first word and imagery test) would have longer latencies than linguistically mediated associations (i.e., logical paradigmatic associations in all tests and syntagmatic associations in the syntagmatic test) received only partial support. All syntagmatic associations, including linguistically mediated ones in the syntagmatic test, as well as imagery mediated ones in the first word and imagery tests, had longer latencies than the linguistically-mediated logical paradigmatic ones. Further, all first word responses, including syntagmatic ones, (presumed to be imagery-mediated) were produced more quickly than all other responses, including syntagmatic ones in the imagery test (also presumed to be imagery-mediated). Thus, all responses respectively presumed to be linguistically and imagery mediated, were not generated with the same speed, and linguistically mediated responses were not consistently slower than imagery mediated responses.

These findings can be interpreted in two ways: 1) by refuting the assumption concerning the mediators of the associations (i.e., that

the syntagmatic associations in the first word and imagery tests on the one hand, and syntagmatic associations in the syntagmatic test and logical paradigmatic ones in all tests on the other, are really respectively mediated by imagery and linguistic factors) or 2) by accepting these assumptions at face value and refuting the hypotheses concerning the time it takes for these mediators to function under certain conditions. Since there is substantial evidence supporting the contention that high imagery and syntagmatic associations are correlated, there is no foundation for questioning this assumption. There is also no reason to question the assumption that logical responses, which reflect hierarchic semantic relationships among words, are mediated by that linguistic factor. Further, syntagmatic associations in the syntagmatic test also seem to be produced by the linguistic factor, sentence-production-principles. Second graders were often observed to make up an entire sentence incorporating the stimulus word before they gave the response word which preceded or followed the stimulus in the sentence. College students were more proficient, and provided responses which together with the stimulus formed a common phrase (e.g. car-coat). Kindergarteners were least able to follow this test instruction, changing their pattern of responding least of all. But for the two older groups, at least sentence-production principles do seem to be at work.

Thus, the second interpretation seems more reasonable. Hence, the linguistic factor of sentence production mediates word associations more slowly than that of hierarchic semantic organization. This is consistent with Moran Mefferd and Kimble (1964) who found that contrast responses, a type of logical response, were faster than various types of syntagmatic responses. Thus, while both semantic organization and

sentence production principles may be linguistic factors, they are not invoked with the same temporal efficiency.

Further, syntagmatic responses in the first word test occurred much more quickly than those in the imagery test, though both appear to be mediated by imagery. But all responses in the first word test occurred more quickly than in any other test. Introducing any of the special instructions into the word association process slowed the process down. Hence, the disparity in these response latencies is not sufficient grounds to disclaim the assumption that first word and imagery syntagmatic association of all subjects are in fact imagery mediated. It is simply that asking Ss to deliberately produce images in response to verbal stimuli slows down the process of responding.

Related to this is the developmental finding that college students responded more quickly than both second graders and kindergarteners in the first word test. But in the paradigmatic, imagery and especially syntagmatic tests, second graders were much more slow to respond than either kindergarteners or college students, who responded equally quickly. These results may be considered in the light of the fact that kindergarteners were least likely to change their level of responding over the various tests, while college students and second graders changed to about the same extent. Yet second graders responded more slowly and kindergarteners responded just as quickly as college students. This may indicate that college students were so adept at the word games they were asked to play in this experiment that they were not slowed down by special instructions. Kindergarteners were not slowed down either, but neither did they comply with the instructions. Second graders complied

to about the same extent as college students, but they did so only by considerably slowing down their rate of response. It appears then that they can change their word association response pattern to accord with task demands only through much deliberate effort, as manifested by slower response times.

GENERAL DISCUSSION

As has already been discussed, the shift with age to paradigmatic responding occurred only when negation associations were not categorized as paradigmatic. Although negation responses were generated on the basis of an essentially paradigmatic principle, they can justifiably be discarded as paradigmatic since many children produced them automatically, without consideration of the meaning of the stimulus word, and thereby generated many responses that are not accepted words in English. When these responses were discarded, it appeared that (a) explicit knowledge of word-word relationships, and (b) metalinguistic knowledge as well as (c) a filled-in hierarchic semantic organization determined the greater spontaneous production of paradigmatic responses. Hence, spontaneous production of paradigmatic responses (other than negation responses) in a word association task requires self-conscious awareness of both what words are and what the semantic relationships among words are, as well as filled-in tacit knowledge of hierarchic semantic organization (which presumably mediates the production of such responses). Further, children and adults who have this knowledge and produce these paradigmatic responses, do so without self-conscious awareness.

Production of negation responses required none of the cognitive abilities that other paradigmatic responses did. Yet these responses were

deliberately produced. In other words, children who produced negation responses performed in a manner which seemed to require conscious recognition of the nature of the cognitive items involved and yet did not have what would appear to be the cognitive prerequisites of that recognition. Apparently all that is required to produce negation responses is knowledge of a "negation" rule; process the phonological content of the stimulus word and apply the prefix "not" or "un" to it for a response. This rule is learned in the classroom and can be used to generate the negated associations in a deliberate manner, with limited metalinguistic skill since only word sound, and not word meaning is considered.

These results support two basic assumptions of this study. First, that in order to respond paradigmatically, the subject must gain awareness of those responses through education, as manifested by explicit articulation of hierarchic relationships. This was shown by the finding that a higher level of paradigmatic responding in the first word test required higher levels of explicit knowledge of hierarchic semantic relationships among words. Second, that the word association test has subtle task demands which the subject must grasp in order to respond appropriately, i.e. paradigmatically. This was shown by the fact that metalinguistic knowledge also determined paradigmatic responding in the first word test. This suggests that explicit category knowledge alone is insufficient for its implementation in the word association task. Rather, it appears that hierarchic semantic organization must be accessed by a somewhat higher level cognitive mechanism than imagery or sentence production or negation principles in order to mediate word association, since its spontaneous use seems to depend on the understanding that words

are arbitrary linguistic units. This implies that task demands, which call for the production of paradigmatic responses are understood.

The finding that the shift to higher levels of paradigmatic responding was accompanied by more completely filled-in hierarchic semantic organization was not predicted, however. But this is not at all surprising in light of the fact that hierarchic semantic organization becomes completely filled-in with age, a result which was not predicted by other investigations (e.g., Steinberg & Anderson, 1975; Mansfield, 1977).

Neither metalinguistic knowledge, nor explicit knowledge of imagery was important in determining the change in paradigmatic and syntagmatic responding in the paradigmatic, syntagmatic and imagery tests. In fact, explicit knowledge of hierarchic semantic organization was the only cognitive variable that was more important than age in determining compliance with test instructions, and that only in increasing paradigmatic responding in the paradigmatic test. Age and implicit hierarchic semantic organization were equally good predictors of such responding. At first glance these results seem rather inconsistent with the finding that metalinguistic knowledge was more important than age in determining the developmental shift to paradigmatic responding in the first word test. But distinguishing between the two types of paradigmatic shifts under question from a somewhat different perspective may help to shed light on these seemingly incongruent results.

The amount of paradigmatic responding in the first word test is determined by the subject. It is not directly influenced by external directive. The amount of paradigmatic responding in the paradigmatic test, on the other hand, obviously is influenced by external directive;

the test instructions. Metalinguistic knowledge may be related only to the first of these, in tasks in which the subject is required to spontaneously produce linguistic items. Indeed, Gerschitz & Glick (1975) found that metalinguistic knowledge was related to the child's propensity to spontaneously produce words (color labels) which were to be used as mnemonic devices to aid their performance on a color recognition task. But it was related to the efficiency with which those words mediated recognition, even if they were produced upon experimenter's insistence. Similarly, metalinguistic knowledge appears to be related to the child's propensity to spontaneously produce paradigmatic responses via hierarchic semantic organization in the first word test. But it is not related to the extent to which hierarchic semantic organization successfully mediates associative responding when the subject is expressly directed to use it. In other words, if a child is told to produce associations based on category relationships she does so, so long as she has a higher level of explicit knowledge of the semantic relationships underlying those responses. Metalinguistic knowledge, important to the spontaneous production of paradigmatic responses, becomes irrelevant in this situation since its role is superseded by the external instructions.

None of the cognitive abilities assessed in this study were related to change in syntagmatic responding in the syntagmatic and imagery tests.

This is probably because other skills which are more closely related to the specific task demands of each test are better predictors of performance on them. For example, the ability to understand exactly what a sentence and its parts are is probably important in determining performance on the syntagmatic test. Similarly, some factor other than

explicit knowledge of imagery must be more closely related to the ability to control cognitive processes so as to generate images in response to verbal stimuli.

These results suggest many further avenues of research, particularly one investigating the role of cognitive variables in language behaviors. The conjectures concerning metalinguistic knowledge can be studied more directly by comparing its influence on tasks analyzed in advance to differ in terms of the spontaneous vs. externally directed use of linguistic symbolic mediators. This may have ramifications for a developmental information processing model of cognition in which changes in executive functioning can be traced through changes in awareness of various cognitive processes and items.

In sum, there appears to be a developmental progression in the way children approach the word association task. First, very young children seem to produce responses based only on the phonological form of the word; i.e., they produce clang responses, which rhyme with the stimulus, or negated responses, generated through an " negation " rule which consisting of prefixing "not" or "un" to the phonological form of the stimulus word to produce a response. Later, children begin to consider the meaning of the stimulus word. At the start, this may be confined to considering the imagery which the stimulus word evokes. Evidence indicates that stimulus imagery mediates the generation of syntagmatic associations. Gradually, as tacitly known hierarchic semantic organization becomes more filled-in, and the child gains explicit access to it, it is possible for her to produce paradigmatic responses. But in order to do so spontaneously, she must also understand that words are arbitrary, manipulable units. On the other hand, if she is explicitly directed to produce

paradigmatic responses, she will be able to do so, as long as she has explicit access to a filled-in hierarchic semantic structure. Metalinguistic knowledge does not play a role in this case since the explicit directions replace its function as an aid to the spontaneous production of paradigmatic responses.

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Appendix A

Stimuli for Word Association Tests

High Imagery Words

Word	Imagery Value [3]	Concreteness [3]	Meaningfulness [4]	Rinsland Frequency [5]
Nouns:[1]				
1. apple	6.73	7.00	7.67	1a3
2. baby	6.70	6.90	7.04	1a1
3. bird	6.67	6.96	7.88	1a3
4. book	6.43	6.96	7.68	1a2
5. car	6.87	7.00	6.38	1a2
6. dress	6.53	6.93	5.68	1a2
7. picture	6.20	6.75	7.16	1a3
8. table	6.50	7.00	7.60	1a3
$\bar{X}$	6.57	7.06	7.13	
Verbs:[2]				
9. to eat	4.91	no ratings	no ratings	1a2
10. to fly	6.4*	"	"	1a4
11. to jump	4.66	"	"	1a4
12. to laugh	6.4*	"	"	1b4
13. to sit	4.56	"	"	1a4
14. to skate	5.9*	"	"	1b4
15. to sleep	5.34	"	"	1a3
16. to swim	6.0*	"	"	1b1
$\bar{X}$	5.48			
Adjectives:[2]				
17. beautiful	5.38	"	"	1b5
18. cold	4.78	"	"	1a2
19. dark	5.63	"	"	1b3
20. red	6.00	"	"	1a1
21. sick	5.10	"	"	1a4
22. soft	4.81	"	"	2a
23. sweet	4.72	"	"	1b2
24. young	5.31	"	"	1a2
$\bar{X}$	5.2			

Low Imagery Words

Nouns:[1]				
25. chance	2.50	1.51	5.61	2a
26. idea	2.20	1.42	4.88	1b5
27. life	4.07	2.96	6.78	2b
28. month	4.37	3.20	4.58	1b5
29. secret**		2.86	6.90	2a
30. time	4.13	2.47	7.00	1a1
31. truth	2.73	1.69	4.78	2a
32. year	3.4*	no ratings	no ratings	1a5
$\bar{X}$	3.34	2.30	5.79	

Appendix A Continued

Verbs: [2]				
33. to ask	4.6*	no ratings	no ratings	1b1
34. to begin	3.9*	"	"	2a
35. to find	2.81	"	"	1a3
36. to happen	4.4*	no ratings	no ratings	1
37. to have	1.61	"	"	1a1
38. to hope	3.83***	1.18	5.52	1a5
39. to promise	2.72	no ratings	no ratings	2b
40. to remember	4.5*	"	"	1b1
$\bar{X}$	3.55			
Adjectives: [2]				
41. good	3.13	no ratings	no ratings	1a1
42. great	3.69	"	"	1b1
43. nice	2.78	"	"	1a2
44. proud	4.31	"	"	2b
45. rich	4.53	"	"	2b
46. safe	3.7*	"	"	3a
47. small	3.88	"	"	2a
48. wonderful	3.81	"	"	3b
$\bar{X}$				

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* rating obtained through author's own sample
** rating obtained from Spreen & Shulz (1966)
*** ratings based on those for 'hope'.

1. Norms for high and low imagery nouns obtained from Paivio, Yuille, & Madigan (1968), with indicated exceptions.

2. Norms for high and low imagery verbs and adjectives obtained from Paivio, A. Unpublished norms, U. of Western Ontario, London, Canada.

3. These values are based on the mean ratings of an adult sample who scored each item on a scale from 1 (low) to 7 (high) on the extent to which the item a) evoked an image and b) referred to a sensed experience.

4. Meaningfulness scores were based on mean number of adults' free associations to each item within a 30 second period.

5. The Rinsland frequencies of vocabulary words of first-eight grade children are based on 4630 pages of conversation and 100,212 written compositions. All words used in this list, with the exception of "to happen" are of very high frequency in the vocabulary of first graders, the youngest children investigated by Rinsland (1945).

Appendix B

Stimuli for Test of Hierarchic Semantic Organization

Category	Retrieval Cues (Critical Items)				
	Target Picture	Close Cohyponym	Remote Cohyponym	Close Superordinate	Remote Superordinate
Vehicles	car*	bus	airplane	something that goes on the road.	something that takes you some-place.
Food	apple*	banana	hot dog	fruit	food
Clothes	dress	skirt	pants	something that only girls can wear	clothes
Furniture	table	chair	bed	kitchen furniture	furniture
			(Pratice Items)		
Buildings	house	apartment house	barn	a building you live in	buildings
Writing	pencil	pen	paint brush	something you write with.	something you can draw with.

*These items were used by Steinberg & Anderson. 1975.

Appendix C

Stimuli for Word-Word Relationship Task

	Superordinate	Logical Coordinage	Contrast	Synonym
Noun	dress - clothing	apple-orange	life-death	baby-infant
Verb	to have lunch-to eat	to run to jump	to laugh-to cry	to begin-to start
Adjective	red-colored	red-green	rich-poor	beautiful-pretty