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AUTHOR Horvitz, James Mark
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ABSTRACT

This study was designed to assess whether negative transfer in children's paired-associate learning could be reduced by changing the levels of meaning at which stimuli were encoded on the two lists. It was hypothesized that changes in meaning levels from a first to a second list would result in less interference than conditions where stimuli remained at constant levels of meaning over lists. Another facet of the study was designed to test the encoding variability hypothesis with children, which suggested that less meaningful stimuli would be subject to less interference. Three separate experiments were conducted as part of this study. The hypotheses were not confirmed by the experiments. The results were discussed in terms of possible characteristics of the learners and the stimuli that may have contributed to the nonsignificant findings. Fourth graders may have been labeling stimuli spontaneously, and the stimuli may not have retained the same level of meaning after repeated trials. (Author/RB)

Technical Report No. 313

TRANSFER IN CHILDREN'S PAIRED-ASSOCIATE LEARNING AS A FUNCTION OF LEVELS OF MEANING

Report from the Project on
Children's Learning and Development

by James Mark Horvitz

Joel R. Levin
Principal Investigator

Wisconsin Research and Development
Center for Cognitive Learning
The University of Wisconsin
Madison, Wisconsin

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J.M.H.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

ABSTRACT

The study was designed to assess whether negative transfer in children's paired-associate learning could be reduced by changing the levels of meaning at which stimuli were encoded on the two lists. Stimuli and instructions were specifically designed to approximate three levels of meaning postulated by Paivio (representational, referential, and associative). It was hypothesized that changes in meaning levels from first to second list would result in less interference than conditions where stimuli remained at constant levels of meaning over lists. Another facet of the study was designed to test the encoding variability hypothesis with children, which suggested that less meaningful stimuli would be subject to less interference.

Three separate experiments were conducted. Experiment I contained four conditions, defined by the presence or absence of labels provided by E to abstract line drawings on first and/or second lists. Conditions were Label-Label, Label-No Label, No Label-Label, and No Label-No Label. Fourth graders learned a paired-associate list to criterion, and then transferred to a second list mixed with half C-D and half A-Br items. Experiment II was a replication of the first experiment with second graders. Experiment III was conducted with fourth graders who received labels or sentence contexts to paired-associate pictures. Conditions were Label-Label, Label-Sentence, and Sentence-Sentence. First-list learning was assessed via trials to criterion. After reaching criterion Ss were transferred to a second list containing all first-list items re-paired (A-Br), and an equal number of new pairs (C-D).

The hypotheses were not confirmed by any of the three experiments. No significant differences were found in degree of negative transfer as a function of meaning levels changing or remaining constant over lists, at either grade level. Results were discussed in terms of possible characteristics of the learners and the stimuli that may have contributed to the nonsignificant findings. Fourth graders may have been labeling stimuli spontaneously, and the stimuli may not have retained the same level of meaning after repeated trials. Sentences were powerful facilitators of overall recall, as expected.

Chapter I

INTRODUCTION AND REVIEW OF THE LITERATURE

The research literature in recent years has burgeoned with studies comparing the relative efficacy of verbal and visual processes in learning. Perhaps the most extensive review of this literature can be found in Paivio (1971). Not only has extensive attention been given to controlling the modality of to-be-learned materials (e.g., pictures vs. words) but also to the types of strategies employed by the learner to facilitate encoding and retrieval (e.g., imagery or sentential elaboration). From this enormous accumulation of research findings many hypotheses have emerged about developmental aspects of visual and verbal elaboration strategies (Levin, 1972; Reese, 1970; Rohwer, 1970) and their interaction with modality of stimulus materials. Perhaps the most widely documented of these developmental postulates is that imagery becomes more effective with increasing age.

In the Psychological Bulletin (1970) paper alluded to above, Reese (1970), the trend toward the study of imagery was emerging. Paivio's (1969) article in Psychological Review brought together the work that had been emanating from his laboratory, but concerned itself largely with the cognitive behavior of college sophomores. Bugelski (1970) brought the subject into focus in the American Psychologist. However, the Reese symposium signaled the appearance of imagery into the study of child development, and inevitably into the study of language behavior;

Since that time developmental research concerned with the dual process of verbal and imaginal channels in children's learning has been a popular pursuit. Much theoretical discussion has centered around the respective parts that each of these processes play in the storage and retrieval of information, yet most theoretical formulations still result in some kind of interaction between the two processes as being responsible for learning.

For instance, Rohwer (1970) has posited the importance of Ss supplying a verbal tag to paired-associate (PA) pictures. In this case, pictures represent imagery-encoded materials, but a simultaneous verbal tag attached to the pictures is thought to account for the developmental trend for imagery to be more highly effective with increasing age. Paivio's "conceptual peg" hypothesis, that the image serves as a peg for storage and retrieval of verbal items, is another example of postulated interplay between verbal and imaginal processes. Documented research demonstrates that verbal elaboration facilitates the learning of noun pairs (Rohwer, 1967), and that imagery instructions facilitate the learning of noun pairs (Paivio, 1969). Also, proposed schemes have included transformations from verbal to visual and back in the encoding-decoding process (Levin, 1972), which clearly proves that verbal and imaginal processes are thought to both be involved to some degree in the cognitive behavior of most humans.

Thus, it is no surprise that the exact relationship between verbal and imaginal encodings in children's learning has proved to be a very difficult problem to tackle (e.g., Davidson, 1972). Although Paivio (1971) has presented a strong case for a dual-coding model of information processing, involving distinct systems of imagery (i.e., the symbolic representation of concrete stimuli and parallel processing in a spatial sense) and verbal systems (predominantly dealing with abstract information, and characterized by sequential or serial processing), the precise manner in which these systems interact at various ages continues to elude researchers. Of crucial importance to such a study, and also a major obstacle, is the fact that any distinctions between imaginal and verbal mechanisms in learning and memory are based on inferential, rather than directly observable, data. For this reason choice of experimental paradigms is important.

However, another way of conceptualizing verbal and visual domains in learning is to think of both processes as contributing to <u>meaning</u>. Davidson (1972), for instance, suggests that when a visual image is functional, it is <u>always</u> tied to some other symbolic system. Semantics or meaning can be interpreted in terms of a deep structure of language, and the visual image could be conceived of as one surface structure transformation from that deep structure. Both the image and the internal verbalization (another kind of surface transformation) would be generated from one abstract deep structure. From this point of view, then, meaning becomes the focal point of learning facilitation.

A brief synopsis of the concept of "meaning" as it relates to verbal learning research will be now considered.

Any attempt to deal with the mental representation of a symbol must take into account the meaning state aroused by the symbol, i.e., the capacity of symbols to consistently arouse covert and overt reactions of various kinds (Paivio, 1971). Information processing (Neisser, 1967), mediation (Flavell, 1970; Kendler and Kendler, 1962), elaboration (Rohwer, 1967) are all concerned with the various processes, states, and transformations, either overt or covert, that incoming stimulus information undergoes in either short-term or long-term memory storage. A general assumption in contemporary psychology is that stimuli that elicit higher levels of meaning, i.e., those that arouse the most active mediational processes, leave the strongest memory traces (as measured by subsequent recall). The transformations that stimuli undergo can, among other things, be in the form of verbal or imaginal representations, or both. In fact, a large body of recent literature supports this contention that both imaginal mediation (Paivio, 1969) and verbal elaboration (Rohwer, 1967) can substantially increase recall of PA stimuli (words, pictures, even nonsense syllables). Moreover, the effects have been observed in both sophisticated subjects who spontaneously mediate, in less mature subjects with elaboration provided by the experimenter, or with instructions given by the experimenter to mediate, and have taken the form of both overt and covert processes (see Levin, in press). Moreover, a substantial literature exists in regard to the developmental aspects of mediational processes, attempts both at delineating ages at which mediators can be produced and/or used by children (Flavell, 1970; Jensen and Rohwer, 1965) and at determining over various age ranges the relative effectiveness of verbal and imaginal mediators respectively (Levin, 1972; Paivio, 1971; Reese, 1970; Rohwer, 1970).

Thus, two variables that may affect the degree of coding that takes place are the nature of the stimuli to be learned, and the cognitive sophistication of the learner. Both of these variables determine the kind and amount of mediation that will take place in a given learning act.

Considering the nature of the stimuli first, psychological researchers over the years have worked at hierarchically arranging word and nonsense syllable stimuli along various dimensions of meaning, as measured by association (Noble, 1952), imagery-concreteness (Paivio and Madigan, 1968), semantics (Osgood, Suci, Tannenbaum, 1957). Norms gathered on such dimensions have provided the material for scores of controlled laboratory experiments. Paivio (1971) has recently postulated three levels of stimulus meaning, a system that can be conceptualized in both verbal and visual modalities in a parallel manner.

The representational level of meaning corresponds to "knowing" the stimulus itself without the occurrence of any associative chains. In the verbal domain, a word may be emitted but lacking in any higher order meaning. Visually, a stimulus configuration may be seen or perceived at the lowest level without the elicitation of any verbal label or referent. The verbal domain is assumed to be auditory-motor in nature and thus more directly aroused when the stimulus word is auditory.

The referential level constitutes the development of interconnections between imaginal and verbal representational processes and is seen in the ability to label or name objects or pictures, or to establish an imaginal representation of a verbal stimulus (drawing would be one behavioral indicator). Paivio assumed that at this level of meaning implicit labeling responses (to objects) and evoked mental images (to names of referent objects) are present. Furthermore, the referential network may be symmetrical or assymetrical such that verbal and imaginal referential reactions may or may not be equally available. The relative availability of referents in opposite domains has implications for performance in paired-associate tasks involving verbal and pictorial stimuli (Paivio, 1971).

The highest level of meaning proposed by Paivio is the level of associative meaning. Whereas the referential process involves associations that are close to the referent, in the present level the associative process extends to conceptual categorizations involving different referents. It is assumed that at this level the stimulus can run off a long chain of associations which may be entirely verbal, entirely imaginal, or cross over both domains. The nature of the associative chain would depend largely on previous experience and it is particularly difficult to partial out the verbal and visual components in any associative reaction at this level. Two assumptions that Paivio adheres to are that structures at this level of meaning are associative, and that they may be hierarchically organized such that each stimulus is a component of a subset (e.g., nose is part of face) and not a random association.

Paivio's model appears to hold promise as a method whereby an experimental stimulus may be controlled for "meaning" by virtue of the nature of its associative network. For instance, nonsense forms, perceived visually, which offer little opportunity for referential labeling (inasmuch as the stimulus would be dissimilar to anything the subject had ever seen before or incorporated as part of his referential vocabulary) could be controlled at Paivio's first (representational) level. On the other hand a picture of a cat would likely be perceived at the referential or associative level depending on the cognitive sophistication of the viewer.

Labeling Research

The Paivio model of levels of meaning suggests that the provision of a label to a picture, either S-generated (overtly or covertly), or

E-supplied, will render the stimulus meaningful at the referential level. The assumption is that for a young child who does not spontaneously label a picture, the picture will be at the representational level. Along the same line of thinking, it would follow that sentence or imaginal mediation, again either supplied by E or S, that has the effect of connecting paired-associate stimuli via interactive or dynamic representations, would qualify such stimuli at the associative level of meaning. Thus, according to this kind of formulation, experimental variables can be used to manipulate materials along the three levels of meaning, and extant studies in the literature can be reviewed in such a manner. Following is a review of some of the research on labeling as a mediator.

A significant body of literature has evolved around developmental aspects of labeling stimuli. Reese (1962) posited that labels act as mediators between stimuli and overt responding, but that in young children these labels are ineffective in actually providing the linkage. Reese's theory, dubbed the mediation deficiency hypothesis, holds that potential mediators are present, but that young children cannot make appropriate use of them. However, Flavell and his associates have taken issue with the mediation deficiency hypothesis and concluded that a production deficiency really accounts for the data. This theory maintains that young children do not make use of mediational strategies because they do not spontaneously produce mediators by themselves, and Flavell has distinguished between a "mediational deficiency" and a "production deficiency" on such a basis.

In a similar manner, Kendler (1972) distinguished between "production deficiency" and "control deficiency," the latter being analogous to Reese's "mediational deficiency."

Flavell, Beach, and Chinsky (1966), using kindergarten, second, and fifth grade youngsters, found that although all youngsters in the study could label the picture materials used, almost none of the kindergarten children overtly verbalized or rehearsed the names while attempting to order sets of objects. This was in sharp contrast to the older subjects, whose verbalizations were many. This study supported the existence of a verbal production deficiency in young children which could be reflective of immature language development, or intellectual development (lack of systematic plan or cognitive strategy).

Keeney, Cannizzo, and Flavell (1967) utilized a similar task with six and seven year old first graders. Children who spontaneously rehearsed (producers) recalled significantly more items than non-rehearsers (non-producers). In addition, when non-producers were trained to rehearse, their recall increased to the level of the spontaneous rehearsers. However, when these same Ss were no longer instructed to rehearse verbally, they ceased to use the strategy. This study is indicative of the notion that production-deficient Ss are not necessarily mediation-deficient.

Hagen and Kingsley (1968) gave youngsters aged 5, 6, 7, 8, and 10 a serial recall task comparing effects of overt labeling of animal pictures with no-label controls. Significant labeling effects were found at ages 6 and 8, with a non-significant effect at age 7. However, no effects were obtained for the 10-year-olds (explained on the basis that such Ss would label spontaneously) and for the 5-year-olds (the latter finding being supportive of the mediational deficiency hypotheses).

However, another study by Bernbach (1967) did find labeling facilitative for 5-year-olds, using hard-to-name colors as stimuli, and Bush and Cohen (1970) demonstrated that labeling improves retention even for 4-year-olds. It is evident then, that task variables may interact with labeling to account for the latter's usefulness.

A later study by Kingsley and Hagen (1969) concluded that 5-year-olds induced to verbally rehearse labels to nonsense pictures (labels provided by E) recalled more than Ss told to label covertly, and more than overt labelers not told to rehearse. Covert labelers did no better than controls, suggesting that mere possession of labels does not facilitate recall performance, or that 5-year-olds cannot use covert language. Hagen, Hargrave, and Ross (1973) demonstrated a production deficiency in 6- and 7-year-olds, using a serial picture recall task. Rehearsal facilitated recall of pictures only when Ss were prompted by E. Simple instructions to verbally rehearse were not sufficient. These studies clearly demonstrate the facilitative gains to be made by verbal rehearsal, using labels, but which young children do not spontaneously employ without explicit direction to do so. There is little question that when these children actually engage in such mediation, their ability to recall picture items increases.

Silverman and Craig (1969) observed that kindergarten children made use of mediation in a motor task, if they were required to verbalize the mediators during training. However, second graders utilized the mediation without explicit instruction to do so. Daehler, Horowitz, Wynns, and Flavell (1969) inspected the use of verbal or gestural rehearsal to recall sequences of flashing colored lights. As in previous findings, spontaneous verbal rehearsal was positively related to age, and increased recall significantly when used.3 Moely, Olson, Hawles, and Flavell (1969) suggested that the verbalization of stimulus names occurs spontaneously at early ages, even before kindergarten. However, verbal rehearsal is infrequent ~~prior to~~ grades 1 and 2. Higher order mediational strategies, such as clustering or categorizing of items, are infrequent before grade 5. Developmentally, then, what is important is the transition from non-production to production (of mediators). It seems that in the case of verbal labeling, recall is increased if Ss produce them.

It might be that the production of verbal labels to mediate stimulus recall, as cited in the studies above, has the effect of providing the materials with referential meaning. However, this assertion would be true especially, or perhaps only, if the materials are initially ambiguous or meaningless. With young children, although labels are available, they are not used spontaneously in item rehearsal. If rehearsal is induced, a higher level of meaning might ensue. Similarly, with older children, unfamiliar line drawings can most likely take on referential meaning if a common verbal label is attached to them.

Robinson and London (1971) found that second and third graders could learn uncodable line drawings best when supplied with appropriate names by E. This performance was found superior to Ss with names generated by themselves, or those instructed to imagine visually the stimulus configuration. Indications were then that appropriate labels enabled more stimuli to be encoded, and that E-provided labels can be used even if they disagree with S's labels. Similarly, Robinson (1970) found that availability of names for uncodable pictures aided Ss in remembering them.

The research generally shows that verbal labels aid in the recall or recognition of pictures, even for youngsters as young as nursery school age. As the production deficiency literature points out, children prior to first or second grade need to be strongly encouraged to use such labels as mediators in order for such utilization to occur. Similarly, labels given to ambiguous stimuli, in the case of second and third grade children, produce higher rates of stimulus recall. The assumption is that materials are made more meaningful by provision of labels.

Sentence Research

If labels supply referential meaning to visually perceived items, it seems that Paivio's model of levels of meaning would include sentence mediation under the associative level. At least in the realm of paired-associate learning, the paradigm to be considered here, where learning is considered dependent on the degree of stable associations within pairs (Levin, 1972), sentential elaboration provides a context that includes more than simple referents. For instance, in "The cow jumps over the fence," where "cow" and "fence" are the to-be-associated items, it is presumed that the dynamic process of "jumping" is included in the S's conceptualization. Paivio's formulation allows for the arousal of both verbal and imaginal associations, and it is assumed that the above sentence might spark off any number of such associations, depending on S's experience. As mentioned earlier, it is difficult to tease out the verbal and visual components of such associations, but the combination fits into Paivio's associative level of meaning. Memory traces are assumed to be stronger than those elicited in lower levels of meaning, and subsequent recall is assumed to be higher.

The sentence elaboration effect in paired-associate learning (Rohwer, 1967) is well-documented and need not be explained in great detail here. Investigations have been made using induced sentence elaboration strategies (_Ss_ instructed to generate a sentence to link the pairs) and imposed strategies (sentences uttered by _E_), and developmental comparisons have been made. In the "induced" category, a parallel to Flavell's production deficiency has been discovered. That is, Jensen and Rohwer (1965) found that kindergarten children are unable to generate sentences, but rather utter conjunctive phrases (the cow and the fence), and their recall performance has been equal to controls. It should be noted, however, that the long-accepted Jensen and Rohwer finding has recently been questioned, and that perhaps motivational variables can account for the kindergarten performance (McCabe, Levin, and Wolff, 1973). On the other hand, older children benefitted tremendously from their contrived sentences. In the "imposed" domain, Rohwer and his associates (e.g., 1967) have not only demonstrated the superior recall brought about by sentence contexts, but have established that action verb contexts are better than prepositional phrases. It has been also concluded that kindergarten children can utilize imposed sentences.

The resounding conclusion from the above research is that sentence elaboration makes paired-associate materials a great deal more meaningful to the learner. A study by Holyoak, Hogeterp, and Yuille (1972) further demonstrated the semantic benefit that accrues from sentence elaboration. They analyzed the errors made by their sentence and control groups and found a significantly higher proportion of "semantic errors" (errors semantically related to correct responses) in the elaboration groups. This suggests that pairs are stored in a meaningful way, and that on test trials the mediator is recalled, its meaning being the criterion used in evoking a response.

Transfer Research

One experimental method by which researchers can learn more about how subjects encode information verbally and visually is by creating a situation where interference occurs. Verbal learning research has long used transfer paradigms where subjects first learn one list to criterion, followed by another list, in order to assess various theoretical issues involved in memory and forgetting. Underwood and Postman have been the pioneers in this area, and Postman's review in Kling and Rigg's <u>Handbook of Experimental Psychology</u> (1971) gives comprehensive coverage to the research on interference. What is immediately noticeable is the absence of studies with children (Keppel, 1964), although the transfer paradigm holds much promise for the elucidation of data concerning learning processes in children (Goulet, 1968; Jeffrey, 1970). One way in which the meaningfulness of learning, as discussed earlier, can be studied is through such a transfer paradigm. By manipulating levels of meaning over lists via labeling and/or sentential elaboration, and then investigating amounts of interference, it might be possible to see how meaning relates to encoding.

Traditional transfer paradigms have most often utilized the A-B, A-D (experimental) and A-B, C-D (control) method, where A-B represents first list stimulus and response items respectively in a paired-associate task, A-D represents second list items comprising first list <u>stimuli</u> but new responses, and C-D represents second list items consisting of independent stimuli and responses. Almost universally, second list learning of C-D has been superior to A-D, and this difference is what is commonly known as retroactive inhibition. In this classical interference paradigm forward associations are thought to be the source of the interference. Indications are that the amount of negative transfer may be a function of meaningfulness (as defined by Noble, 1953) because of the development of associations that interfere effectively with second list learning (Goulet, 1965; Jung, 1963).

Another interference paradigm, less commonly used, is A-B, C-B where response terms are constant over lists. Response learning is facilitating in this paradigm, while interference is considered the result of backward associations (Postman, 1971).

However, yet another paradigm, A-B, A-Br, combines the negative interference features of A-B, A-D, and A-B, C-B (forward and backward associations as well as list differentiation). Second list items consist entirely of first list stimuli and responses, but with new pairings of stimulus-response. This condition has consistently been shown to cause even more negative interference than A-D (Besch and Reynolds, 1958; Jung, 1962; Kausler and Kanoti, 1963; Porter and Duncan, 1953; Postman, 1962; and Twedt and Underwood, 1959). Price, Cobb, and Morin (1968) extended this finding in one of the rare cases of such a paradigm used with children. The A-B, A-Br transfer paradigm, according to research available, should be the most interfering of the methods, and would be suitable for usage in a task where interference is desired.

As Jeffrey (1970) points out, little child research has been done with classical transfer paradigms. Spiker (1960) had fifth and sixth grade Ss learn an A-B list followed by a second list of half C-D and half A-C items (equivalent to A-D), and the usual interference effects were found. Boat and Clifton (1968) demonstrated negative interference with 4-year-old children by using a three-stage mediation paradigm. This is an imposed paradigm where A-B, B-C, A-C is compared to A-B, D-C, and A-C controls, and the interference takes place on the second list B-C relative to D-C. However, facilitation occurred on the A-C third list relative to D-C (as it should), showing that imposed mediation can help such young children.

Several studies have, however, utilized a transfer paradigm with children in order to look at verbal discrimination learning (e.g., Blank and Altman, 1968; Goulet and Sterns, 1969; Rowe, 1972). Hall (1969) presented kindergarten and second grade children paired-associate lists either aurally or visually, and used an A-B, A-C design. The common negative interference effect was obtained for both age groups. Kirk and Johnson (1972) investigated negative transfer as a function of children's I.Q., and with an A-B, A-C paradigm found the interference to be greater with retarded children.

A series of experiments by Davidson and his associates has specifically utilized transfer paradigms in order to study relationships between imaginal and verbal encodings in children's learning. Studies by Davidson, Schwenn, and Adams (1970) and Schwenn and Davidson (1969) suggested the powerful facilitating effect sentence contexts may have for paired-associate transfer. Negative transfer of A-C was substantially reduced, and the effect was attributed to the resulting differentiation in first- and second-list learning.

Furthermore, Davidson, Schwenn, and Adams (1970) and Davidson (1972) attempted to change the meaning of stimulus (A) terms over lists by manipulating the sentence context, or by changing the pictorial representation to signal a different meaning for the term across lists. For example, the stimulus term "bat" might be rendered as a baseball bat and a flying mammal in sentences or pictures over lists. Theoretically, such a manipulation was thought to render an A-B, A-D item functionally A-B, C-D because of the supposed change in the meaning of the "A" term. Contrary to expectations, the transformation produced marked negative transfer. Davidson and Levin (1973), however, induced Ss to encode items visually via imagery instructions without verbalizations, on the assumption that accompanying identical verbal tags (e.g., "bat") had caused the negative transfer in previous experiments. They obtained reduced negative transfer, and also found a positive relationship between amount of reduction of interference and degree of meaning change over lists. The effect was more pronounced for second than for fourth graders, and explained on the basis of second graders being less likely to label spontaneously.

The above experiments are quite significant in that they represent a new way of looking at how children encode information. Specifically, it has been now demonstrated that sentence contexts can significantly reduce interference effects in a paired-associate transfer task (A-B, A-D) and that meaning change experimentally-manipulated over lists can also render items functionally dissimilar so as to reduce interference.

Chapter II

STATEMENT OF THE PROBLEM

Davidson has shown that the transfer paradigm can be utilized as a mechanism for studying the relationship between semantic meaning of learning materials and children's methods of encoding information. The research that has been reviewed indicates that labels and sentences, when acting as facilitators in paired-associate learning, substantially increase recall and are assumed to make paired-associate materials more meaningful. In addition, it has been pointed out that such usage of mediation can probably modify the levels of meaning represented by certain materials, along the lines postulated by Paivio's representational, referential, and associative levels.

The purpose of this study is to determine if the levels of meaning, as developed by Paivio, result in different modes or locations of encoding and storage for children. The transfer paradigm represents an ideal vehicle for the systematic manipulation of stimuli across meaning levels, while the relative amounts of negative transfer across conditions gives clues to how materials at various levels of meaning are encoded.

If materials at various levels of meaning are stored differently, then it should be reflected via a reduction in negative transfer when meaning level changes between two lists (since items on respective lists would supposedly be stored differently). On the other hand, more interference would be predicted when meaning remains constant over lists, because new linkages would theoretically be attempted in the same "site" and be hindered by the old pairs.

This study will attempt to utilize the transfer paradigm to tap Paivio's three levels of meaning via manipulation of two variables: kinds of picture stimuli (line drawings of real, concrete common objects or animals; and abstract line representations), and amount of E-provided verbal elaboration (labels or sentence contexts). The A-B, A-Br paradigm has been chosen as one that elicits the greatest amount of interference.

Although the aforementioned research has answered many questions about how enhanced meaning (via elaboration) results in improved rates of recall, such studies have been between-subject comparisons. Also, Davidson's work, although demonstrating that meaning changes can reduce interference, did so by changing the semantic features of the stimulus materials. The present study will be an attempt to systematically relate levels of meaning to encoding, by providing different kinds of mediation in order to influence the stability of S-R associations and, rather than looking at the differential contribution of verbal and imaginal processes, as previous studies have done, the concept of meaning will be the primary focus in how PA items are linked.

For second and fourth grade students, it is assumed that abstract line drawings should evoke few, if any, associations. These drawings should be the visual analogue of low meaningfulness (M) nonsense syllables commonly seen in verbal learning transfer studies. Thus, without further elaboration provided by E, the child should encode such stimuli at the lowest (representational) level of meaning. However, should E provide S with a common label for the form he sees (e.g., dog, house, etc.) the stimulus should take on a referent name which will be strengthened over trials and raise stimulus meaning to the referential level. It is hypothesized that if meaning level can be changed over lists of a transfer task by using abstract drawings, but only providing labels on the second list, then interference can be substantially reduced. The reasoning is that A-Br items could perhaps be rendered more as C-D on the second list by the addition of labels, thus effecting a meaning change. Comparison can be made with a condition where labels are provided on both lists and no meaning change takes place. Identical labels on both lists should create interfering associations.

Another facet of this section of the study will attempt to extend to children's learning a concept asserted by Martin (1968). His "encoding variability" hypothesis posits that low-meaningfulness items have more alternative encoding possibilities than high-meaningfulness items, because of the absence of primary associations. Martin's review shows that paired-associate hook-ups take longer to occur in low-m pairs, but that on a transfer list these linkages are easily broken and new associations are available to be formed. However, high-m pairs must first be unlearned, resulting in more negative transfer. As Martin's work was done with adults, a demonstration at the elementary age level could extend his hypothesis to children.

Accordingly, abstract forms without labels will be used in this study to represent low-m pairs, and the same forms accompanied by labels will represent high-m pairs. A comparison of the amounts of interference produced in these two conditions will provide the test of the encoding variability hypothesis. Theoretically, the former condition will be representational-representational in terms of meaning level over the two lists, and the latter will be referential-referential. Less negative transfer for the former will support Martin's hypothesis.

As the Flavell research has pointed out, young children manifest a production deficiency with respect to usage of verbal labels as mediators. By using abstract stimuli in this study, it is hypothesized that second and fourth grade Ss will demonstrate such a deficiency in their spontaneous labeling and rehearsing of abstract items. This assumption is implicit in the discussion of the encoding variability hypothesis. However, it is questionable whether these children will continue to mediate on the second list if only provided labels on the first list. Thus, a comparison will be made of the relative amounts of interference in a No Label-Label condition and a Label-No Label condition in order to answer this question. If no transfer difference exists, it may be hypothesized that labels are not carried over to the second list, the rationale being that meaning changes take place in both conditions. However, if the former is less interfering, it may be that labels are continued, thus rendering both lists of the Label-No Label condition at the referential level of meaning.

Just as labels can render abstract drawings more meaningful, it is conjectured that sentence contexts can be encoded at the associative level of meaning. Thus, meaning changes over lists could also be brought about by providing sentence contexts to real pictures, in essence manipulating these materials along a referential-associative dimension. Davidson and Levin (1973) demonstrated that changes in stimulus meaning over lists reduce negative transfer, as does sentential elaboration of the pairs. However, that study only changed the meaning of stimulus terms, while using independent response terms. The present study will attempt to demonstrate the reduction of interference by changing the way in which PA items are associated over lists, and thus changing the level of meaning of the associations. For instance, pictures with labels on List I followed by pictures with sentence context on List II according to the hypothesis, would signal a switch from referential to associative level of meaning, and a corresponding reduction in negative interference would support the change of meaning hypothesis. According to the theory to be tested, more interference should occur when meaning levels are constant over lists than when meaning changes over lists.

Besides the Davidson et al. studies, some unpublished pilot data by Levin, Davidson, and McCabe lead to the above hypothesis. They attempted to demonstrate a reduction in negative transfer by imposing different modes of elaborative context over lists. For instance, imposed visual imagery on the first list, followed by imposed sentences on the second list (using A-Br and C-D items) was predicted to be less interfering than either visual or verbal contexts on both lists. However, even with employment of the A-Br paradigm, no more interference was noticeable in the same-mode condition than in the "switch" condition. A rethinking of the issue brought about the present hypothesis that level of meaning is something to be considered. It can be noted that all three conditions employed in the above study were manifestations of the same level of meaning (associative) and it is entirely possible that both the verbal and visual modes contained associative elements of the other which may have obscured the modality difference. Or, imagery and language are not separate processes at that point, but operate from the same deep structure of meaning (Davidson, 1972).

While Davidson et al. were able to create less negative transfer by provision of sentential elaboration for paired-associate items, those investigations were done with the traditional A-B, A-D paradigm. To date, no such effect has been attempted with A-B, A-Br method. Similar results would greatly enhance the generality of the Davidson findings as well as indicate the power of sentences to overcome what has been traditionally the most interference-producing paradigm. Thus, a test of this hypothesis will be made via comparison of a sentence context condition (on both lists) and a label condition (on both lists). These represent constant levels of meaning across lists, the former at the associative level, and the latter at the referential. It is hypothesized that the higher level of meaning (associative) will produce less negative transfer than the lower level (referential) because of increased list differentiation, thus essentially replicating the Davidson findings.

In summary, the purpose of this study is to determine if the levels of meaning, as developed by Paivio, result in substantially different modes or locations of encoding and storage for children. If the above assertion is true, then it should be reflected in a reduction in negative transfer when meaning level changes (since items on respective lists would be stored differently). On the other hand, more interference would be predicted when meaning remains constant. In addition, when meaning level is constant over lists, the vast research on elaboration and mediation would predict that stimuli encoded at a higher meaning level would be more easily differentiated than those at a lower level of meaning. However, stimuli corresponding to the lowest level of meaning would be expected to result in less negative transfer than referential items because of the encoding variability hypothesis.

The following predictions can then be made:

(1) Items encoded at the representational level on the first list, and then switched to referential level on the second list should manifest reduced negative interference relative to items at the same level on both lists.

(2) A within-"same level" comparison will be made between items at the representational level on both lists and those at the referential level on both lists. According to the encoding variability hypothesis, non-labeled pairs on both lists should have less negative transfer than pairs labeled on both lists.

(3) A comparison of within-"switch" conditions has no clear-cut predictions. A No Label-Label condition which switches levels from representational to referential over lists will be compared to its opposite where pairs are labeled on the first list only, and where it is unknown whether labels will be continued spontaneously on the second list. This comparison is not central to the study and is included primarily as a contrast that is orthogonal to the two major comparisons of interest, although more interference in the Label-No Label condition would be indicative of label carry-over across lists.

(4) A meaning change from referential to associative level, brought about by real pictures labeled on the first list and in sentence context on the second list is predicted to have less interference than (a) labeling on both lists and (b) sentence contexts on both lists. Separate comparisons of the above should find the meaning change condition less interfering.

(5) If meaning level is constant over lists, items at the associative level should result in less interference than pairs at the referential level. Thus, the prediction is that Sentence-Sentence will overcome negative transfer more than Label-Label. The hypothesis is based on the notion that the former allows for greater list differentiation, as a result of the sentence elaboration.

Chapter III

EXPERIMENT I

Subjects

Seventy-two fourth grade students participated in this section of the study. They were drawn from the only three fourth-grade classrooms in a school district serving a rural community in Wisconsin. Two of these classrooms were located in the town's central school, the other in a rural outlying school. Subjects were randomly assigned to four conditions which were determined by the presence or absence of E-provided labels on first and second lists. They were Label (first list)-Label (second list), Label-No Label, No Label-Label, and No Label-No Label. Subjects were randomly assigned to the four groups, with 18 students comprising each. The order of testing was random within blocks of 24. Six different list combinations, as described below were randomly assigned to Ss in each experimental condition (4), such that each list-condition possibility was used once (resulting in a block of 24) before any other combination was used again.

Before random selection commenced, the three teachers were asked to name any students they felt were extremely slow learners and/or seriously emotionally disturbed, or who were grade-repeaters. Four students were eliminated on such a basis. In addition, during the first list acquisition, two "Label" condition subjects were dropped, the first because of failure to achieve criterion within 15 trials, and second because of the arrival of the school bus. One "No Label" subject was eliminated because of failure to comply with directions. Fifteen trials had been selected a priori as a limit because piloting had shown this amount of practice as being sufficient for most fourth graders. Also, the subject dropped on this account was not showing improvement over trials.

Design and Materials

The design consisted of a single between-subjects factor (Levels of Meaning) and two within-subject factors (Item Types and Trials). All Ss learned a first list consisting of 10 pairs of abstract line drawings. Half of the Ss were provided with labels to the drawings by E and half were not given any labels. Following attainment of criterion (8 out of 10, including 7 out of 8 of each item type), all Ss were transferred to a second list. Half of the Ss from each of the List I conditions (Label or No-Label) received labels on List II, while half received no labels on List II. Thus, four different conditions were created, as defined by the presence or absence of labels on each of the two lists. Half of the second list pairs consisted of items from List I in different S-R pairings (A-Br), and half of the List II items consisted of new pairs (C-D). The design is presented in Table 1.

The line drawings were cut out and pasted on 5" x 8" yellow index cards, and presented to S via turning of the cards by E.

The drawings were selected for the study in the following manner. A pool of abstract artist sketches to pictures of common objects or animals were collected. The abstract representations were based on materials used by Kingsley and Hagen (1969) and were intended to be sufficiently vague that they would not likely elicit a spontaneous label from S. However, with provision of a label by E, it was hoped

Table 1.

Design of Experiment I

List I	List II	Trial I		Trial II	
Label 36 Ss	No Label 18 Ss	A-Br	C-D	A-Br	C-D
	Label 18 Ss	A-Br	C-D	A-Br	C-D
No Label 36 Ss	No Label 18 Ss	A-Br	C-D	A-Br	C-D
	Label 18 Ss	A-Br	C-D	A-Br	C-D

that S would accept the given label and use it. Pilot testing was conducted with 30 third graders to assess their acceptance of the E-provided label.

To measure overall acceptance of the E-provided label, pilot Ss were asked to rate each E-provided label on a dimension of: 1 point = full agreement that the drawings could represent such a label; 2 points = possible acceptance of the label, but some doubt about it; 3 points = complete or almost complete refusal of the label. Only items that obtained average ratings of less than 2.0 were selected for the study.

While Ss looked at items, arranged individually in a small booklet, E orally presented the desired label in order to elicit S's rating. However, half of the items were given the appropriate label while half were accompanied by a false label, randomly chosen from among the other alternatives in that group. Ss were piloted in two groups of 15 Ss, such that each group received opposite halves of the list with appropriate and bogus labels, respectively. Thus, only 15 Ss were actually involved in rating the <u>acceptance</u> of each item while 15 other Ss were involved in rating the acceptance of a different label for those items. Only those items that received a mean rating of more than 2.0 for a false label, as well as below 2.0 for the appropriate label, were selected.

This procedure was used because it was felt that asking Ss to give their own labels would not provide an estimate of acceptance of the E-provided label.

Thirty drawings thus selected were randomly matched into 15 pairs, which were then randoml divided into three groups of five pairs each.

Three different lists of 10 pairs were constructed by the three possible combinations of two groups. These constituted the first lists in the transfer paradigm. Materials for the second list were generated by dropping one of the two first-list groups, re-pairing the items remaining from the first list to make five A-Br pairs, and adding the five pairs comprising the group not used in the first list (C-D). The lists were counterbalanced, such that each group was used an equal number of times, and with each other group, as A-Br (used on both lists), C-D (used only on second list), or used on first list only. Six different combinations resulted from this method. Within the three 5-pair groups, all stimuli were randomly re-paired with the new responses from that same group to make up A-Br pairs.

The list combinations were randomly assigned to Ss, and each list appeared an equal number of times for the four experimental groups.

See Appendix A for examples of some of the line drawings, and for a listing of the pairs and their A-Br counterparts. The labels given to the drawings are the labels that were rated in the pilot study.

Procedure

The Ss were tested individually in a small room by one E. Upon entering the room, S was asked to sit down at a table next to E.

The Ss in all conditions were told that they would be seeing some cards with two sketches on each one. It was explained to them that their job was to try to remember that the two sketches on each card went together, and that they would be shown a number of cards in this manner. They were then told that after they had seen all the pairs, they would be shown some more cards with only one of the two sketches on them, the other one being missing. At this point it would be their job to think back to what sketch went together with the one seen, and to point to the missing sketch on the response board (the E showed S the back of the poster board containing the response items, without revealing any of the items.)

To insure that all Ss understood the directions, an example was provided with two pairs of geometric figures. Upon ascertaining that S understood these instructions, E announced that the task would begin. However, just prior to commencing the first study trial, Ss in first-list Label conditions were told that while they were attempting to remember what sketches went together, they would hear E utter the names of the items. No other differences in instructions existed between the Label and the No-Label groups.

Following issuance of the instructions, E presented the 10 study pairs to S one at a time at a 5-second rate. The manner of presentation was via E flipping over each card, while simultaneously saying the names of first the stimulus item and then the response item, for those Ss in Label conditions. For Ss in No-Label conditions, E merely flipped over the cards. E wore a small earphone plugged into a tape-recorder that signalled to him the 5-second interval. These signals could not be heard by S.

After the exposure of the last item in the study trial, a 10-second interval ensued before the presentation of the first test item. During this time S was reminded that he should point to the response corresponding to each sketch he would be shown, and a 12 x 18 inch posterboard on which all the response items for List II were pasted was revealed. The test cards were then presented at a 5-second rate, while E repeated the name of the stimulus item for Ss in Label conditions. The Ss were required to respond within 5 seconds in order for a response to be counted as correct.

Immediately after completion of the test trial, E shuffled the two piles of study pairs and test stimuli respectively so that they were presented in a different random order on all subsequent trials. A new study trial was begun as soon as the cards were shuffled, and each study-test sequence was identical to that described above. While the shuffling was taking place, E told S that the same procedure would be repeated, and it was often necessary, especially during later trials, to let S know that he was doing well. The Ss were given as many trials as necessary to reach a criterion of one trial of 8 out of 10 correct items. However, part of this criterion was that at least 4 out of 5 A-Br items (items to be re-paired on the second list) be correctly responded to, and at least 4 out of 5 of the items to be omitted on the second list be correct. The Ss were not continued after 15 trials, and only one S was dropped from the study on this basis. However, most Ss, after several trials, ascertained that a certain performance level was required before termination of the task, and frustration often ensued. For this reason, mild words of encouragement were given freely by E between trials.

Ss were transferred to the second list immediately after reaching criterion on the first list. Instructions by E were simply that S would be seeing some more sketches and the task would be identical to the previous one. However, for those Ss in the No Label-Label condition, E mentioned that he would utter the names of the items while they were trying to remember which ones went together. Also Ss in the Label-No Label condition were told that they would not hear names while looking at the pairs. Because of the often long and strenuous journey that many Ss had gone through to reach criterion on List I, E told all Ss that the new task would not take as long. It should be noted that Ss were not told that some items would be the same that they had seen earlier, or that the first list pairs had been switched around. They were only told that they would see "some more sketches."

Two study-test trial sequences were given on List II, half being re-paired items from List I (A-Br), and half being new items (C-D). Method of presentation, iter-item interval, inter-trial interval, and shuffling procedures were all identical to List I methods.

Results

First-list acquisition was measured in terms of the number of trials required to reach criterion. Second-list learning was evaluated according to four variables that were created from the original data. Total number of correct responses across the two test trials was a between-subject comparison, while the other three variables comprised within-subject comparisons. Hypotheses regarding item type differences (A-Br vs. C-D), trials differences, and item types by trials interactions, which were all within-subject variables, were tested. All hypotheses were tested via three planned orthogonal contrasts.

The layout was a four conditions by two item types by two trials repeated measures design, with the first factor representing a between-subjects measure, and the latter two factors representing within-subject variables.

All hypotheses were tested with the probability of a Type I error (alpha) set equal to .05.

On first-list acquisition, a significant effect of labels was found. The mean number of trials to reach criterion for Ss given labels to stimuli on the first list was 5.83, while No Label Ss averaged 8.05 trials to criterion ($t = 3.72$ with 68 df, $p < .05$).

The three planned contrasts used to test second-list hypotheses were designed as follows: The major comparison (Comparison 1) was Label-Label and No Label-No Label vs. Label-No Label and No Label-Label, which was test of the change in levels of meaning hypothesis regarding interference. The other two comparisons were nested within each of the factors above (change in levels or same levels) with one (Comparison 2) designed to test the encoding variability hypothesis (Label-Label vs. No Label-No Label) and the other (Comparison 3) added in as the remaining orthogonal comparison (No Label-Label vs. Label-No Label) to test for label carry-over effects.

The between-subjects variable, total number of correct responses over two trials, was evaluated via the three contrasts described above. None of these tests was directional, as no predictions were generated for this variable, and the three comparisons failed to reveal any significant effects. Comparison 1: $F = 3.81$ with 1,68 df, $p > .05$; Comparison 2: $F < 1$ with 1,68 df, $p > .05$; Comparison 3: $F < 1$ with 1,68 df, $p > .05$). Table 2 contains the means for the total correct responses.

The main effect of Trials was significant with more learning taking place on Trial II ($F = 59.19$ with 1,68 df, $p < .05$). The comparisons comprising Trials x Condition interactions failed to reach significance. For Comparison 1, $F < 1$ with 1,68 df, $p > .05$; Comparison 2, $F < 1$ with 1,68 df, $p > .05$; Comparison 3, $F = 3.00$ with 1,68 df, $p > .05$. Means can be found in Table 2.

Table 2.

Mean Number of Correct Responses for Each Item Type and Each Trial as a Function of Conditions: Experiment I

	Trial I			Trial II		
	ABr	CD	Total	ABr	CD	Total
Label-Label	.67	2.44	3.11	1.83	3.33	5.16
Label-No Label	.94	1.77	2.71	1.50	2.56	4.06
No Label-Label	.61	1.67	2.28	1.72	3.05	4.77
No Label-No Label	1.39	2.00	3.39	1.67	3.17	4.84

As would be expected, the main effect of Item Types was significant ($F = 75.36$ with 1,68 df, $p < .05$), indicating that overall, C-D items were recalled more effectively than A-Br items. The major comparisons of the study, the Item Types x Conditions interaction will be considered next. Comparison 1, which represents the levels of meaning hypothesis, was not significant ($F = 1$ with 1,68 df, $p > .05$). Comparison 2, the encoding variability hypothesis, also was not found to offer significant results ($F = 2.19$ with 1,68 df, $p > .05$). The third contrast which looks at residual effects was nonsignificant also ($F < 1$ with 1,68 df, $p > .05$). The means of A-Br and C-D recall by conditions are presented in Table 2.

The Trials x Item Types interaction was not significant ($F = 1.95$ with 1,68 df, $p > .05$). The last set of comparisons, representing Trials x Item Types x Conditions interactions were nonsignificant for Comparisons 1 and 3 ($F < 1$, both with 1,68 df, $p > .05$). However, Comparison 2 was significant, with No Label-No Label manifesting a decrease in interference over trials, relative to Label-Label ($F = 4.29$ with 1,68 df, $p < .05$). The associated means may be found in Table 2.

Discussion

As can be seen in the data reported, the major hypotheses in this experiment were not supported. Moreover, the finding that No Label-No Label Ss performed equally as well as Label-Label Ss points to the necessity to question one basic assumption underlying the study. That is, were the stimuli used actually differentiating between the two levels of meaning on the basis of provision of labels by E? Informal observation of No Label Ss indicated that many of these youngsters were formulating their own labels and rehearsing them. Such labeling may have had the effect of contaminating the levels of meaning assumed to be operating, and may have erased the representational-referential distinction. For instance, items may have been referential on both lists for many of the No Label-No Label Ss, giving the levels of meaning hypothesis an inadequate test.

Because of the ambiguity of these results (a more complete discussion will be found in Chapter VI), Experiment II was conducted with second graders. It was hoped that younger students would less likely engage in independent labeling of the stimuli, and that a replication of Experiment I with 7- or 8-year-olds would yield a better test of the hypotheses.

Chapter IV

EXPERIMENT II

Subjects

Forty-eight second-grade students were used in this section of the study. . They were taken from two classrooms in an elementary school serving a semi-rural town in Wisconsin. Subjects were randomly assigned to the same four experimental groups described in Experiment I, resulting in 12 Ss per group.

Students identified by teachers as being especially slow learners and/or grade-repeaters were not included in the random assignment to conditions. Although a 15-trial limit was established to reach criterion, no Ss failed to do so, and attrition of Ss due to other factors did not occur. Thus, all Ss initially randomly selected, completed the task.

Design and Materials

The design was identical to that presented in Experiment I. However, the length of the paired-associate list was trimmed down to six pairs due to the younger age of these Ss, and after piloting revealed such a length to be short enough for second graders to reach criterion in several trial- The pairs selected for study were those that in Experiment I had the largest differences between C-D and A-Br, and were thus considered the most interference-producing. Total number of correct responses were tabulated for all C-D pairs on List II, from which was subtracted the total number correct of each A-Br counterpart (same stimulus and different response), which would be found in other list combinations. For instance, SNAKE-HOUSE, a C-D item on List II for one combination would be SNAKE-CLASSES, an A-Br item for another combination and another subject. Nine pairs were chosen in this manner.

The pairs were further divided into 3 groups, as defined in Experiment I, so that six different list combinations could be composed. The list combinations were randomly assigned to Ss, and each list appeared an equal number of times for the four conditions.

Procedure

All the procedures employed in collecting the data are precisely the same as those described in Experiment I, except for one additional technique. After completion of the task, Ss were asked to tell E if they thought of names for some of the sketches while they were looking at them (although this was not done consistently). The Ss in the Label-No Label condition were shown only List II C-D items for this purpose; the Ss in the No Label-No Label condition were shown all List II pairs. Those who received labels on the second list were not included, as they were expected to have used the labels provided by E.

The Ss told E the names to each stimulus for which they supposedly had a label, and it was thus possible to gain some insight into whether these Ss labeled spontaneously, or continued to label after having experienced such practice on List I. However, this method of inquiry is subject to alternative interpretation as it is impossible to ascertain whether the questioning itself might not elicit labels out of children who actually had not used any.

Results

No significant effects were found due to provision of labels during first-list acquisition with second graders. Mean number of trials to criterion for the Label and No Label groups were 5.50 and 6.75 respectively (t = 1.46 with 44 df, p > .05). Although the difference was not statistically significant, it was nonetheless in the expected direction. First-list data were also analyzed by totaling the number of correct responses on the first two trials. Performance on this measure averaged 4.21 and 3.33 correct items for the Label and No Label conditions respectively. Again, the difference was in the predicted direction, but not statistically significant (t = 1.25 with 44 df, p > .05).

Second-list data were analyzed via the three orthogonal contrasts used for Experiment I, which enabled trials, item types, and the item types by trials interaction to be looked at in conjunction with the between-subjects variable.

Table 3 lists the mean number of correct responses for A-Br and C-D, by trials for the four experimental conditions. None of the contrasts were statistically significant with the F-ratios for the three contrasts respectively being 2.29, 1, and 1 with 1,44 df, all nonsignificant at the .05 level.

The main effect of Item Types revealed C-D items to be better recalled than A-Br items, thus demonstrating the overall interference (F = 24.15 with 1,44 df, p > .05). Mean number of correct responses on each of the two item types (A-Br and C-D) can also be found in Table 3. The contrasts involving change vs. same levels of meaning, and the encoding variability hypothesis (Label-Label vs. No Label-No Label)

Table 3.

Mean Number of Correct Responses for Each Item Type
and Each Trial as a Function of Conditions: Experiment II

	Trial I			Trial II		
	ABr	CD	Total	ABr	CD	Total
Label-Label	1.00	2.08	3.08	1.25	2.50	3.75
Label-No Label	1.17	1.25	2.42	1.75	1.58	3.33
No Label-Label	.67	1.92	2.59	1.08	2.25	3.33
No Label-No Label	1.42	2.08	3.50	1.33	2.00	3.33

on the variable constituting the A-Br – C-D difference failed to reach significance (Comparison 1: $F = 1.69$ with 1,44 df, $p > .05$, and Comparison 2: $F = 1.90$ with 1,44 df, $p > .05$). However, the residual contrast involving the within change of level conditions revealed significant differences between Label-No Label and No Label-Label groups on this variable ($F = 11.86$ with 1,44 df, $p < .05$), with the former condition manifesting less (in fact, no) negative transfer. An explanation for this result is not immediately forthcoming in that, if anything, it is opposite to what might have been expected.

Table 3 contains the breakdown of mean number of A-Br and C-D items correct on each trial, as well as total number correct items on each trial. The Trials main effect was significant ($F = 4.94$ with 1,44 df, $p < .05$).

The Trials x Conditions interaction was investigated vis-à-vis the three contrasts, none of which reached significance (for Comparison 1, $F = 1.43$ with 1,44 df; Comparison 2, $F = 1.46$ with 1,44 df; Comparison 3, $F < 1$ with 1,44 df, all p's $> .05$). No interaction was found between trials and item types ($F < 1$ with 1,44 df, $p > .05$).

The Trials x Item Types x Conditions interaction was nonsignificant for the three contrasts of interest: F-values were less than 1 for all three, with 1,44 df, $p > .05$).

Discussion

Although this experiment was conducted primarily in order to clarify the ambiguous results of Experiment I, the data only raise more questions. Most puzzling, of course, is the absence of a labeling effect on first-list acquisition, a finding that can be given no ready explanation. Another unexpected result is the significant contrast between

Label-No Label and No Label-Label on the interference variable, the former condition yielding no noticeable negative transfer.

As in Experiment I, no differences were found in amounts of negative transfer as a function of change or no change in levels of meaning, and it was also unclear whether second graders were spontaneously labeling the abstract stimuli. These factors will be discussed in more detail in Chapter VI.

Another possibility that might be raised, however, is whether the abstract stimuli actually remained representational over a series of trials. While the stimuli may have been encoded at such a leval when S was initially exposed to them, repeated presentation over trials may have actually given the stimuli a higher level of meaning on later trials (through S's increased familiarity with the stimuli). It would appear feasible that such a meaning change may occur even without concurrent labeling. That is, even if S did not emit a spontaneous label, the stimulus would still be more familiar than it was on the first trial. Such a factor may have been operating in both Experiments I and II, and have contributed to the nebulous results.

Although the levels of meaning hypothesis was not supported in Experiments I and II, these studies only considered the change between representational and referential levels. Experimental modifications may clarify these data in the future. However, whether or not the hypothesis is viable at such a level, it is nonetheless possible that a meaning change between referential and associative levels may bring about less interference, relative to constant levels of meaning (either referential or associative). Thus, Experiment III was carried out in order to investigate such a possibility.

Chapter V

EXPERIMENT III

Subjects

Forty-eight fourth grade students were used as subjects for this portion of the study. They were randomly selected from two classes in an elementary school serving a semi-rural community in Wisconsin. Students who were earlier identified by teachers as being particularly slow learners or grade-repeaters were not randomly included in the selection process. Sixteen subjects were randomly assigned to each of three conditions which were determined by the presence or absence of E-provided labels or sentence contexts on first and/or second lists. These conditions were Label (first list)-Label (second list), Label-Sentence, and Sentence-Sentence.

Design and Materials

The design consisted of a single between-subjects factor (Levels of Meaning) and two within-subject factors (Item Types and Trials). All subjects learned a first list, comprised of 16 pairs of pictures of common objects or animals, to criterion. Two-thirds of the Ss were told the names (labels) of the pictures, while one-third heard a sentence containing the stimulus and response in an action sequence.

Following attainment of a criterion of 14 out of 16 items, 7 A-Br and 7 C-D, all Ss were transferred to a second list containing half

List I items re-paired (A-Br) and half new items (C-D). One half of the subjects who were provided labels on List I received the same treatment on List II, while the other half were given sentence contexts on the second list. The Ss who heard sentences on List I were also provided with sentences on List II. Table 4 contains the design of this experiment.

The pictures were artist drawings, in black ink, of objects, animals, or things recognizable to most children. They were assembled from a pool of drawings that have been used for previous paired-associate studies done at the Wisconsin Research and Development Center for Cognitive Learning. All pictures were cut out and pasted on yellow 5" x 8" index cards. Cards used for study trials contained two side-by-side drawings, while those used for test trials contained one drawing (stimulus), which was centered on the card.

Sixty-four drawings were divided into 32 pairs. The only restriction on pairings was that an action sentence could be formulated around the pair, with the stimulus as subject, and response as object. The 32 pairs were then divided into two groups of 16 pairs each. Another precaution taken at this point was to attempt a fairly even matching, between the groups of different semantic classifications (e.g., animals, vehicles, etc.). Some shuffling took place in order to bring this equalization about.

Two list orders were devised in the following manner. One of the 16-pair groups constituted the first list of the transfer paradigm. After criterion was reached (one trial of 14 out of 16 correct responses), Ss were transferred to List II. The second list was made up of all 16 List I items, but in different pairings (A-Br), and in addition, the 16

Table 4.

Design of Experiment III

List I (16 pairs)	List II (32 pairs)	Trial I		Trial II	
Label 16 <u>Ss</u>	Label 16 <u>Ss</u>	A-Br	C-D	A-Br	C-D
Label 16 <u>Ss</u>	Sentence 16 <u>Ss</u>	A-Br	C-D	A-Br	C-D
Sentence 16 <u>Ss</u>	Sentence 16 <u>Ss</u>	A-Br	C-D	A-[illegible]	C-D

pairs not used on List I (C-D), resulting in a total of 32 pairs. The two groups were each used an equal number of times as List I (and List II A-Br) and as C-D items on List II. Within the two groups, stimuli were randomly paired with responses to make up the A-Br items. However, they were subject to the same restriction that required the enabling of sentences to be formed around them.

The two list combinations were randomly assigned to Ss, and each list appeared an equal number of times for the four experimental groups. See Appendix C for a listing of the pairs, sentences used, and their A-Br counterparts.

The arrival at a 16-pair first list, followed by a 32-pair second list came about after extensive pilot testing revealed that with sentence contexts, fourth graders perform at ceiling level with a 16-pair list. However, longer lists are difficult for Ss in the Label condition to reach criterion in a reasonable number of trials. It was concluded that no optimal common list length could be found in which Label-Ss could reach criterion comfortably, and in which Sentence-Ss would not perform at ceiling level. Thus came the decision to hold the first list length at 16 pairs, but to double the second list length to protect against a ceiling effect. This method still allowed for an equal number of A-Br and C-D items.

The sentences which E provided in some conditions were all of the form "the Stimulus verb the Response," with the picture on the left always imposing the action on or toward the picture on the right. Care was taken to insure that the same verb was not used twice, and that sentences within the same group were not too similar semantically.

All response items were pasted in rows on a large red posterboard that was used on test trials for Ss to point to the correct response.

Procedure

The Ss were tested individually in a small room by a single E. The S set at a table beside E.

All Ss were instructed that they would be seeing some cards with two pictures on each card, and that they were to try to remember that the two pictures went together. It was explained that after seeing a number of cards in this manner, they would see some more cards with only one of the two pictures on it, the other picture being missing. It would be their job to think back to what picture went together with the one shown, and to point to the missing picture on the response board.

In order to prepare Ss for the task, an example was given consisting of two pairs of geometric figures. After completing the examples correctly, Ss were told that the task would soon begin. However, E informed Ss in first list Label conditions that while they were looking at the pictures, they would hear E utter the names of them. Similarly, Ss in the first list Sentence condition were told that they would hear E tell a sentence or a small story about the pictures.

Immediately following the instructions E presented the cards to S at a 5-second rate, the signal to turn the card being monitored via an earplug in E's ear, which S could not hear. The E uttered either the names of the pictures, or a sentence about the pictures, depending on the condition. After exposure of the 16 pairs, a 10-second interval ensued before revealing the first test item. During this time S was reminded to point to the picture that previously was seen with the one to be shown, and the posterboard containing response items was placed in front of S. The test cards were then presented at a 5-second rate, while E repeated the name of the stimulus item for Ss in all conditions.

Immediately after completion of the test trial, E shuffled all the cards so that different random orders of cards would result on each trial. A new study trial commenced as soon as the cards were shuffled, and S was told that the same procedure would be repeated. The study-test sequence was terminated after the first trial in which S achieved a criterion of 14 correct responses.

Transfer to the second list followed immediately after criterion was met on the first list. Instructions were simply that S would see some more pictures, and that they were to try to remember again which ones went together. Those in the Label-Label condition were told that they would still hear E give the names of the pictures, and those in the Sentence-Sentence condition were told that they would again hear sentences about the pictures. Ss in the Label-Sentence condition were told that this time they would hear E utter sentences about the pictures, instead of names. In no way were Ss warned that some of the items would be the same as those seen in the first list. They were only told that they would see some more pictures.

Two study-test trial sequences were given on List II, half of the pairs (16) being List I items in new pairings and half of the pairs (16) being previously unseen pictures. All methods of presentation were identical to those used on List I, except for the inter-item interval on test trials. Because of the large array of possible responses to be scanned (32), no time limit was imposed on S. As soon as S pointed to what he thought was a correct response, E turned over the next card.

Results

First-list acquisition data were evaluated by comparing mean numbers of trials to criterion between Ss receiving labels and those given sentence contexts. In this experiment, two groups received labels on the first list and one group heard sentences. All youngsters reached criterion fairly rapidly, with the mean performance for Sentence-Ss being 1.25 trials, and Label-Ss 3.78 trials. Standard deviations were 1.09 and .45 respectively. The difference in trials to criterion was significant at the .05 level, with $t = 8.58$ with 45 df.

Analysis of second-list data was done by converting scores into the same four variables used in the first two experiments: total number correct items, item-type differences, trials differences, and trials by item type interaction. The latter three, all within-S variables, were analyzed in interaction with conditions. The method of analysis was by Tukey's pairwise comparisons on each of the four variables.

The number of correctly recalled items for each of the three conditions can be seen in Table 5. The mean second-list performance of Label-Label Ss was significantly lower than each of the other two conditions, both of which contained sentence elaboration during second list, according to Tukey's method. However, the Sentence-Sentence and Label-Sentence totals did not differ significantly from one another.

The main effect of Item Types was significant ($F = 66.12$ with 1,45 df, $p < .05$). Table 5 also lists the mean number of correctly recalled A-Br and C-D items for each condition, by trials. The differences in recalled A-Br and C-D items provide the measures of degree of negative transfer employed in this part of the study. However, all three pairwise comparisons (Tukey, alpha = .05) on this variable (C-D minus A-Br)

Table 5.

Mean Number of Correct Responses for Each Item Type
and Each Trial as a Function of Conditions: Experiment III

	Trial I			Trial II		
	ABr	CD	Total	ABr	CD	Total
Label-Label	3.125	5.625	8.75	6.9375	10.875	17.8125
Label-Sentence	10.50	13.375	23.875	14.375	15.50	29.875
Sentence-Sentence	8.8125	10.6875	19.50	13.625	14.875	28.50

failed to reach statistically significant levels.

The Trials main effect was significant ($F = 175.25$ with 1,45 df, $p < .05$). However, looking at the Trials by Conditions interaction via the three pairwise comparisons, the increments in learning over trials do not differ significantly among the three conditions (Tukey, alpha less than .05).

The last variable investigated was the Item Types by Trials interaction. However, it should first be noted that no Item Types by Trials interaction was evident ($F = 1$ with 1,45 df, $p > .05$). The Item Types by Trials by Conditions comparisons essentially enabled the amount of interference to be seen as a function of trials. The pairwise comparison between Label-Label and Sentence-Sentence did not quite obtain significance. However, negative interference was reduced from Trial I to Trial II in the Sentence-Sentence condition, but actually increased in the Label-Label condition. The comparison between Label-Sentence and Label-Label conditions reached significant levels, however. In the former condition, negative transfer was reduced over the two trials by almost two items. It should be noted that perhaps this finding may be the result of a ceiling effect, however, on the second list C-D items. A nonsignificant difference was obtained between Label-Sentence and Sentence-Sentence conditions on this variable. However, the same ceiling effect may account for some or all of it. The possibility is raised, also, that maybe the effects need more trials in order to be revealed.

Discussion

As the data point out, no significant interference differences were found as a result of the "same" vs. "change" in level of meaning.

However, it seems that sentence elaboration provided on the second list was a powerful facilitator in overall learning, as evidenced by the total recall differences between the two sentence conditions and the Label-Label condition. A more detailed discussion of this experiment will be found in the general discussion, Chapter VI.

Chapter VI

GENERAL DISCUSSION

This study was conceived and developed around a theory that was devised to account for some previous research findings regarding interference in children's paired-associate learning. Namely, it was hoped that the levels of meaning hypothesis could explain why previous studies employing imagery and/or verbal elaboration techniques on first and second lists did not produce more same-modality interference (i.e., verbal-verbal or imagery-imagery) relative to cross-modality interference. The theory was based on a model proposed by Paivio, but heretofore untested in a transfer paradigm, and the study required implementation of materials and paradigms that were based on two assumptions: that abstract line drawings would be fairly meaningless without labels, and that the youngsters tested would not label these stimuli independently.

Unfortunately, the results of the study failed to confirm any of the major hypotheses and perhaps raised more questions than they actually answered. Because the intended scope of the study was fairly broad, and because the experiment was a first attempt at a virgin research area, then a residue of many unanswered questions is to be expected. Besides modifications that are probably necessary in the hypotheses themselves, there are possible refinements and changes indicated in the methods of experimentation used. Clearly this study in itself does not reliably clarify in a comprehensive manner the relationship between levels of meaning and encoding variables, but it can hopefully lend some direction via its ambiguous results. Therefore, a significant portion of the discussion and conclusions to follow will address itself to speculation concerning why the predicted findings failed to occur.

The three different experiments employed as part of this study were geared toward tapping the three levels of meaning on which the hypotheses were based: representational, referential, and associative. Procedurally, it was impossible to investigate all three levels within one paradigm because of the differences in learning difficulty presented by materials at the three levels. Thus, Experiment I was designed to test the hypotheses as they related to meaning changes between the first two levels, and Experiment II was intended as a replication of such with a younger age group. Experiment III was centered around meaning changes between the referential and associative levels only. Thus, no attempt was made toward looking at effects of changes between the lowest and highest levels of meaning, although the change would be theoretically the most dramatic and most likely to confirm the hypotheses if they were in fact true. This issue will be returned to later.

The first experiment, with fourth graders, failed to confirm any of the predictions, although the encoding variability hypothesis appeared to be in the expected direction. Specifically, No Label-No Label resulted in less negative transfer than Label-Label, but the difference was not significant. The hypothesis that less interference would occur with meaning changes over lists was not supported by the data. (C-D) - (A-Br) differences were largest for the Label-Label condition, followed by No Label-Label, No Label-No Label, and Label-No Label. Besides the nonsignificant results of the comparisons of interest, it is noteworthy that the condition predicted to most overcome negative transfer in this experiment (No-Label-Label) was less interfering than Label-Label only.

Before any theoretical explanations are invoked to account for the flatness of the data, it might be profitable to look toward the procedures and assumptions underlying the experiment. One assumption was that the abstract line drawings which comprised the stimuli would not elicit spontaneous labels from Ss. However, observation of fourth graders involved in this experiment throws some doubt on that assumption. Although no formalized procedures were used to make these observations, many Ss in first-list No Label conditions were overtly verbalizing labels to these stimuli. Their lip movements were often noticed, in much the same manner as Flavell, Beach, and Chinsky (1966) used to study verbalizations.

The fact that many fourth graders overtly named labels to the stimuli could stem from two possibilities: either fourth graders are too cognitively sophisticated for the materials used, or the materials simply were not abstract enough to be free of familiar-appearing features to Ss. The result of either or both of these possibilities would be a breakdown of the levels-of-meaning hypothesis. In other words, if the stimuli were not actually at the representational level for No Label Ss, then they were probably more meaningful and at or near the referential level. Furthermore, if the above were the case, meaning level changes would not be pronounced between first and second lists, and no differences in amount of interference would be expected. The absence of any significant comparisons makes this hypothesis a plausible one, although it also casts doubt on the levels-of-meaning hypothesis.

The above reasoning is not weakened by the fact that a significant "labels" difference did occur on first list learning. Rohwer (1967) has shown that provision of labels by E, even when it is known that Ss are capable of doing so spontaneously, produces better learning results. Robinson and London (1971) also found that performance of Ss who were supplied with appropriate names by E was superior to that of Ss who generated their own labels. Perhaps there actually exist varying levels of meaning dependent on quality of labels supplied to stimuli, and E-provided labels are better than those that Ss come up with themselves. For instance, youngsters may address themselves to attributes of the stimuli, such as geometric shapes. Acoustic feedback is also present in the labeling condition. In any case, Moely et al. (1969) state that verbalization of stimulus names (for real pictures) may spontaneously occur even before kindergarten.

As noted earlier, the test for the encoding variability effect was not significant. If No Label-No Label Ss were actually labeling, as has been intimated, then their overall performance should not be different from Label-Label Ss. In terms of the encoding variability hypothesis, it cannot be expected that more encoding possibilities are open if in fact the materials are not meaningless. An interesting sidelight, however, is that No Label-No Label Ss actually did equally well in total overall performance on the second list, and descriptively better than the two "change" conditions. This same finding was true for second graders. Certainly there is no theoretical reason to expect poorer second list performance from labels than from none -- apart from encoding variability -- and for the present, this puzzling outcome must remain unexplained.

One more finding tends to lend credence to the idea that labels did not create the differences in levels of meaning that were expected. Errors on the A-Br items from the second list were analyzed in terms of the proportion of intrusion errors for the four conditions and were as follows: Label-Label, 24%; Label-No Label, 19%; No Label-Label, 24%; No Label-No Label, 24%. It appears that all groups were basically similar in this regard.

Because of the paucity of findings in the first experiment, the second experiment was undertaken with second graders in the hope that the younger Ss would be less likely to engage in spontaneous labeling of the abstract stimuli. However, results of this experiment were also somewhat enigmatic and failed to clarify whether change of levels in meaning brings about a reduction in negative transfer.

The absence of a labeling effect in first list acquisition is surprising on the basis of the fact that so many previous studies have obtained such effects. Certainly the trend is still in the expected direction, in that No Label Ss took more trials to criterion and had lower mean recall scores on the first two acquisition trials, but the non-attainment of statistical significance raises an important question. Namely, for 7- or 8-year-old Ss attempting to encode fairly ambiguous pictorial stimuli, did the labels given to them fail to add much meaning to the stimuli? Or, as seemed to be the case with fourth graders, did No Label Ss label spontaneously, resulting in little difference in acquisition rate between the two groups?

Post-experimental questioning of Label-No Label and No Label-No

Label groups with regard to their usage of labels on second list C-D items revealed that the former labeled on the average 68% of those items, while the latter labeled an average of 51%. These data are not totally compelling for explaining the lack of first-list differences, inasmuch as: (1) they were tabulated for second-list only; and (2) the inquiry in itself is not a reliable measure of what Ss were really doing cognitively. The possibility cannot be dismissed that a sizeable number of youngsters did generate labels on their own, nonetheless. Unfortunately, the normative data gathered on the stimulus materials prior to the implementation of the study could not assess whether the stimuli tend to be spontaneously labelled by children of this age, and the speculation cannot be settled at the present time.

The other possibility centers around whether second graders benefit significantly in higher levels of meaning as a result of being given labels. A crucial point in this hypothesis would be the extent to which 7- or 8-year-old Ss spontaneously rehearse the labels once they are available. The research by Flavell and his associates seems to point to this age group as beginning to utilize verbal rehearsal independently. It then becomes difficult to support the notion that second graders in this study were not making appropriate use of the labels.

The issue becomes even more muddled as we turn to the outcome of second list learning as a function of conditions. The significant contrast between Label-No Label and No Label-Label on the interference variable (the latter manifesting less negative transfer) can be traced to the C-D item type. Performance on C-D items is depressed on the second list for those Ss who received labels on the first list but not on the second. Since A-Br performance is equally as good as those in other conditions, it appears that these Ss retained the labels they received in first list learning (A-Br) but were not able to generate their own labels for the new (C-D) items on the second list. Since No Label-No Label Ss were evidently able to learn new C-D items as well as Label Ss were, however, the effect cannot be attributed to an inability for No Label Ss to come up with labels. Perhaps what can account for this finding is a learning set that is developed during first-list acquisition. No Label Ss may begin to label not during the first couple of trials, but after several repeated exposures to the stimuli. Once indoctrinated into that set, it is probably natural to continue such cognitive behavior into second-list performance. Label Ss, on the other hand, may not be engaged in active label rehearsal on their own, and may not spontaneously employ such techniques on the second list when they no longer are supplied with them.

The major hypotheses of the study were not confirmed. The levels-of-meaning hypothesis and the encoding variability hypothesis may not have been given an adequate test because of the possibilities outlined earlier. If all Ss were labeling, or if labels were not significantly raising the level of meaning of the stimuli, the net effect in either case would be a lack of differentiation between levels of meaning, the backbone of the study. Percentage of A-Br intrusions were again approximately equal for the four conditions.

Despite the lack of confirmation of the major predictions in the first two experiments, it seems premature to discard the hypotheses. The materials would need modification in the direction of even more abstractness, and the age of the youngsters could perhaps be lowered to 6 years. In addition, Ss may be prompted by E to insure that the labels were being used. If such a study still clouded the issue, then a more complex explanation would have to be sought in an area that is already poorly understood.

Acquisition data in Experiment III essentially replicated the previous findings of Rohwer and others that sentence elaboration produces higher rates of recall in paired-associate learning. The effect is particularly dramatic when the individual subject data are examined. Of 16 Ss who received sentence contexts on the first list which consisted of 16 picture pairs, 75% reached criterion of 14 correct on the very first trial. The remaining Ss did so on the second trial.

As in the first two experiments, the major hypotheses were not supported. It will be recalled that this portion of the study attempted to pick up less negative transfer in the Label-Sentence condition, which re resented a switch from referential to associative level of meaning. In addition, it was predicted that Sentence-Sentence would manifest less interference than Label-Label because of increased list differentiation assumed to be brought about by the sentence contexts. However, despite the descriptively larger C-D - A-Br difference found in the Label-Label condition relative to the others, this failed to reach statistical significance. But another way of looking at the data may shed different light on the matter. The Interference (Item Types by Conditions) by Trials interaction shows that negative transfer actually increased between Trial I and Trial II in the Label-Label condition, while it was reduced over trials in the two sentence (second-list) conditions. Even though the latter two conditions may have been partly influenced by a possible ceiling effect, it appears that A-Br performance was recovering more quickly under the sentence conditions. It therefore cannot be dismissed that a significant interference effect between Label-Label and the two sentence conditions may have been attained if a longer list and additional trials had been employed.

There is no question that sentence context on the second list proves to be a major boost to overall learning, as evidenced by the significant differences between each of the sentence conditions and the Label-Label group. The nonsignificant difference between the two sentence groups on this variable suggests that sentential facilitation is extremely powerful in aiding recall. However, the absence of any differences in interference between these two conditions, which provided no evidence to support the hypothesis that meaning change from the referential to the associative level would serve to reduce negative transfer, suggests a need to revise the hypothesis.

It is possible that with a modification of procedure, as described earlier, more negative transfer could be made to occur on the Label-Label condition relative to the sentence conditions. However, it seems that both sentence conditions manifest equal amounts of interference, despite the powerful effects that sentences have in increasing overall performance. Perhaps, the meaning-level change in the Label-Sentence condition does not have the effect of making second-list A-Br more functionally like C-D, as had been expected. The results of Davidson et al. (1970) suggest that the common verbal labels across both lists still serve to bring about interference, and it was not until stimuli were biased in the direction of a nonverbal encoding (Davidson and Levin, 1972) that reduced negative interference resulted.

The increased list differentiation made possible by sentence contexts may reduce negative transfer relative to a paired-associate label only control (although this finding was not corroborated statistically in this study), and Davidson et al. (1970) found such to be true. Thus, the hypothesis that sentences can reduce interference relative to the other "same" level of meaning counterpart (Label-Label) does have support in previous literature.

Another possibility that might explain the lack of difference between Label-Sentence and Sentence-Sentence may be that regardless of what first-list learning took place, the second list sentence context is powerful enough to erase differences in codability from first list. That is, despite the supposedly weaker associations in the first-list sentence condition, the provision of sentences on the second list is so facilitative that it can overcome the stronger associations as well as it can the weaker ones. The high level of meaning on the most recent list may take precedence over what was learned earlier, whatever its meaningfulness might be. Along this line of thinking, it would be expected that a Sentence-Label condition would manifest a greater degree of negative interference than a condition with second-list sentence. Such would, in fact, be a revision of the levels-of-meaning hypothesis, and subsequent empirical test needs to be done.

However, the results of this part of the study do not completely justify the total revision of the hypothesis. For instance, no test was made of the meaning-level change going from representation to associative (i.e., spanning the entire spectrum by bypassing referential). This could be done by using abstract stimuli with or without sentence context on the first and second lists. If the conditions tested were Label-Sentence, No Label-Sentence, and No Label-No Label it would be possible to look at both the change of meaning hypothesis (from lowest to highest) and the encoding variability hypothesis.

A common result to the three experiments was the significant item types effects. That is, taken across conditions and trials, C-D items were always recalled better than A-Br items, and is certainly indicative of the fact that the materials were successful in creating the interference effect. Also, the significant Item Types by Trials by Conditions interaction that was found in two of the experiments points out the possibility that a greater number of second list trials may have brought about more information regarding the original hypotheses of the study.

A final point might be made about the choice of experimental paradigms. The A-B, A-Br scheme was used because of its demonstrated interference-producing properties (see Chapter I). However, if paired-associate transfer is conceptualized as a two-stage process of response learning and associative hook-ups (Underwood and Schulz, 1960), the A-Br paradigm eliminates the necessity of the first stage (response learning) in transfer. If the A-B, A-D paradigm had been used in this study, it would be interesting to speculate how levels of meaning would interact with response learning. Since labels provided on the second list would probably aid in response learning, the Label-Label condition might be expected to perform well. However, less interference in the No Label-Label condition would support the change in levels as being less interfering.

BIBLIOGRAPHY

Bernbach, H. A. The effect of labels on short term memory for colors with nursery school children. Psychonomic Science, 1967, 7, 149-150.

Besch, N. F. & Reynolds, W. F. Associative interference in verbal paired-associate learning. Journal of Experimental Psychology, 1958, 55, 554-558.

Blank, M. & Altman, L. D. Effect of stimulus modality and task complexity on discrimination and reversal learning in preschool children. Journal of Experimental Child Psychology, 1968, 6, 598-606.

Boat, B. M. & Clifton, C. Verbal mediation in 4-year-old children. Child Development, 1968, 39, 505-514.

Bugelski, B. R. Words and things and images. American Psychologist, 1970, 25, 1002-1012.

Bush, E. S. & Cohen, L. B. The effects of relevant and irrelevant labels on short-term memory in nursery school children. Psychonomic Science, 1970, 18, 228-229.

Daehler, M. W., Horowitz, A. B., Wynns, F. C., & Flavell, J. H. Verbal and nonverbal rehearsal in children's recall. Child Development, 1969, 40, 443-452.

Davidson, R. E. Interference among images? In Issues in imagery and learning: Four papers. Theoretical Paper No. 36, Wisconsin

Research and Development Center for Cognitive Learning, Madison, February 1972.

Davidson, R. E. & Levin, J. R. Imagery in transfer. Technical Report No. 249, Wisconsin Research and Development Center for Cognitive Learning, 1973.

Davidson, R. E., Schwenn, E. A., & Adams, J. F. Semantic effects in transfer. Journal of Verbal Learning and Verbal Behavior, 1970, 9, 212-217.

Flavell, J. H. Developmental studies in mediated memory. In L. Reese and J. Lipsitt (eds.), Advances in child development and behavior, Vol. 5. New York: Academic Press, 1970.

Flavell, J. H., Beach, D. R., & Chinsky, J. M. Spontaneous verbal rehearsal in a memory task as a function of age. Child Development, 1966, 37, 283-299.

Goulet, L. R. Interlist response meaningfulness and transfer effects under the A-B, A-C paradigm. Journal of Experimental Psychology, 1965, 70, 264-269.

Goulet, L. R. Verbal learning in children: Implications for developmental research. Psychological Bulletin, 1968, 69, 359-376.

Goulet, L. R. & Sterns, H. L. The effect of verbalization on discrimination learning and transfer in nursery school children. Journal of Experimental Child Psychology, 1969, 7, 479-484.

Goulet, L. R. & Sterns, H. L. Verbal discrimination learning and transfer with verbal and pictorial materials. Journal of Experimental Child Psychology, 1970, 10, 257-263.

Hagen, J. W., Hargrave, S., & Ross, W. Prompting and rehearsal in short-term memory. Child Development, 1973, 44, 201-204.

Hagen, J. W. & Kingsley, P. R. Labeling effects in short-term memory. Child Development, 1968, 39, 113-121.

Hall, V. Acquisition and transfer differences between kindergarteners and second-graders on aurally and visually presented paired-associates using an A-B, A-C design. Journal of Experimental Child Psychology, 1969, 7, 400-406.

Holyoak, K., Hogeterp, H., & Yuille, J. C. A developmental comparison of verbal and pictorial mnemonics in paired-associate learning. Journal of Experimental Child Psychology, 1972, 14, 53-65.

Jeffrey, W. E. Transfer. In H. Reese and L. Lipsitt (eds.), Experimental child psychology. New York: Academic Press, 1970.

Jensen, A. R. & Rohwer, W. D. Syntactical mediation of serial and paired-associate learning as a function of age. Child Development, 1965, 36, 601-608.

Jung, J. Effects of response meaningfulness (m) on transfer of training under two different paradigms. Journal of Experimental Psychology, 1963, 65, 377-384.

Kausler, D. H. & Kanoti, G. A. R-S learning and negative transfer effects with a mixed list. Journal of Experimental Psychology, 1963, 65, 201-205.

Keeney, T. J., Cannizzo, S. R., & Flavell, J. H. Spontaneous and induced verbal rehearsal in a recall task. Child Development, 1967, 38, 953-956.

Kendler, H. H. & Kendler, T. S. Vertical and horizontal processes in problem solving. Psychological Review, 1962, 69, 1-16.

Kendler, T. S. An ontogeny of mediational deficiency. Child Development, 1972, 43, 1-17.

Keppel, G. Verbal learning in children. <u>Psychological Bulletin</u>, 1964, <u>61</u>, 63-80.

Kingsley, P. & Hagen, J. Induced vs. spontaneous rehearsal in short-term memory in nursery school children. <u>Developmental Psychology</u>, 1969, <u>1</u>, 40-46.

Kirk, R. E. <u>Experimental design: Procedures for the behavioral sciences</u>. Belmont, California: Wadsworth, 1968.

Kirk, W. J. & Johnson, J. T. Negative transfer as a function of IQ and mode of presentation in paired-associate learning. <u>Journal of Experimental Child Psychology</u>, 1972, <u>14</u>, 233-241.

Levin, J. R. What have we learned about maximizing what children learn? Theoretical Paper, Wisconsin Research and Development Center, for Cognitive Learning, Madison, in press.

Levin, J. R. When is a picture worth a thousand words? In <u>Issues in imagery and learning: Four papers</u>. Theoretical Paper No. 36, Wisconsin Research and Development Center for Cognitive Learning, Madison, February 1972.

Martin, E. Stimulus meaningfulness and paired-associate transfer. <u>Psychological Review</u>, 1968, <u>75</u>, 421-441.

McCabe, A. E., Levin, J. R., & Wolff, P. The role of overt activity in children's sentence production. <u>Journal of Experimental Child Psychology</u>, 1974, <u>17</u>, 107-114.

Moely, B. E., Olson, F. A., Hawles, T. G., & Flavell, J. H. Production deficiency in young children's clustered recall. <u>Developmental Psychology</u>, 1969, <u>1</u>, 26-34.

Neisser, U. <u>Cognitive psychology</u>. New York: Appleton-Century-Crofts, 1967.

Noble, C. E. An analysis of meaning. Psychological Review, 1952, 59, 421-430.

Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. The measurement of meaning. Urbana, Illinois: University of Illinois Press, 1957.

Paivio, A. Imagery and verbal processes. New York: Holt and Co., 1971.

Paivio, A. Mental imagery in associative learning and memory. Psychological Review, 1969, 76, 241-263.

Paivio, A. & Madigan, S. A. Imagery and association value in paired-associate learning. Journal of Experimental Psychology, 1968, 76, 35-39.

Porter, L. W. & Duncan, C. P. Negative transfer in verbal learning. Journal of Experimental Psychology, 1953, 46, 61-64.

Postman, L. Transfer, interference, and forgetting. In J. W. Kling and L. A. Riggs (eds.), Woodworth and Schlosberg's experimental psychology, 3rd ed. New York: Holt, Rinehart, and Winston, 1971.

Price, L. E., Cobb, N. J., & Morin, N. J. Associative interference as a function of amount of first-task practice and stimulus similarity. Journal of Experimental Child Psychology, 1968, 6, 202-211.

Reese, H. W. (Chm.) Imagery in children's learning: A symposium. Psychological Bulletin, 1970, 73, 383-421.

Reese, H. W. Verbal mediation as a function of age level. Psychological Bulletin, 1962, 59, 502-509.

Robinson, J. P. Effects of verbal and imaginal learning on recognition, free recall, and aided recall tests. Journal of Experimental Psychology, 1970, 86, 115-117.

Robinson, J. P. & London, P. Learning and imagining as aids to memory.

Child Development, 1971, 42, 641-644.

Rohwer, W. D., Jr. Mental elaboration and learning proficiency. In J. P. Hill (ed.), Minnesota symposium on child psychology, Vol. 4. Minneapolis: University of Minnesota Press, 1970.

Rohwer, W. D., Jr. Social class differences in the role of linguistic structures of paired-associate learning: Elaboration and learning proficiency. Final report on basic research, Project No. 5-0605, U.S. Office of Education, 1967.

Rowe, E. J. Discrimination learning of pictures and words: A replication of picture superiority. Journal of Experimental Child Psychology, 1972, 14, 323-328.

Schwenn, E. A. & Davidson, R. E. Syntactical mediation and transfer. Journal of Educational Psychology, 1970, 61, 440-444.

Silverman, I. W. & Craig, J. G. Mediational performance as affected by overt verbalization during training and testing. Child Development, 1969, 40, 295-305.

Spiker, C. C. Associative transfer in verbal paired-associate learning. Child Development, 1960, 31, 73-87.

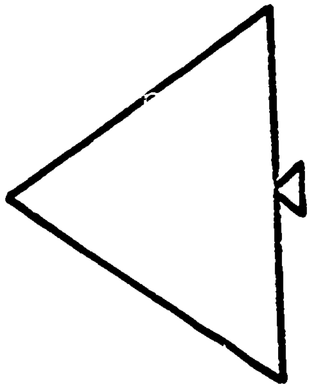
Twedt, H. M. & Underwood, B. J. Mixed vs. unmixed lists in transfer studies. Journal of Experimental Psychology, 1959, 48, 111-116.

Underwood, B. J. & Schulz, R. W. Meaningfulness and verbal learning. New York: Lippincott, 1960.

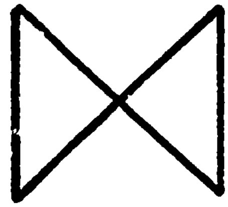
APPENDIX A

Experiment I

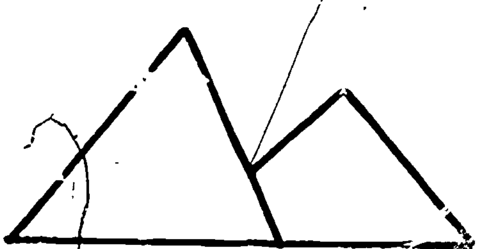
C-D	A-Br
Snake-House	Snake-Glasses
Bow-Hat	Bow-Spider
Pie-Glasses	Pie-Radio
Bus-Spider	Bus-Hat
Lamp-Radio	Lamp-House
Spoon-Bell	Spoon-Television
Log-Television	Log-Table
Fish-Desk	Fish-Bell
Window-Mountain	Window-Desk
Knife-Table	Knife-Mountain
Telephone-Boat	Telephone-Flag
Gun-Piano	Gun-Ring
Bicycle-Piano	Bicycle-Dog
Owl-Flag	Owl-Boat
Plane-Dog	Plane-Ring



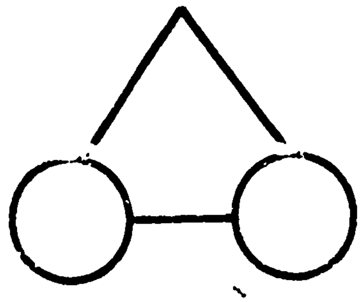
Fish



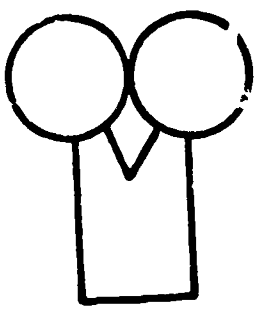
Bow



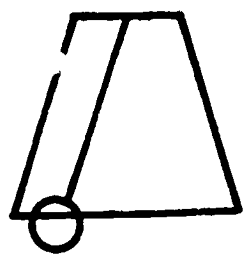
Mountains



Glasses



Owl



Bell

APPENDIX B

Experiment II

C-D	A-Br
Snake-House	Snake-Glasses
Pie-Glasses	Pie-Radio
Lamp-Radio	Lamp-House
Spoon-Bell	Spoon-Mountains
Fish-Desk	Fish-Bell
Window-Mountains	Window-Desk
Bicycle-Piano	Bicycle-Flag
Gun-Ring	Gun-Piano
Owl-Flag	Owl-Ring

APPENDIX C

Experiment III

C-D	A-Br
The SNAKE crawls under the HOUSE	The SNAKE wears the GLASSES
The BOW falls off the HAT	The BOW decorates the SPIDER
The LAMP knocks over the PURSE	The LAMP lights up the MOON
The PIE smears the GLASSES	The PIE splatters the HOUSE
The BUS crushed the SPIDER	The BUS delivers the RADIO
The MONKEY plays the RADIO	The MONKEY carries the PURSE
The GUN shoots through the RING	The GUN rips the HAT
The BOY looks at the MOON	The BOY polished the RING
The CAKE is in the MAILBOX	The SPOON lands on the BED
The SPOON rings the BELL	The BICYCLE slips on the BAT
The KNIFE cuts the BED	The FISH nibbles the BELL
The FISH swims into the DESK	The HAND plays the PIANO
The BICYCLE rams the PIANO	The CAKE falls on the DESK
The LEAF sticks to the BAT	The KNIFE slides down the MOUNTAIN
The HAND holds the BOTTLE	The LEAF floats over the MAILBOX
The RABBIT climbs the MOUNTAIN	The RABBIT drinks from the BOTTLE
The SOLDIER eats the BREAD	The SOLDIER reads the BOOK
The CONE melts in the CUP	The CONE is under the UMBRELLA
The HORSE licks the STAMP	The HORSE kicks the CUP
The KEY opens th 'MBRELLA	The KEY presses down the STAMP
The TRUCK drags the SHIRT	The TRUCK drives through the WINDOW
The TELEPHONE rings on the BOAT	The TELEPHONE wakes up the DOG
The TREE breaks the WINDOW	The TREE smashes the CHAIR
The LOG leans against the TELEVISION	The LOG rolls over the SHIRT
The OWL waves the FLAG	The OWL watches the TELEVISION
The DUCK sits in the CHAIR	The DUCK pecks the BANANA
The PLANE scares the DOG	The PLANE pulls the FLAG
The CANDLE burns the BANANA	The CANDLE drips on the BOAT
The SCISSORS slashes the TIRE	The SCISSORS slices the BREAD
The FAN blows on the BOOK	The FAN catches the PIN
The SHOE steps on the PIN	The SHOE squashes the STRAWBERRY
The BELT is around the STRAWBERRY	The BELT ships the TIRE

APPENDIX D

Experiment I

Source of Variance			df	MS	F
Between Ss			71	--	--
Conditions		3		10.91	--
$\hat{\psi}_1$	1			32.00	3.81
$\hat{\psi}_2$	1			.03	<1
$\hat{\psi}_3$	1			.29	<1
Error		68		8.39	
Within Ss			216	--	--
Item Types		1		420.51	75.36*
Item Types x Conditions		3		6.69	--
Item Types x $\hat{\psi}_1$	1			5.56	<1
Item Types x $\hat{\psi}_2$	1			12.25	2.19
Item Types x $\hat{\psi}_3$	1			2.25	<1
Error		68		5.58	--
Trials		1		241.67	59.20*
Trials x Conditions		3		5.37	--
Trials x $\hat{\psi}_1$	1			.50	<1
Trials x $\hat{\psi}_2$	1			3.36	<1
Trials x $\hat{\psi}_3$	1			12.25	2.99
Error		68		4.09	--
Item Types x Trials		1		5.55	1.95
I.T. x Trials x Conditions		3		4.90	--
I.T. x Trials x $\hat{\psi}_1$	1			2.00	<1
I.T. x Trials x $\hat{\psi}_2$	1			12.25	4.29*
I.T. x Trials x $\hat{\psi}_3$	1			.44	<1
Error		68		2.85	--

* $p < .05$

APPENDIX E

Experiment II

Source of Variance			df	MS	F
Between Ss			47	--	--
Conditions		3		4.07	--
$\hat{\psi}1$	1			12.00	2.29
$\hat{\psi}2$	1			.04	<1
$\hat{\psi}3$	1			.17	<1
Error		44		5.24	
Within Ss			144		
Item Types		1		108.00	34.15*
I.T. x Conditions		3		15.40	--
I.T. x $\hat{\psi}1$	1			5.33	1.68
I.T. x $\hat{\psi}2$	1			1.39	<1
I.T. x $\hat{\psi}3$	1			37.50	11.86
Error		44		3.16	
Trials		1		14.08	4.94*
Trials x Conditions		3		2.81	--
Trials x $\hat{\psi}_1$	1			4.08	1.43
Trials x $\hat{\psi}_2$	1			4.17	1.46
Trials x $\hat{\psi}_3$	1			.17	<1
Error		44		2.85	
Item Types x Trials		1		.83	<1
I.T. x Trials x Conditions		3		.47	--
I.T. x Trials x $\hat{\psi}_1$	1			1.02	<1
I.T. x Trials x $\hat{\psi}_2$	1			.04	<1
I.T. x Trials x $\hat{\psi}_3$	1			.17	<1
Error		44		2.08	

* $p < .05$

APPENDIX F

Experiment III

Source		df	MS	F
Between Ss		47	--	--
Conditions	2		3285.36	42.33*
Error	45		77.62	
Within Ss		144	--	--
Item Types	1		981.22	66.12*
I.T. x Conditions	2		47.12	3.18
Error	45		14.84	
Trials	1		3087.90	175.25*
Trials x Conditions	2		41.31	2.34
Error	45		17.62	
Item Types x Trials	1		4.70	
I.T. x Trials x Conditions	2		58.24	8.55*
Error	45		6.81	

* $p < .05$

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