EFFECTS OF RETRIEVAL INSTRUCTIONS ON CHILDREN'S RETENTION FOR BIZARRE AND NONBIZARRE PICTURES

by

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(ABSTRACT)

There is a transitional period between preschool and first grade during which children develop from reliance on instructions to self-sufficient, spontaneous retrieval. Past research has revealed that retrieval instructions are vital to preschoolers' retention of paired-associates. Preschool and kindergarten children were presented with a mixed-list of 20 paired-associate pictures to learn. Ten of the 20 pairs depicted 2 nouns as interacting in an uncommon or bizarre (funny) manner with one another whereas the other 10 pictures depicted component nouns as normally (nonfunnily) interacting. Type and timing of instructions to learn the paired-associates were manipulated. Funny-group subjects were provided with encoding instructions highlighting the silliness quality of the pictures. Nonfunny-group subjects were provided with encoding instructions which concentrated on the interactive aspects of the pictures. A control group was told to remember the pictures "really hard." For the former two instructional groups, half of each group served as a control during test-time. These control groups were told to try really hard to remember the pictures. The experimental halves of these groups were given elaborative retrieval instructions at test-time, dependent upon their encoding instructions. Reference to the funny pictures was provided for half the Funny group whereas reference to the normal interaction was given to half the Nonfunny group. This study revealed that elaborative instructions do not enhance memory for paired-associates over nonelaborative or control instructions. These preschoolers did not exhibit retrieval deficiencies though control retrieval instructions may have provided sufficient information to enhance memory. As well, nonbizarre (nonfunny) interactive pictures were remembered better than bizarre (funny) interactive pictures.

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This work is dedicated to the memory of

Albert J. Tomalis, Jr.

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For the past 15 years, research has been conducted to assess children's use of learning strategies to enhance memory (see Kail & Hagen, 1977). Basically, a learning strategy enables an individual to integrate actively new information with existing knowledge thereby aiding the encoding, storage and eventual use of the new material on subsequent tasks (Mayer, 1980). One memory strategy studied in this paper is elaboration, which will be defined in the context of paired-associate learning. Paired-associate learning involves connecting two nouns by relating them in some manner. For example, two nouns may be joined by a verb, as in "boy bounced ball," or the nouns may be depicted as pictorially related by showing a boy bouncing a ball. This study examined the factors which facilitate paired-associate learning. Two specific factors, bizarreness and retrieval instructions were examined with regard to how their influence may change developmentally. This study also explored the relative importance of specific determinants of paired-associate learning, particularly the importance of elaboration at encoding.

Elaboration through interaction of paired-associates, the bizarreness of this interaction and instructions highlighting the interaction were examined. Each determinant will be defined and studies will be reviewed concerning its effects on memory for paired-associates. Finally, a study which assesses the role of bizarreness in light of elaborative retrieval instructions is discussed, with emphasis on the developmental significance of this study.

The Role of Elaboration in Memory

Elaboration is a coding technique associated with proficient paired-associate learning (see Rohwer, 1973). Elaboration may be implemented in several modes depending on the nature of the to-be-remembered material. In general, elaboration refers to establishing a relationship or association between the to-be-remembered items. Many types of elaborations, be they visual or verbal, may aid retention of target items (see Paivio, 1971). For to-be-remembered nouns, such as a monkey and a chair, a pictorial elaboration would involve showing a picture of a monkey sitting on a chair. Verbal elaboration would consist of stating "the monkey is sitting on the chair," with no visual cues.

In general, children's abilities to generate mental images of concrete objects surpass their abilities to associate two nouns verbally (Bender & Levin, 1976). However, Rohwer (1970) found that children below the age of 4 years, 6 months are significantly different than older children in retention of visually elaborated pictures. He argued that verbal presentation facilitates recall more than visual presentation in this younger age group, probably due to the fact that the younger children are less likely to label pictures verbally than older children. This hypothesis, however, is probably incorrect (Pressley, 1977). Instead, with development, children are more likely to use memory strategies consciously to learn, and are often called "mnemonic" (Higbee, 1979; Pressley, 1982). Furthermore, pictures may become more meaningful in the sense that these pictures stand out in the subject's memory. The quality of distinctiveness does play a role in memory. Distinctiveness is defined in terms of the entire set of stimuli. One item may be distinct relative to the other common items because it stands-out in the person's memory. A bizarre picture, (e.g., a kite smashed over a boy's head) would be distinctive, in comparison with normal, everyday pictures (e.g., a boy flying a kite) (McDaniel & Einstein, 1986). This, in turn, could cause increased memory for pictures.

Developmental changes in the relative effectiveness of verbal and visual elaboration may be attributed to the presence of spatial interaction in visual elaborations. Unlike verbal elaborations, pictorial elaborations depict the

to-be-remembered nouns as interacting (i.e., doing something together spatially Research has shown that interactive pictures are recalled better than noninteractive (i.e., showing the target items side-by-side) pictures in paired-associate tasks (Davidson & Adams, 1970; Kee & Rohwer, 1974; Rohwer, Kee & Guy, 1975). Similarly, Rohwer (1973) proposed that elaborative presentation, particularly use of interactive paired-associates, prompts the encoding of common referents for otherwise disparate items. Consequently, these referents establish a more meaningful relational encoding for the items, thereby increasing their availability as compared to standard presentation pairs, which lack such meaningfulness to the subject. The research depicting the types of interactive elaboration, including comparisons of bizarre versus nonbizarre elaborations, will now be examined.

The Importance of Bizarreness in Elaboration:

Initial Studies

Following the discovery of the importance of interaction in paired-associate learning, research focused on the effects of varying types of interaction. Since the age of Greek philosophers, mnemonic devices have been used to enhance memory. The word "mnemonic" means "aiding the memory." Lorayne, a professional mnemonist, and Lucas, in their book "The Memory Book," (1974) stressed the importance of forming bizarre pictures and associations when memorizing lists of names, places, etc. For example, when forming an image of a plane and a tree, one should imagine "trees boarding the plane rather than a plane flying over a tree" (Lorayne & Lucas, p. 10). Bizarre associations should enhance the meaningfulness of the to-be-remembered nouns and thereby improve recall relative to nonbizarre associations (Bower, 1970).

However, research does not support the Lorayne and Lucas (1974) idea that bizarreness is a key component for memory. Bizarreness refers to a strikingly unusual relationship between the two to-be-remembered target nouns (Wollen, Weber & Lowry, 1972). Using adult subjects, Wollen, Weber and Lowry (1972) first studied the effects of bizarreness when assessing recall of pictures. In the Wollen et. al. study, both the interactiveness and bizarreness of pictures were manipulated. A bizarre interactive picture included the two target nouns interacting in an unusual manner (e.g., a piano smoking a cigar). A bizarre, noninteractive picture depicted each noun doing something unusual, without interacting with the second noun (e.g., the cigar burning at both ends; the piano balanced on one leg). Interactive pictures of to-be-remembered associates led to higher levels of recall than standard, noninteractive pictures in the Wollen study. However, bizarreness of the pictures had no impact on recall.

Subsequent research supported the finding that bizarre imagery, in in general, is no more effective than plausible imagery (e.g., Beven & Feuer, 1977; Nappe & Wollen, 1973; Hauck, Walsh & Kroll, 1976; Senter & Hoffman, 1976). In some studies, subjects were instructed to form their own interactive pictures, as bizarre and/or nonbizarre images (Collyer, Jonides & Beven, 1972;

Nappe & Wollen, 1973). It was hypothesized that more time would be spent on the pairs if subjects generated their own interactive images than if they were provided with experimenter-generated images. In addition, Nappe and Wollen (1973) hypothesized that bizarre images would be more efficient and be remembered more readily than nonbizarre images due to a distinctive quality inherent in bizarre images. They argued that less time would be spent generating bizarre images than nonbizarre images simply because "funny" associations should be easier to form with random pairings of words not normally associated. In the Nappe & Wollen study, a within-subject design was employed in which each subject was instructed to form 24 bizarre images and 24 common images for a total of 48 word pairs. The pairs consisted of words which, according to the Experimenters' judgments, would be readily formed as either bizarre or common interactions. Nappe and Wollen found that bizarre images did not facilitate recall for the paired-associates relative to the nonbizarre images although these images did take significantly longer to generate. Intuitively, this finding makes sense. It should be easier to form a common interactive image for related nouns, such as table and chair, than to form a bizarre interactive image because such nouns often are paired together in free association tasks (Palermo and Jenkins, 1964). Thus, random pairings could facilitate bizarre imagery generation over controlled, related pairings.

A related issue in the Nappe and Wollen study concerns their construction of word pairings. Instead of randomly assigning pairs, Nappe and Wollen systematically matched moderately associated words. By doing so, they avoided the confound that paired-associates may be bizarre simply as a function of being associated. For example, Wollen, Weber and Lowry (1972) randomly paired "whale and cradle" as a stimulus pair. Any combination of whale and cradle may appear to be bizarre in and of itself, whether interacting bizarrely or nonbizarrely. The degree of associability of words in the first place may dictate the degree of bizarreness of word pairs. Thus, in the present study, pairs were matched according to controlled associative criteria to avoid implausible pairings. The few studies which have found bizarreness to be effective in paired-associate learning will now be reviewed.

Two of the three studies reporting a significant effect of bizarreness incorporated sentences as stimuli rather than interactive pictures (Merry, 1978; Merry & Graham, 1978). The third study (Webber & Marshall, 1978) involved experimenter-generated pictorial representations. Like the Nappe and Wollen (1973) study, these studies predominantly followed a mixed-list design in which subjects were shown pictures of both bizarre interactive noun pairs and nonbizarre interactive noun pairs.

Merry and Graham (1978) asked 12-year-olds to recall nouns presented in 6 bizarre, 6 normal and 6 abstract sentences; each sentence was rated by both the experimenter and subject as belonging to the appropriate category. For example, a bizarre sentence would be "The man pecked the worm." By replacing the subject of the sentence with a new noun, the normal sentence "The hen pecked the worm" was formed. Abstract sentences contained two abstract nouns in a nonbizarre relationship as in "The idea changed the rule." With this mixed-list design, 12-year-olds recalled words from sentences they had rated as producing bizarre images more often than they recalled the same words incorporated in sentences rated as normal. In addition, the value of bizarreness was noted in both immediate and unexpected delayed recall.

Merry (1980) replicated the Merry and Graham (1978) study using adult subjects because most of the research to date has analyzed adults rather than children. Each subject rated the 18 sentences for bizarreness, as before, and was tested for immediate and delayed recall. Subjects were instructed to form images for each sentence and did not expect to be tested on the nouns. Because bizarre sentences were remembered better than nonbizarre and abstract sentences, and subjects believed that image-formation was the task and not recall, Merry inferred that subjects were forming images as instructed. Merry found that recall of the nouns in bizarre sentences was 49% better than memory for those same nouns in ordinary sentences on the immediate recall test, and 144% better on the unexpected delayed test. He explained the bizarreness advantage in terms of individual differences in motivation when forming images for bizarre sentences and in terms of interference factors. Bower (1970) argued that facilitation of memory based on bizarre images was due to

increased arousal and interest in novel associations. Arousal increases the ability to encode the paired-associates. However, at retrieval time, the arousal is absent, and some undefined mechanism allows the target noun to be remembere (Bower, 1970). Merry (1980) found support for this hypothesis, adding that subjects seemed to be amused more often by bizarre sentences than by ordinary ones. He also argued that when bizarre images are retrieved, less information interferes with the remembered items than when nonbizarre images are retrieved. That is, common images in memory interfere with one another but bizarre images are distinctive and therefore less likely to suffer from interference.

Webber and Marshall (1978) also used a within-list design, which featured pictorial interacting nouns with no verbal elaboration. While studying adults, they found that bizarre imagery facilitated recall under the prescribed conditions of intentional learning and delayed recall. Subjects were told to perform one of three orienting tasks while viewing the interacting pairs. The shallowest level of processing involved asking the subjects to write down the first initial of each noun depicted in the pictures or to note the geometric shape of the nouns. A functional condition in which subjects indicated if the interaction was plausible or implausible represented a deeper level of processing. Finally, the deepest level of processing involved the intentional learning condition in which subjects were instructed to write down the first letter of each noun as well as write the association of the nouns for later recall, as depicted in the interactive picture. In addition, these latter subjects anticipated a recall task.

Bizarreness of stimuli facilitated recall for the intentional learning group but only for delayed (one week) testing. Apparently, subjects who were aware that they would be tested for recall of paired-associates used bizarreness to facilitate recall. Persons unaware of testing circumstances did not perform any differently in remembering bizarre and nonbizarre images. Bizarreness did not facilitate memory for any of the groups in immediate recall. In fact, the intentional group's performance on bizarre pictures was slightly lower in immediate recall than that of the incidental functional group. This finding

parallels findings in other immediate versus delayed testing paradigms in that the effect of bizarreness was observed only in delayed recall conditions (Andreoff & Yarmey, 1976; O'Brien & Wolford, 1982). These other paradigms will be reviewed below. Based on the Webber and Marshall (1978) and McDaniel and Einstein (1986) studies, one may infer the importance of certain determining factors with regard to the effects of bizarreness on recall. These factors included use of mixed-list designs, delayed testing conditions, and intentional learning instructions. In the next section, these determining factors will be discussed in further detail.

The Importance of Bizarreness: Determining Factors

Considering the large number of studies refuting the facilitative effect of bizarreness on recall, the above three studies (i.e., Merry, 1980; Merry & Graham, 1978; Webber & Marshall, 1978) should be reassessed in order to determine the conditions in which bizarreness facilitates recall. If these conditions are outlined, then the conflicting literature may make more sense with regard to the controversy over the bizarreness issue. As noted, the mixed-list design may be considered a viable parameter to facilitate recall. In past research, mixed list designs employ both bizarre interactive paired-associates and nonbizarre interactive paired-associates per subject (Webber & Marshall, 1978). Other parameters to be discussed will include the importance of free versus cued recall, the effect of immediate versus delayed testing and, finally, the importance of instructions presented during the task. Instructions will be reviewed with regard to their type and timing.

To begin with, Wollen and Cox (1981) attempted to replicate the Merry studies, using a mixed-list design and testing cued- versus free- recall for bizarre, nonbizarre and abstract sentences. Using the same 18 sentences introduced by Merry and Graham (1978), Wollen and Cox (1981, Expt. 1) found that nouns in bizarre sentences were remembered more readily than nouns in nonbizarre or abstract sentences in a free-recall task. With cued-recall testing (i.e., when one noun was given and the subject was instructed to indicate the matching noun), the nouns in the nonbizarre sentences were remembered more often than the nouns in the bizarre sentences. However, Wollen and Cox reasoned that subjects would be more likely to pair two nouns together that normally go together than to associate freely words not normally related to one another. That is, they would be more likely to pair the word "fish" with "pond" than with "telephone," biasing results in favor of memory for the nonbizarre sentences when guessing occurred. Although it is important to note that the factor of mixed-list designs is important in paired-associate learning, no studies comparing strictly mixed-list versus homogeneous-list designs have been conducted.

Similarly, the procedure of switching the sentence subjects to form the

bizarre sentences in the Merry and Graham (1978) study may have also introduced a "bizarre inter-sentence" cue bias. That is, when one sentence subject is recalled during free recall, it provides a cue for the second sentence subject. For example, if a subject recalled the bizarre sentence "The hen smoked the cigar," the word "hen" could very well be associated with the "pecked the worm" whereas a "man" could be associated with "smoked a cigar." Thus, remembering one bizarre sentence via free recall cues the second bizarre sentence. Therefore, the second sentence "The man pecked the worm" could be recalled as an artifact of inter-sentence cuing in free recall. A between groups design would eliminate this intersentence cue bias (Wollen & Cox, 1981).

Wollen and Cox, in a second experiment, controlled for both of the above cuing factors by comparing inter-sentence cuing with the absence of such cuing. In this second experiment, a 2 x 2 between-group factorial was employed, with one factor being inter-sentence cuing (i.e., present or absent) and the second factor being type of sentence (i.e., bizarre versus nonbizarre). Even with these controls, the nouns of the bizarre sentences with cued recall were not remembered more often than the nouns of the nonbizarre sentences. Despite the lack of the bizarreness effect, two conclusions can be drawn from the Wollen and Cox study. First, nouns that are highly associated should not be paired in test sentences to avoid guessing of the probed-target noun. Second, between-group designs should be used so that subjects do not study the same noun in more than one sentence or pictorial stimulus.

Having reviewed the importance of the cued- versus free- recall parameter, the determining factor of test timing will now be discussed. In general, it has been found that bizarreness facilitates recall in delayed testing situations when compared with immediate testing.

Several studies support a positive effect of bizarreness on delayed memory for noun pairs (Furst, 1957). These studies were all conducted with college students. As mentioned earlier, Webber and Marshall (1978) found such an effect when testing recall of pictorial paired-associates after a seven-day delay period. Similarly, Delin (1968) reported that improvement in recall persisted for a 15-week period for subjects who formed bizarre links for nouns

as compared to subjects who formed more common links for the same nouns. The effect of bizarreness was found for delayed testing but not for immediate testing. Likewise, O'Brien and Wolford (1982) found similar results in that bizarre imagery facilitated recall over time. However, O'Brien and Wolford found floor effects for both the nonbizarre-control group and the bizarre-experimental group after a seven-day delay. When they traced the deterioration in recall over the seven days, they found an interaction between delay of test and type of image (with bizarre images more distinctive and therefore remembered better than nonbizarre ones). Specifically, type of imagery was found not to have a significant effect on the immediate recall test on Day 1 or Day 3, but on Days 5 and 7 the recall for bizarre images was increased significantly over recall of nonbizarre images. Bizarreness over nonbizarreness should enhance retention after delay because nonbizarre images would fit into subjects' schemes of already-encoded material. Bizarre images would not easily fit in with subjects' common image mind sets. Rather, these images should stand out and be retrieved more readily.

A study by Andreoff and Yarmey (1976) demonstrated an effect of bizarreness in a cued-recall task for both immediate and delayed (i.e., 24 hours) testing. Like the Merry studies, a mixed-list design was implemented. However, subjects were instructed to generate their own images in the Andreoff and Yarmey study. When tested, those words for which bizarre images were recalled were remembered significantly more often than words formed as common images. One might argue, however, that such a positive effect was an artifact due to the random pairings of the nouns. Thus the conclusion that bizarre images are easier to recall than plausible images must be considered tentative.

Despite much research, the controversy regarding the determining factors for the effectiveness of bizarreness in paired-associate learning remains. For instance, in dealing with cued- versus free- recall, Wollen and Cox (1981) is the only study which militates against the use of cued recall in studying bizarreness effects. In most cases, cued recall has not been considered detrimental in paired-associate learning unless the pairings were overly obvious (Andreoff & Yarmey, 1976; Nappe & Wollen, 1973). Similarly, it is important

to control pairings of the 2 associates to eliminate unwanted elements of bizarreness inherent in pairing low associates (such as whale and cradle as well as to eliminate highly-associated pairs (i.e., table and chair). Recall for bizarre imagery, too, is enhanced more by delayed testing than by immediate testing (Andreoff & Yarmey, 1976; O'Brien & Wolford, 1982). Finally, bizarreness has been effective when employing a mixed-list design (i.e., using both bizarre and nonbizarre pictures) rather than a between-list design (i.e., using only all bizarre or all nonbizarre pictures per subject). One final parameter of particular importance, though often neglected in the literature, is the type of instruction the subject receives. The next section will emphasize the importance of instructions with regard to their type and timing in paired-associate tasks.

The Impact of Instructions On the Bizarreness Effect

Often in the literature dealing with the effects of bizarreness, the potential importance of elaboration instructions is ignored. In fact, memory studies are often conducted and cited in journals with no reference to the types of instruction implemented. In contrast, studies aimed at teaching subjects specific mnemonic strategies, such as the keyword method and the method of loci, have included detailed reports of the instructions employed (Pressley & Dennis-Rounds, 1980). Research conducted on the effects of instructions on learning and retention of verbal material is limited . In general, when learning strategies are taught, they have proven to be effective (Pressley & Dennis-Rounds, 1980).

Instructions should greatly facilitate children's recall performance for two reasons. First, elaboration, in the form of pictorial or verbal interactions, has been found to increase children's performance of memory tasks over standard presentation of paired-associates (Emmerich & Ackerman, 1979; Kett & Nakayama, 1982). Any form of elaboration in conjunction with pictorial elaboration, then, should continue to facilitate recall because instructions should highlight the elaboration. Second, retrieval instructions should remind (or prompt) children who do not normally associate the strategy with which they learn the noun pairs to their performance (Pressley & MacFadyen, 1983). Therefore, children may not think to retain a mnemonic strategy between encoding and recall phases without instructions to do so. Such children are said to have production deficiencies (Flavell, 1977). In the following paragraphs, type of instructional prompts for children as well as timing of instructions will be examined. Then, the developmental implications of this study will be reviewed.

Typical instructions depend on whether target stimuli are pictures or words. If pictorial elaborates are shown, then simple instructions to "try hard to remember the items in the picture" are typically used (e.g., Andreoff & Yarmey, 1976; Emmerich & Ackerman, 1979). When words are presented, the subjects are usually instructed to generate their own interactive images. Then, instructions incorporated here would be: "construct a picture by imagining the two nouns doing something together" (e.g., Higbee & Millard, 1981;

Merry, 1980). Testing generally consists of a cued-recall task in which one noun is stated and the subject must recall the target paired-associate. Both of the above encoding instructions are not elaborative. Subjects simply told to remember a bizarre (funny) picture may not understand the mnemonic advantages of remembering pictures in a bizarre (funny) context. If young children perform better on a recall test when they know they will be tested after the encoding period than when the test is unexpected (Andreoff & Yarmey, 1976), then perhaps they should also be informed about the benefits of particular picture types. Paris, Newman & McVey (1985) have shown that demonstrating the utility of memory strategies enhances strategy use and generalization in young children. Therefore, elaborative instructions should prove to be beneficial to learning relative to simple instructions such as "try really hard to remember."

Whereas the content of instructions to elaborate noun-pairs is obviously important, the timing of these instructions may be even more important. In most previous associative learning studies, elaboration instructions have been administered only during the encoding phase and no instructions or reminders have been given during the retrieval period to reinforce use of the assigned mnemonic strategies (Pressley & Levin, 1980; Wolff & Levin, 1972). Referring back to their Levin and Pressley (1978) study, Pressley and Levin (1980) noted that imagery facilitation occurred when image-retrieval instructions were incorporated in the studies (Levin & Pressley, 1978; Pressley & Levin, 1980). In these studies, subjects were reminded to "think back to the picture made (or viewed of the first paired-associate doing something." This cue enabled retrieval of aninteractive picture as compared to control groups not reminded of the interactive images formed (or viewed) during encoding and told only to "try hard to remember what went with the first paired-associate."

The Levin and Pressley (1978) study also indicated that imagery-generation competence develops as a function of age, rather than education. They studied separate samples of 5-year-olds at either the beginning or the end of the kindergarten school year and compared ability to generate paired-associates across the samples. The experimental groups outperformed the

control groups during both Fall and Spring testing. Levin and Pressley found that age predicted paired-associate learning in the experimental condition but not in the control condition and that school experience did not affect performance in either condition.

The Levin and Pressley (1978) results were obtained with 4- to 6-year-olds. Pressley and Levin (1980) extended their experimental design to include older groups of children and found developmental differences in the importance of retrieval instructions. First- and sixth- graders were asked to generate their own images and recall the matched pairs when cued with instructions. Retrieval instructions were found to be vital for first- graders but not for sixth- graders. Apparently, by the time children are in the sixth grade, they no longer need retrieval instructions to improve their memory and remind them of the learning strategies incorporated at encoding. For the first graders, however, the imagery instructions were effective only if the elaborated, imagery instructions were repeated at retrieval.

Pressley and MacFadyen (1983) found that young children require retrieval prompts even when elaborative, interactive pictures are presented. Preschool and kindergarten children were divided into three groups: 1) A Mnemonic + Retrieval (M+R) group in which children were given instructions referring to the interactive pictures both during encoding and retrieval phases of the study ("Think back to the 'picture' of the (paired-associate) doing something"), 2) A Mnemonic (M) group which received instructions referring to the interactive pictures solely during the encoding period (during retrieval they were given control instructions to "try really hard to remember the 'word' that went with (paired-associate)"), and 3) A Control (C) group which was shown standard, noninteractive pictures of paired-associates and instructed at retrieval to"try really hard to remember the 'word' that went with (paired-associate)."

Pressley and MacFadyen (1983) tried to determine the age at which retrieval cues are most important when providing interactive pictures. Kindergartners in this study were found to recall the noun-pairs better than the kindergartners in the Pressley and Levin (1980) study because pictures were

shown rather than generated by the subjects. In addition, those kindergartners who were presented with the mnemonic instructions during encoding performed equally well whether or not the retrieval instructions were also presented. However, preschool children in the M+R group performed significantly better than preschoolers given the mnemonic instructions solely at encoding. All subjects in the M+R groups performed significantly better than control subjects, who were presented with noninteractive, standard pictures and simply instructed to "try hard to remember the 'words'" and not the pictures.

When comparing the M and C groups, Pressley and MacFadyen found that the M group kindergartners performed significantly better than the control group. Thus, the importance of encoding instructions as well as interactive pictures is evident for this age group. Preschool children did not benefit from the mnemonic instructions given solely at encoding. Pressley and MacFadyen (1983) did not employ an interactive picture group implementing control instructions. Perhaps such a group would have led to further evidence regarding the importance of both instructions and elaboration. If learning strategies are most important for kindergartners in recalling paired-associates, then this "interactive" control group would not be expected to perform significantly better than the comparable preschool control group. However, if age is an important factor in development of imagery generation competence, as shown by Levin and Pressley (1978), then performance should vary between the two interactive control groups, with kindergartners recalling more than preschoolers. This idea lends support to a Piagetian framework of cognitive development in which age is one index of the stage of intellectual development and abilities (Piaget, 1968).

The Pressley and MacFadyen (1983) study indicates that retrieval instructions substantially aid recall for preschoolers as compared to kindergartners when interactive pictures are presented. The older children could remember the paired-associates from storage to retrieval solely on the basis of encoding instructions, provided that pictorial elaboration was included. Thus, developmental shifts do occur in the influence of testing cues on memory performance. As children develop, they are less likely to need the instructional

prompts at testing time for elaborated pictures. These results may not be extended to situations in which children generate their own interactive images. Developmental shifts do occur in such situations but at an older age level. At this point, the Pressley and Levin (1980) study is the only study which concentrates on the influence of retrieval cues on children's memory for self-generated interactive images. The rationale for the current study is based on the Pressley and MacFadyen (1983) study of experimenter-provided images and will be discussed below.

Rationale for the Current Study

When children have the abilities and strategies to learn but do not spontaneously implement these strategies, they are said to have production deficiencies (Flavell, 1977). Children in preschool generally must be instructed as to the best way to perform a task, they do not spontaneously use the strategies or cues available to them. As children develop, they begin to use strategies spontaneously. Pressley and MacFadyen (1983) studied this transitional period from production deficiency to spontaneous use of strategies. In the current study, this transitional period of development was also studied. However, the importance of the types of specific instructional prompting and not just instructional prompting per se was assessed in the current study. Children learned paired-associates depicted in either bizarre (funny) or nonbizarre (nonfunny) manners under instructions that did or did not highlight picture type.

Kindergarten and preschool children were studied to determine whether specific retrieval instructions enhance or deter memory for paired-associates. A mixed-list design (within subjects) was incorporated. Each subject saw both bizarre (funny) and nonbizarre (nonfunny) pictures. Previous studies have shown that enhanced learning occurs with a mixed-list design for the paired-associates rather than a between-list design (with one type of list versus another type of sentence)(Merry & Graham, 1978; Webber & Marshall, 1978). Instructions varied in both timing and type. Comparisons were made between groups which simply were given encoding instructions and groups given both encoding and retrieval instructions. Each subject was referred back to the 'pictures' they viewed rather than back to the words which they had heard together. Thus, this study followed the Pressley and MacFadyen (1983) design in that the same age groups were studied and similar instructions were incorporated. Reference to pictures and not to words, however, was a key difference between the present study and the Pressley and MacFadyen (1983) study.

The present study attempted to answer the following specific questions concerning the role of type of pictures and type of instructions on cued recall: 1) whether adding retrieval instructions to encoding instructions; 2) whether encoding instructions are important relative to no instructions); 3) whether the

type of interactive picture has any effect on learning without encoding and/or retrieval instructions and 4) whether there is a developmental shift in cued recall between preschoolers and kindergartners in their memory for paired-associates as a function of either encoding or retrieval instructions.

Subjects were shown a series of 20 interactive pictures and instructed to remember that the "two things in the picture belonged in the same picture." A mixed-list design was used with 10 bizarre-interactive pictures and 10 nonbizarre-interactive pictures. As each picture was shown, subjects were instructed to repeat the identifying labels given to them by the Experimenter because verbal labels facilitate children's memory. For example, 5- and 6-year-olds studied by Wilgosh (1975) and Nelson and Kosslyn (1976) recognized more paired-associates when they verbally labeled the nouns than when no labels were generated. With development, the importance of verbal labeling of pictures declines. Horowitz, Lampel and Takanishi (1969) found that labeling facilitated children's memory in free-recall testing up to the age of ten. Around the age of ten, however, verbal labels do not continue to facilitate memory over a no-label control (Davies, Milnee & Glennie, 1973). This is probably due to the fact that children around the age of 10 spontaneously rehearse and implement learning strategies that increase attention towards the stimulus pairs (Kail, 1979).

In this study, bizarre (funny) interactive and nonbizarre (nonfunny) interactive pictures were compared across three instructional groups. The 2 mnemonic-funny (F) groups were instructed during encoding to "remember the (paired- associate #1) and (paired-associate #2) doing something funny together." One of these F groups received retrieval instructions (i.e., Think back to the picture you saw of the (paired-associate #1) doing something funny...", the second F group (control) was told at retrieval to "try really hard to remember what went with (paired-associate #1)" (Groups 1 and 2, respectively, see Table 1). The 2 mnemonic-nonfunny (NF) groups were instructed during encoding to "Remember the (paired-associate #1) and the (paired-associate #2) doing something together." The first NF group was given these elaborated instructions during retrieval (i.e., "Think back to the picture

you saw of the (paired-associate #1) doing something...", whereas the control retrieval instructions for the second NF group were "Try really hard to remember what went with (paired-associate #1)..." (Groups 3 and 4, respectively, see Table 1). The Control (C) group (Group 5, see Table 1) was told during both encoding and retrieval to "Try really hard to remember the (paired-associate #1) and the (paired-associate #2)." The instructions were provided at encoding and retrieval for both preschoolers and kindergartners to eliminate potential developmental differences in recall due to differences in the need for retrieval prompts (Pressley & MacFadyen, 1983). If recall for paired-associates is facilitated when implementing retrieval prompts over control instructions, then the findings would parallel the Pressley and MacFadyen (1983) data. Thus, the importance of the timing of instructional prompts would be evident.

In addition to confirming the importance of retrieval prompts, the current study tested the hypothesis that the greater the explicitness of instructions, the greater the facilitation for recall of noun-pairs. This hypothesis was based on the findings that elaboration in many forms (e.g., interaction, bizarreness, instruction) enhances recall (Kee & Rohwer, 1974). Rohwer (1970) stated that "meaningfulness" of the paired-associates increases due to elaboration. If retrieval instructions increase meaningfulness of the paired-associates (e.g., by describing that the interaction is funny), then recall should increase for the experimental groups relative to control groups. From this argument, one may predict that the groups given elaborated instructions, whether timed at encoding or encoding plus retrieval, will perform better than the control groups who received no elaborated instructions.

If one were to disregard developmental trends, one would predict that the elaborated instructions for both grades would enhance recall, despite the timing of the instructions. This prediction would support the idea that the better the elaboration, the more memory is facilitated. Comparisons then would show that the funny instructions groups would recall more bizarre (funny) pictures than would the nonfunny instructional groups, who, in turn, would recall more than the control groups. However, developmental trends do occur within these age

Table 1

Each Group and its Respective Encoding and Retrieval Instructions

Group	Encoding Instruction	Retrieval Instruction
1 Funny Retrieval (F-R)	The best way to remember the _____ and the _____ is to remember that they are doing something funny together.	SAME
2 Funny Control (F-C)	The best way to remember the _____ and the _____ is to remember that they are doing something funny together.	Try really hard to remember
3 Nonfunny Retrieval (NF-R)	The best way to remember the _____ and the _____ is to remember that they are doing something together.	SAME
4 Nonfunny Control (NF-C)	The best way to remember the _____ and the _____ is to remember that they are doing something together.	Try really hard to remember
5 Control (C)	The best way to remember the _____ and the _____ is to try really hard to remember them.	SAME

groups, and therefore, the predictions must be reevaluated.

With regard to developmental trends, young preschoolers rely on retrieval prompts to aid recall. Without such prompts, recall for a group given encoding instructions only resembles that of a control group (Pressley & MacFadyen, 1983). However, kindergartners in the experimental groups should perform better than controls, regardless of whether or not retrieval instructions were given. With retrieval instructions, the F and NF groups should perform better than the control groups in both age groups.

Explicitness of instructions should be most important for kindergartners because kindergartners are more attuned to the importance of instructions than preschoolers. That is, if funny (F groups) instructions were given, funny pictures would be remembered better than the nonfunny pictures in this mixed-list design. Similarly, nonbizarre pictures should be remembered better with nonfunny encoding instructions than with funny instructions because the picture-type and instructional-type were compatible. Preschoolers were not hypothesized to benefit from types of encoding instructions simply because they have production deficiencies and do not remember encoding instructions at retrieval. Thus, when learning the paired-associates, these children probably would not realize that the types of encoding instructions are relevant.

With the above predictions in mind, several issues which may have affected the current study will be discussed. First, the issue of attention and motivation will be reviewed. Second, the rationale for beginning this study with kindergartners will be presented and, finally, justification for the stimulus materials will be given.

In the current study, it was important to avoid differences between the two grades as a result of lack of attention in younger children. To insure that the subjects were attending to both nouns of the paired-associate, rather than the more salient noun, the subject repeated the Experimenter's identifications of the nouns. In addition, to insure that the subjects were listening to the instructions during encoding and retrieval, the subject was asked to repeat the instructions prior to encoding and after testing for memory of the paired-associates. Further, subjects were given the instructions after every three paired-associates were

viewed.

No noninteractive pictures were incorporated simply because noninteractive pictures have been found to be less effective in facilitating memory for paired-associates than interactive pictures (Senter & Hoffman, 1976; Wollen, Weber & Lowry, 1972). The importance of this study was to assess the value of varying instructions on memory for bizarre (funny) and nonbizarre (nonfunny) interactive pictures. Therefore, should the effect of instructions be more important than the effect of picture type, then noninteractive pictures (both bizarre (funny) and nonbizarre (nonfunny)) will be studied in a continuation study. At this point, Pressley and MacFadyen (1983) sufficiently demonstrated that retrieval instructions do not enhance memory for separate, noninteracting pictures.

When bizarreness has been found to be important in a mixed-list design, free-recall testing and unexpected-delayed testing seem to be important contributing factors. This study only incorporated the mixed-list design. However, it was predicted that bizarre (funny) pictures would be remembered better than nonbizarre (nonfunny) pictures when the funny instructions were implemented. Without such instructions, nonbizarre (nonfunny) pictures would be remembered better than bizarre (funny) pictures because they are congruent with existing ideas about the world. Bizarre (funny) pictures require subjects not given funny instructions to reorganize their existing ideas about normal occurrences in life.

Previous studies (Ceci & Howe, 1978; Ritter, 1978) have shown that preschoolers rely on cues in employing memory strategies and tend not to incorporate memory devices spontaneously. The preschoolers in this study should act similarly to the preschoolers in the Pressley and MacFadyen (1983) study. Therefore, there should be a developmental shift between kindergartners and preschoolers with regard to recall between instructional- and noninstructional- cued recall. The preschoolers should improve much more significantly when given retrieval instructions about the picture elaboration shown to them than when given control retrieval instructions. This finding would support Rohwer's (1973) claim that younger children need added prompts to

studies incorporate encoding instructions with little or no regard to retrieval instructions. This study assessed the varying aspects of types of retrieval enhance their memory. Pressley and MacFadyen (1983) supported the importance of retrieval cues in addition to detailed encoding instructions. Most cues and attempted to answer whether more explicit retrieval cues enhance memory relative to simpler, less detailed instructional cues. Such an assessment would have valuable implications regarding early childhood education.

Method

Subjects

One-hundred-twenty children participated in the main study. Children attended the preschool and kindergarten grades of Roanoke Valley Christian Elementary School and Church Court Day School. Both schools were located in Roanoke, Virginia. Preschoolers ranged in age from 3 years, 2 months to 4 years, 11 months (mean age = 4 years, 3 months). Kindergartners ranged in age from 5 years, 0 months to 6 years, 9 months (mean age = 5 years, 6 months). Children were assigned randomly to one of the 5 experimental conditions and sex and age were counterbalanced across conditions.

An additional twenty children were solicited to serve as a pilot group in categorizing the materials as either bizarre or nonbizarre. Ten four-year-olds (5 males and 5 females) and ten 5-year-olds (5 males and 5 females) participated in the pilot study. Of these twenty pilot children, 14 attended either of the two main-study schools mentioned above, whereas 2 children were students at DaySpring Christian Learning Center, Blacksburg, Virginia, and 4 children were students at the Montessori School of Blacksburg, Virginia. Appendix 1 lists the pilot study paired-associates.

Materials

Each child was presented with a list of twenty paired-associates. Paired-associate nouns were chosen from Thorndike and Lorge's (1944) word frequency index for first graders through college students. To insure that the preschool and kindergarten subjects in this study understood the first grade words found in Thorndike and Lorge (1944), words chosen were compared to words used in preschool and kindergarten reading primers. Words not found in such primers were eliminated from the sample list of stimulus words. Using the Palermo & Jenkins (1964) word association norms, nouns were systematically matched rather than randomly paired so that only moderately associated words were paired. No high- or low- associates were included. This structured pairing avoided added uniqueness or bizarreness to pairs that are not highly associated (e.g., whale and cradle) and controlled for bias caused by guessing two highly-associated words (e.g., table and chair). The

paired-associates were drawn on 5" x 8" index cards as black line drawings, similar to coloring-book pictures. Each noun was used only once. Appendix II includes the list of paired-associates used in this study.For each pair, two types of interacting pictures were drawn. For the purposes of this study, "interaction" was represented by depicting the two nouns doing something together. One of the interacting picture pairs was depicted as a funny or illogical interaction whereas the other picture pair indicated a normal or plausible interaction. For example, for the pair "boy/kite", the bizarre interaction showed the boy with a kite smashed over his head, whereas the nonbizarre picture showed the boy flying a kite (see Figure 1). Each subject saw 10 bizarre pictures and 10 nonbizarre pictures for 15 seconds per picture. Two groups of pictures were employed with each picture randomly assigned to either of the two groups.

A pilot study was conducted to define operationally "bizarre" and to verify that the pictures used in this study were, indeed, bizarre, according to the given age groups. Children in the pilot study were seen individually and asked to identify each of the two items in a set of 29 different stimulus pictures. Labeling allowed the Experimenter to substitute adult identifications with children's own words and identifications. For example, the word "woman" was replaced by the word "lady" as a result of the children's identifications. In addition, children were asked to identify each of the 29 mixed-list stimulus pictures as either bizarre ("funny") or nonbizarre ("nonfunny"). Instructions to these children used words like "funny", "silly", "crazy", "weird", or "not something you would really see" in place of the word "bizarre." Further, children in the pilot study were shown both types of pictures for the same paired-associates after rating the first 29 pictures and were instructed to choose the funny picture and the nonfunny picture of the pair (i.e., 29 forced-choice decisions). Those bizarre pictures categorized as bizarre by over 85% of the children were used in this experiment (see Appendix II). Similarly, nonbizarre pictures meeting this 85% criterion were included. From the 29 pilot pictures, 20 pictures were found to meet this 85% criterion and were incorporated as stimulus pictures in the main study. These 20 pictures were also successfully identified during the

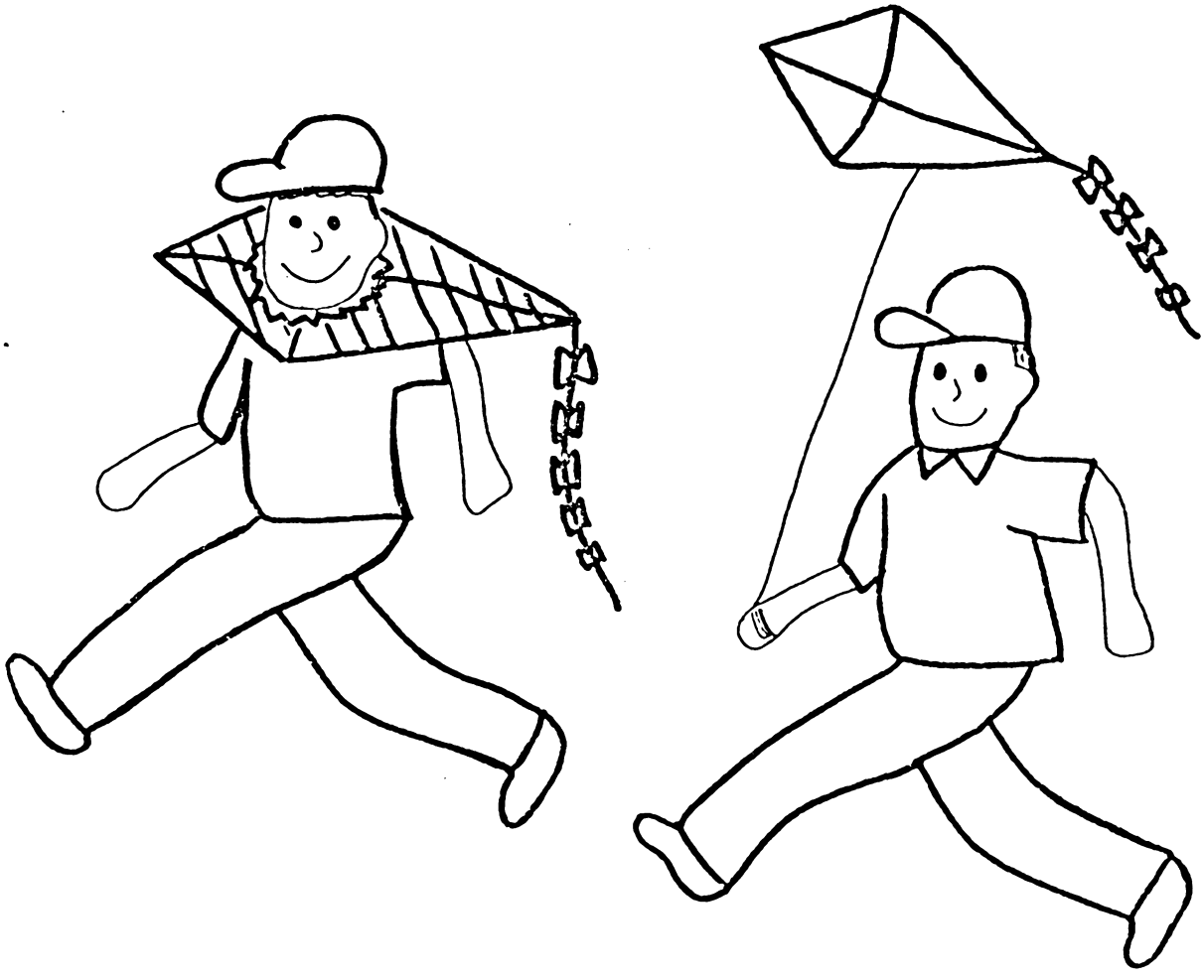

Figure 1. Sample stimulus picture depicting a bizarre and nonbizarre interaction for the paired-associate boy/kite.

forced-choice part of the study (described below) by 95% of the children studied.

Procedure

Children in the main study were tested individually. They were told at the beginning of the session that they would be shown a "bunch of pictures" and that their job would be to remember that "the two things in the picture belong in the same picture." Subjects were asked to repeat these initial instructions to insure that they understood the task at hand. Next, an expectancy question was asked to indicate each child's attitude toward his or her memory capabilities. The rationale for including this section was simply that of interest to the Experimenter, particulary since research in the area of strategy usage has shown that attitudes toward memory tasks and strategies can influence performance (Paris, Newman and McVey, 1982). The idea was that giving the children more chances to express their ideas about the study would perhaps develop further hypotheses whether or not predicted results were obtained. The question incorporated at this point was "How good do you think you're going to be at playing this game? Very Good, Kind of Good, or Not Very Good?" A practice period was provided for each subject prior to the main encoding and testing task. Again, this period was incorporated to make sure that the subjects understood the task. Two pictures, one identified as bizarre in the pilot study and one as nonbizarre, were used in this practice task. For each picture shown, whether sample picture or stimulus picture, the Experimenter identified the nouns and the children were instructed to repeat these identifications while pointing to each paired-associate. Synonyms were not allowed at this point and mistakes were corrected until the child correctly named the pair. Each stimulus picture was shown individually for a 15 second period.

The retrieval instructions described below were given for each paired-associate. Recall testing occurred immediately after the encoding period. Each subject was given a maximum of 15 seconds to recall the target stimulus. Each noun served as either the target stimulus and noun to be identified or as the noun which the Experimenter provided according to random assignment. The order for testing retrieval replicated the presentation order for each subject. This counterbalanced order was replicated across the two grades. No visual cues

were employed during the testing period.

The task instructions varied for each group and were given during the practice and main tasks. These instructions will be explained in the following section in detail. After the instructions were given during the practice task, the child was tested immediately for memory for the practice paired-associate. Children were asked to identify the counterpart of one noun of each of the two practice paired-associates and told that the task would involve and identical testing procedure.

Encoding Instructions. Three types of encoding (i.e., learning) instructions were implemented: Funny, Nonfunny and Control. For the Funny (F) groups (i.e., Groups 1 and 2, see Table 1), the instructions were "The best way to remember that the two things are in the same picture is to remember that they are doing something funny together." The learning instructions for the Nonfunny (NF) group (i.e., Groups 3 and 4, see Table 1) were "The best way to remember that the two things are in the same picture is to remember that they are doing something together." The encoding instructions for the Control (C) group (Group 5, see Table 1) were "The best way to remember that the two things are in the same picture is to try really hard toremember them." These instructions were recited first during the practice paired-associate test. Next, they were repeated prior to the encoding period and after the practice pairs were shown. Finally, they were given after every third paired-associate pair of the 20 test pairs was shown to the subject during the encoding period. Because these instructions were long and mundane (as discovered in the pilot study), the instructions were shortened to include: 1) Funny groups: "remember the _____ and the _____ are doing something funny together," 2) Nonfunnny groups: "remember the _____ and the _____ are doing something together," and 3) Control group: "try hard to remember the _____ and the _____." These condensed instructions were given for each paired-associate. The noncondensed (above) instructions were given after every third paired-associate was shown.

Retrieval Instructions. The retrieval instructions paralled those instructions given during encoding. Here however, control measures were implemented so that future analyses could indicate whether the type of retrieval

instruction was "Think back to the picture you saw of the _____. Try really hard to remember what went with _____." These instructions were given for each instructions or the type of picture facilitated recall for the paired-associates. For instance, for the F groups (Groups 1 and 2, see Table 1), one group received elaborated instructions during retrieval while the second group received control instructions (Groups 1 and 2, respectively). The elaborated retrieval instructions for this F group was "Think back to the picture you saw of the _____ doing something funny. What went with _____?" The control, nonelaborated paired-associate questioned at retrieval time. Similarly, for the two NF groups (i.e., Groups 3 and 4, see Table 1), one group served as the control while the second received elaborated retrieval instructions (Groups 4 and 3, respectively). The elaborated instructions for Group 3 were "Think back to the picture you saw of the _____ doing something. What went with _____?" The control instructions for Group 4 were "Think back to the picture you saw of the _____. Try really hard to remember what went with _____." Finally, the control group (i.e., Group 5, see Table 1) was told to "Think back to the picture you saw of the _____. Try really hard to remember what went with _____", at retrieval. Comparisons of the number of bizarre and nonbizarre pictures remembered for this group would tap any differences in memory for picture-type.

Once the cued recall task was completed, a brief interview assessed whether children had thought anything was funny or bizarre about each of the paired-associates. Each pair was shown to the children again, and subjects were instructed to put the picture in either a "funny" or a "nonfunny" pile. The piles were identified by smiling and nonsmiling (i.e., neutral) faces. When the children's identification disagreed with the Experimenter's classification of the picture, the children were asked immediately to explain their reasons for identifying the picture as such. When the child had no specific reason for placing a picture in the incorrect pile, the Experimenter explained the interaction and the content of the picture. For example, if the child said that the picture of a cat sitting on a chair was funny, the Experimenter suggested that, perhaps, cats could sit on chairs. The interview was included so that results could be compared with results of the pilot study.

The Experimenter then asked the subjects to indicate the method they employed in trying to remember the pictures. They were asked "What was the best way I told you to remember the things in the picture?" This question assessed whether children remembered the encoding instructions, or devised their own method of learning.

After answering all paired-associate match questions, children were asked to rate their success or failure of remembering pictures and rate how well they played the game. Answers to these three questions included a multiple choice of either "very good, kind of good or not very good."

Finally, an attribution question was asked to determine whether children attributed successes or failures to themselves or the Experimenter. The older the children, the more likely they would attribute their successes to the Experimenter simply because they were aware that the Experimenter was providing strategies with which to learn the paired-associate. Dix and Herzberger (1983) have shown that children's attributions of success and failure become more accurate with development.

Results

Strict and lenient critera were established when scoring the subjects' answers. To meet the strict criterion, answers had to match the Experimenter's identifications exactly. For example, the word "man" was not considered a correct substitute for "boy" to meet the strict criterion. With the lenient criterion "man" would be an acceptable substitute for "boy" or for "Indian", etc. Only the data for the strict criterion will be reported because there were no significant differences between the two criteria.

Two judges scored each protocol and there were no disagreements in scoring. Each child received 2 scores, each score ranging from 0 to 10. One score indicated the number of bizarre pictures remembered correctly and the second score represented the correct number of nonbizarre pictures remembered. A 5 (Instructional Group) x 2 (Type of Picture) x 2 (Grade) x 2 (Sex) ANOVA was conducted on these scores and revealed significant main effects of Grade, $\underline{F}$ (1, 100) = 5.77, $\underline{p} < .05$; Instructional Group, $\underline{F}$ (4, 100) = 2.74, $\underline{p} < .05$; Picture, $\underline{F}$ (1, 100) = 6.83, $\underline{p} < .01$ and Sex, $\underline{F}$ (1, 100) = 6.83, $\underline{p} < .01$ as well as 3 significant interactions: Grade x Sex x Picture, Group x Sex x Picture and Grade x Group x Sex. There were developmental increases in the number of correct responses, with kindergartners performing better than preschoolers in 80% of the groups (see Table 2). The nonbizarre pictures were remembered more often than the bizarre pictures and pictures were remembered better by the males than by females 82.5% of the time. The mean number of pictures remembered are presented in Table 2 according to grade, type of picture and type of group and sex (see Table 2).

The main analyses conducted here were designed to answer the following questions: 1) would the mnemonic retrieval instructions produce cued-recall superior to funny/nonfunny control groups, 2) would the funny/nonfunny instructions at encoding produce cued-recall superior to that of the encoding control instructions, 3) was picture-type important without instructional retrieval prompts and 4) was there a developmental transition between preschool and kindergarten from having production deficiencies to spontaneous use of memory strategies. A 5 (Type of instruction: funny-retrieval versus

funny-control versus nonfunny-retrieval versus nonfunny-control versus control) x 2 (Type of Picture: bizarre interactive versus nonbizarre interactive) x 2 (Sex: male versus female) x 2 (Grade: preschool versus kindergarten) factorial design was employed with the dependent variable being correct number of paired-associates recalled. The data analyzed will be discussed in terms of reliable interactions with main effects and analyses of interview responses. The alpha level was .05 for all statistics.

Children were instructed to remember as many of the paired-associates as possible. A test for homogeneity of independent variances showed no significant differences between preschool and kindergarten performance at the .05 level of significance (F=1.13 (1, 59), p>.05). Thus, no floor or ceiling effects were present.

No 2-way interactions were found to be significant with the 5(Instructional Group) x 2(Picture) x 2(Sex) x 2(Grade) ANOVA. Instead, three 3-way interactions were found to be significant (p < .05) and included : 1) Grade x Sex x Picture (F (1, 100) = 2.69, p < .05), 2) Group x Sex x Picture (F (1, 100) = 2.23, p < .05) and 3) Grade x Group x Sex (F (1, 100) = 1.80, p < .05). Tables 3, 4, and 5 include the percentages of correctly remembered pictures for these interactions, respectively. Simple Effects tests were conducted on each sex category separately for the above 3-way interactions to delineate significant comparisons across the variables.

Simple Effects tests, again, showed main effects of sex and pictures (i.e., males performed better than females and nonbizarre pictures were recalled more often than bizarre pictures). In addition, simple effects tests showed that, overall, kindergarten females performed significantly better than preschool females (F (1, 100) = 6.81, p < .01). Kindergartners, as a group, remembered nonfunny pictures significantly better than did preschoolers (F (1, 100) = 6.07, p < .01).

As mentioned, males performed significantly better than did females. In addition, preschool males performed significantly better than preschool females regardless of whether the picture was bizarre (F (1, 100) = 4.45, p <.05) or nonbizarre (F (1, 100) = 3.92, p < .05). With the bizarre pictures,

Table 2

Mean score, per group, grade and sex, out of 10

PRESCHOOL

		Male		Female		
		BIZ PIC	NBIZ PIC	BIZ PIC	NBIZ PIC	$\bar{X}$
GROUP	1 Funny-Retrieval	7.0	7.5	6.5	7.2	7.0
	2 Funny-Control	7.8	7.8	6.7	6.5	7.2
	3 Nonfunny-Retrieval	6.7	7.0	5.2	5.3	6.0
	4 Nonfunny-Control	7.5	7.8	4.5	6.3	6.5
	5 Control	5.8	6.0	6.3	6.5	6.2
	$\bar{X}$	7.0	7.2	5.8	6.4	

KINDERGARTEN

		Male		Female		
		BIZ PIC	NBIZ PIC	BIZ PIC	NBIZ PIC	$\bar{X}$
GROUP	1 Funny-Retrieval	5.2	7.7	7.8	7.5	7.0
	2 Funny-Control	8.5	8.3	6.0	6.7	7.4
	3 Nonfunny-Retrieval	6.2	7.2	6.5	7.2	6.8
	4 Nonfunny-Control	8.3	8.0	6.5	9.0	8.0
	5 Control	6.2	7.3	6.3	7.0	6.7
	$\bar{X}$	6.9	7.7	6.6	7.5	

Table 3

Percentages of pictures correct for the

Grade x Sex x Picture Interaction

		SEX			
		Males		Females	
		BIZ PIC	NBIZ PIC	BIZ PIC	NBIZ PIC
GRADE	Preschool	69.0	72.3	58.0	64.0
	Kindergarten	68.7	76.3	66.7	73.7

Table 4

Percentages of Picture Remembered Correctly for the Group x Sex x Picture Interaction

		SEX			
		Males		Females	
		BIZ PIC	NBIZ PIC	BIZ PIC	NBIZ PIC
GROUP	1 Funny-Retrieval	60.8	75.8	71.7	73.3
	2 Funny-Control	80.8	80.8	63.3	65.8
	3 Nonfunny-Retrieval	64.2	70.8	58.3	62.5
	4 Nonfunny-Control	79.2	79.2	55.0	76.7
	5 Control	60.0	66.7	63.3	67.5

Table 5

Percentages of Pictures Remembered Correctly for the Grade x Group x Sex Interaction

		GRADE			
		Preschool		Kindergarten	
		Male	Female	Male	Female
GROUP	1 Funny-Retrieval	72.5	68.3	63.3	77.5
	2 Funny-Control	78.3	65.8	83.3	63.3
	3 Nonfunny-Retrieval	67.5	52.5	66.7	68.3
	4 Nonfunny-Control	75.8	55.0	81.7	77.5
	5 Control	59.2	63.3	67.5	66.7

kindergarten females performed best given retrieval instructions (F (4, 100) = 3.23, $p < .05$) whereas kindergarten males remembered the bizarre pictures best given control rather than retrieval instructions (F (4, 100) = 3.14, $p < .05$).

A 2(Instructions: encoding plus retrieval versus encoding plus control) x 2(Picture: bizarre versus nonbizarre) x 2(Sex: male versus female) x 2(Grade: preschool versus kindergarten) ANOVA was conducted to investigate any picture by instructions interactions. One ANOVA was conducted between grades while two separate ANOVAs were conducted within each grade. Significant interactions with each ANOVA included Sex x Instruction, Picture x Sex x Instruction and Picture x Grade x Sex x Instruction. The picture x instruction interaction was not reliable. Reliable main effects were found with each ANOVA for sex and picture, but not for grade or retrieval instruction. Table 6, 7, and 8 list the means of correctly-remembered pictures for the Sex x Instruction, Picture x Sex x Instruction and Picture x Grade x Sex x Instruction interactions, respectively.

Simple effects tests for the above 3 reliable interactions showed that males remembered pictures best given retrieval control instructions whereas females remembered the pictures best given elaborative retrieval instructions (see Table 6). In addition, the males remembered bizarre pictures best given retrieval control instructions while the females remembered bizarre pictures best given elaborative retrieval instructions (see Table 7). Finally, Table 8 shows, again, that males performed best given retrieval control instructions whereas the females given these instructions performed best given the nonbizarre pictures. Preschoolers remembered nonbizarre pictures better than bizarre pictures with either type of instruction. Kindergartner males, however, remembered nonbizarre pictures better than bizarre pictures given elaborative retrieval instructions and kindergartner females remembered nonbizarre pictures best given retrieval control instructions.

Analyses conducted for each grade showed a main effect for picture for both preschoolers (F (1,40) = 4.15, $p < .05$) and kindergartners (F (1,40) = 5.72, $p < .05$) with nonbizarre pictures remembered better than bizarre

Table 6

Means for the Interaction of Sex x Retrieval Instructions

		RETRIEVAL INSTRUCTION	
		Elaborative Retrieval	Control
SEX	Male	6.8	7.6
	Female	6.7	6.5

Table 7

Means for the Interaction of Picture x Sex x Retrieval Instruction

MALES

		RETRIEVAL INSTRUCTION	
		Elaborative Retrieval	Control
PICTURE	Bizarre	6.2	8.0
	Nonbizarre	7.3	8.0

FEMALES

		RETRIEVAL INSTRUCTION	
		Elaborative Retrieval	Control
PICTURE	Bizarre	6.7	5.8
	Nonbizarre	6.8	7.2

Table 8

Means for the Interaction Picture x Grade x Sex x Retrieval Instruction

PRESCHOOLERS

		MALES		FEMALES	
		RETRIEVAL INSTRUCTIONS			
		Elaborative Retrieval	Control	Elaborative Retrieval	Control
PICTURE	Bizarre	6.8	7.6	5.8	5.6
	Nonbizarre	7.3	7.8	6.2	6.5

KINDERGARTNERS

		MALES		FEMALES	
		RETRIEVAL INSTRUCTIONS			
		Elaborative Retrieval	Control	Elaborative Retrieval	Control
PICTURE	Bizarre	5.6	8.4	7.6	6.0
	Nonbizarre	7.3	8.1	7.4	7.8

pictures. In addition, preschool males remembered pictures significantly better than did preschool females (F (1, 40) = 8.01, p < .05).

For kindergartners, 2 additional interactions were reliable: sex x retrieval instruction (F (1, 40) = 8.74, p < .05) and picture x sex x retrieval instruction (F (1, 40) = 11.23, p < .05). Simple effects tests for these these reliable interactions found that kindergartner males performed best given control retrieval instructions (F (1, 10) = 10.39, p < .05) whereas kindergartner females remembered best given elaborative retrieval instructions (F (1, 40) = 4.72, p < .05). When given funny encoding instructions, males remembered best given retrieval control instructions (F (1, 40) = 6.79, p < .05) and females remembered best given retrieval instructions (F (1, 40) = 4.72, p < .05). With bizarre pictures, kindergartner males (F (1, 40) = 5.46, p < .05) remembered best given retrieval instructions over control instructions and kindergartner females remembered bizarre pictures best given control instructions (F (1, 40) = 5.77, p < .05).

Of the 20 stimulus pictures, 2 pictures were remembered significantly better by males whereas 1 picture was remembered better by the females. Chi-square tests on the frequencies for each picture pair revealed that the two picture-pairs remembered better by males included the duck/water (X^2 (1, 120) = 4.73, p < .05) and the train/mountain (X^2 (1, 120) = 8.69, p < .05) pictures. The lady/box picture was remembered best by the females (X^2 (1, 120) = 4.73, p < .05. Given that 20 chi-square tests were conducted at the conventional p level of .05, one would expect 1 test to be significant by chance alone. Thus, the impact of the 3 reliable chi-square tests is limited.

Interview Questions

The interview questions showed many developmental changes, some of which proved to be reliable according to chi-square tests. The first question was asked immediately after instructing subjects about the task. This question tapped what the subjects' expected of the task. Simply, subjects were to answer that they would be seeing pictures and would have to remember the pictures. Table 9 shows the percentage of subjects who answered this question correctly. Prompting included asking the subject the question a second time, or

saying "What will I be showing you today?" Preschoolers tended to need the prompting more than kindergartners, especially because they often did not understand what the word "remember" meant (X^2 (1,1) = 33.85, $p<.001$). All children, however, did repeat the task instructions prior to participating in the main task.

Expectancy performance questions were asked to assess subjects' conceptions about their memory. Before the pictures were shown, subjects were asked to state how well they would perform the task. (Answers: Very good, kind of good or not very good). Then, immediately after the recall task, they were asked how well they thought they remembered the pictures given the same alternative answers. Finally, upon conclusion of the entire task, subjects were asked to rate how well they played the game, given the same alternative answers. Table 10 shows the percentage of subjects who answered the 3 questions with not very good, kind of good and very good. Question 1 is considered the base rate from which comparisons for Questions 2 and 3 were made. No significant developmental differences were observed in these expectancies for any of the three questions. Tables 11 and 12 reveal the patterns of subjects' expectations between the first and second question as well as between the first and third question, respectively. Assessments were made with regard to the direction of the subjects' conceptions over the course of the task. For example, subjects were assessed as to whether or not they had a more positive attitude after remembering the picture as compared to their attitude at task onset. Chi-square tests revealed no significant relationships between grade and the direction of self-conceptions (X^2 (1,2) = 4.18, $p > .05$ and X^2 (1,2) = 1.18, $p > .05$). Tables 11 and 12 reveal that most subjects tended to provide the same answer across the questions. In addition, 90% of the children estimated their abilities as being very good or kind of good.

Conceptions about subjects' successes or failures were assessed in an attribution question. Children were to attribute their successes or failures on the memory task to either themselves and their own memory ability or the Experimenter and have suggestions concerning the "best way to remember." Table 13 shows that, in both grades, children reported their successes as being a

Table 9

Percentage of Subjects Who Understood the

Task Either Immediately or After One Prompt

		Prompts Needed to Understand Task	
		No Prompts	One Prompt
GRADE	Preschool	18.3	81.7
	Kindergarten	58.3	41.7

X^2 (1, 1) = 33.85, $p < .001$

Table 10

Percentage of Subjects Who Answered Expectancy Questions with Not Very Good, Kind of Good and Very Good Across the Three Questions

Question 1	Not Very Good	Kind of Good	Very Good
Preschool	12.0	28.0	60.0
Kindergarten	3.3	18.3	78.3

Question 2	Not Very Good	Kind of Good	Very Good
Preschool	6.7	26.7	66.7
Kindergarten	1.7	23.3	75.0

Question 3	Not Very Good	Kind of Good	Very Good
Preschool	8.3	23.3	68.3
Kindergarten	1.7	13.3	85.0

X^2 (1, 2) = 5.3, $p > .05$, n.s.

Table 11

Comparisons of Expectancy Question with Self-Performance

Question Presented Immediately After Recall.

Percentages of Attitude Changes in Specific Directions.

		DIRECTION OF ATTITUDE CHANGE		
		No Change	Attitude Improved (More Positive)	Attitude Lessened (More Negative)
GRADE	Preschool	80.0	15.0	5.0
	Kindergarten	73.3	13.3	13.3

X^2 (1, 2) = 4.18, $p > .05$, n.s.

Table 12

Comparisons of the Expectancy Question with the

Performance Question Given at the End of the Entire Task.

Percentage of Attitude Changes in Specific Directions.

		DIRECTION OF ATTITUDE CHANGE		
		No Change	Attitude Improved (More Positive)	Attitude Lessened (More Negative)
GRADE	Preschool	70.0	20.0	10.0
	Kindergarten	76.7	15.0	8.3

X^2 (1, 2) = 1.18, $p > .05$, n.s.

function of their own capabilities. As children develop, though, they become less egocentric and tend to attribute their successes and/or failures to the Experimenter and not to themselves. In this table (see Table 13), however, the developmental difference in attributions was not significant at the .05 level (X^2 (1,1) = 2.31, n.s.).

In the final question, children were asked to remember the instructions given to them at the beginning of the task, that is, "to remember what the best way to remember the things in the picture was." Table 14 shows the percentage of children who remembered the strategy either 1) spontaneously (i.e., zero prompts), 2) given 1 prompt, 3) given 2 prompts or 4) did not remember the strategy. Thirty-percent of the kindergartners spontaneously remembered the instructions, regardless of the encoding group to which they were assigned. Only 3.3% of the preschoolers remembered these instructions spontaneously. Rather, 75% of the preschoolers did not remember the instructions at all age (X^2 (1,3) = 20, $p < .05$).

Finally, when asked to sort the pictures into funny and nonfunny piles, kindergartners sorted more accurately than preschoolers under both the lenient and the strict criteria. The strict criterion required sorting without prompts whereas the lenient criterion included correct answers after Experimenter prompts were given. The t (1, 238) = 6.58, $p < .05$ for the strict criterion data and t (1, 238) = 2.15 for the lenient-criterion scores. Tables 15 and 16 chart the percentages of correct sorts for the age groups using strict and lenient criteria, respectively. Because the differences in sorting were significant under the strict criterion, a 2-way ANOVA was performed, using the strict, rather than lenient criterion data. Table 17 shows a significant F value for age, with type of picture having no effect on sorting. Furthermore, there was also an age difference in sorting when the lenient criteria was adopted, though the magnitude of the effect was smaller than with the strict criterion scores (see Table 16). Thus, with additional prompting, preschoolers sorted better than with no prompting, but not nearly as well as the kindergartners who did not need any prompting.

In the next section, the results will be discussed in terms of previous

Table 13

Percentages of Subjects Who Attributed Their Success or Failure of Remembering on Themselves or on the Experimenter.

		ATTRIBUTION TO:	
		Self	Experimenter
GRADE	Preschool	73.3	26.7
	Kindergarten	63.3	36.7

X^2 (1, 2) = 2.31, $p > .05$, n.s

Table 14

Percentage of Subjects Who Remembered the "Best Way to Remember the Pictures" Instruction at Retrieval Time - Given Zero, One, or Two Prompts or Not Knowing At All.

		PERCENTAGE CORRECT FOR EACH PROMPT CONDITION			
		Zero Prompt	One Prompt	Two Prompt	No Answer
GRADE	Preschool	3.3	11.7	10.0	75.0
	Kindergarten	30.0	33.3	3.3	33.3

X^2 (1, 3) = 20, $p < .05$

Table 15

Percentage of Pictures Correctly Sorted, by Preschoolers and Kindergartners, Using the Strict Criterion

		PICTURES	
		Bizarre	Nonbizarre
GRADE	Preschool	75.5	73.0
	Kindergarten	89.7	90.3

t = 6.58, significant at .05 level

Table 16

Percentage of Pictures Correctly Sorted, by Preschoolers and Kindergartners, Using the Lenient Criterion

		PICTURES	
		Bizarre	Nonbizarre
GRADE	Preschool	93.8	91.7
	Kindergarten	97.8	95.8

t = 2.15, significant at .05 level

Table 17

ANOVA on Two Factors: Type of Picture and Age When Sorting Using the Strict Criterion

Source	SS	df	ms	F	p
Total	1001.1	239	4.2	1.16	n.s.
Picture	.5	1	.5	.14	n.s.
Age	148.9	1	148.9	41.36	<.001
Picture x Age	1.5	1	1.5	1.50	n.s.
Error	850.3	236	3.6	1.00	n.s.

research and developmental implications of these results will be presented.

Discussion

This study was designed to answer four questions: 1) what effects on cued-recall did retrieval instructions have; 2) would elaborative encoding instructions enhance memory as compared to control instructions; 3) was picture-type important to cued-recall and 4) was there evidence for a transition between preschool and kindergarten from having production deficiencies to spontaneous use of strategies? This section will review the results and discuss them in terms of the above questions while comparing these results with the Pressley and MacFadyen (1983) findings.

Main Effects

Pictures. For both grades, nonbizarre pictures were remembered better than bizarre pictures. Bizarre pictures were hypothesized, at the onset of this study, to be remembered better because they would be out of the ordinary and stand out. Because Webber and Marshall (1978) had found that pictorial nouns interacting bizarrely enhanced memory for those nouns, given no verbal elaboration, it was hypothesized that verbal instructional elaboration could only further enhance memory for the paired-associates. This study showed that the bizarre pictures were not remembered better than the nonbizarre pictures even using a mixed-list design and elaborative verbal instructions. Young children typically do not see bizarre pairings of common, real-life objects. Showing children these interactions, then, did not fit into their own ideas or schemes about what belongs in the real world. In support of this interpretation, Schmidt, Schmidt and Tomalis (1984) found that younger children lack the ability to reorganize schemes quickly. They studied developmental trends in terms of children's abilities to monitor and remember story text as well as integrate sentence themes with anomalous information. As children develop from preschool to second grade, they learn to reorganize their own ideas, or schemes, in order for anomalous or out-of-the-ordinary information to fit into these schemes. Preschoolers in the Schmidt, Schmidt and Tomalis (1984) study were unable to integrate the anomalous information into the story theme and disregarded the anomaly altogether. Kindergartners, however, tried to integrate the anomaly to no avail with existing knowledge and became confused with the

story theme. Second graders were able to identify the anomaly, ignore it (since it obviously could not be integrated with the story theme logically) and continued their integrative processes with regard to the story theme. These findings are relevant to the present study in that the preschoolers probably ignored the relationship between instruction and picture, whereas the kindergartners, who were more attuned to the task, probably became confused by the discrepancies between the mixed-list picture design and the instructions.

Sex. The males consistently performed better than the females for both age groups. Sex differences in picture-preference, whereby 3 separate pairings were salient to one of the two sexes, did not contribute to the significant sex factor. As mentioned previously, when the 3 pairings were removed from analysis, the same pattern of results were maintained. O'Brien, Huston, & Risley (1983) found that sex differences can occur according to picture/word context. Thus, precautions were taken prior to the pilot study to develop words that were concrete for this age group and familiar to both sexes (Paivio, Yuille & Madigan, 1968; Palermo & Jenkins, 1974; Thorndike & Lorge, 1944). The pictures used in the main study did not yield any sex differences in memory during the pilot study. Granted, the pilot study involved only 10 males and 10 females who may not have been as sensitive to sex differences as were the 30 males and 30 females studied in the main task. These salient picture-pairs could very well have been significant due to a chance factor due to the large amount of stimulus pictures.

Males may have performed better than the females because males related better to objects than did females. Nelson (1973) reported that the first 50 words a male child utters usually center around objects whereas the first 50 words a female child utters usually center around persons. Thus, the males, compared to the females, relate better to objects and can label items better. In this study, both the males and the females labeled the pictures well. None of the children reached the point whereby the Experimenter had to provide labels for the paired-associates. However, one could infer that if males relate better to objects, in general, then they may be more likely to retrieve the objects from their memory.

Another possibility for the significant sex differences, though very

controversial, involves spatial ability. Adolescent males perform better than females at tasks involving spatial abilities (Samuel, 1983). Whether or not such a difference occurs for pre-elementary school children has not been proved. Sherman and Fennema (1978) have disputed the fact that such sex differences occur for adolescents. If such differences do occur, then one could conclude that spatial preference may have caused the sex differences found in this study.

Finally, the conclusion that these sex differences may have occurred simply by chance should be noted. With the large amount of subjects, as well as the high potential for individual differences with this age group, the possibility is high that these differences may have occurred simply by chance.

Instruction x Grade Factor (Group). The importance of each instructional group depended upon the child's age. Kindergartners profited most from the nonfunny/control instructions. Preschoolers performed best with the funny/control instructions. The kindergartners receiving the nonfunny encoding instructions probably did best because all pictures, whether bizarre or nonbizarre, were "doing something together." With this mixed-list design, not all pictures were "doing something funny together" and would not easily match the funny instructions. Kindergartners had difficulty matching the nonbizarre paired-associates with the funny instructions much like the kindergartners in the Schmidt, Schmidt and Tomalis (1984) study who had difficulty matching anomalous clues with convergent clues. Preschoolers, however, considered even nonfunny pictures to be funny. When asked to sort the pictures into nonfunny and funny piles, preschoolers put nonfunny pictures into funny piles 17% more often than did kindergartners (see Table 15). Because preschoolers tended to treat nonfunny pictures as funny, the funny instructions benefited recall. Preschoolers were often detail-oriented and considered one dimension of the picture to categorize that picture as funny. For example, if a person was smiling, the picture was funny. Similarly, when a man reading a book was funny, it was funny because the man was reading a funny book.

Younger children, too, were often confused by the nonfunny instructions. These children often replied that two things "doing something together" needed to talk to one another. Obviously, a box does not talk to a lady

holding it and vise versa. Consequently, it was funny for a lady to be "doing something together" with a box because boxes can't talk. Again, the funny instructions benefited these preschoolers because it would be funny to them to see a box talking to a lady.

The fact that the control retrieval instructional groups performed well does not rule out the importance of retrieval instructions. In this study, all groups were referred back to the picture they had seen. It is important to note that Pressley and MacFadyen (1983) found a difference in memory when comparing groups referred back to the words with groups referred back to the picture. All groups, despite encoding or retrieval instructional differences were referred back to the picture shown in the current study. Hence, simple reference to the picture may have been enough to facilitate memory of the paired-associates. In Pressley and MacFadyen (1983), those preschool-control children referred back to the words heard remembered 38% of the pictures. This study's control preschoolers referred back to the picture remembered 62% of the paired-associates. All other picture-reference groups in the Pressley and MacFadyen (1983) study performed comparably to this study's groups. Hence, the comparisons found to be significant for Pressley and MacFadyen (1983) were probably significant because of the low correct-response for the preschool-control group. Because this study's preschool-control group's responses surpassed those of Pressley and MacFadyen (1983), it is not unusual to have attained nonsignificant developmental findings.

Grade. Kindergartners performed better than did preschoolers probably because the kindergartners understood the task better. Sixteen-percent more kindergartners than preschoolers knew the difference between the two types of pictures as evidenced by their sorting abilities. Also, when asked to state what the task at hand involved, kindergartners were more likely to repeat the Experimenter's instructions than preschoolers (see Table 13). After the testing period, 67% of the kindergartners, and only 25% of the preschoolers still remembered the best memory strategies told to them by the Experimenter (see Table 13).

Interactions

The three interactions found to be significant given the 5(Group) x 2(Picture) x 2(Sex) x 2(Grade) design all had the common variable of sex as a contributing significant factor. Simple effects tests showed consistently that the males performed better than did the females. This significance could very well have contributed to each of the 3-way interactions.

In addition, simple effects tests demonstrated that the male and female kindergartners remembered the bizarre pictures better with different types of retrieval instructions. That is, the males performed best with no retrieval instructions while the females performed best with retrieval instructions. If the instructions' absence or presence caused increased memory for the bizarre pictures, then, they should also have caused an increase for memory of the nonbizarre pictures, particularly since recall was not different between the two instructional groups. Because the nonbizarre pictures were not remembered as well as the bizarre pictures under the above conditions, it is unlikely that the presence or absence of the retrieval instructions alone caused the increase in memory for the bizarre pictures. Instead, some outside factor, such as attention span or outlier statistics could have caused the significance.

For the 2(Grade) x 2(Picture) x 2(Sex) x 2(Retrieval Instruction) design, the three significant interactions, again, each had sex as a variable. Males performed best over the females despite retrieval instructions, in most cases. However, with bizarre pictures, the females given retrieval instructions remembered better than the males given control instructions. Kindergartner females especially did better than kindergartner males when given elaborative retrieval instructions whereas the males performed better given retrieval control instructions. No difference for type of instruction should have occurred for these kindergartners, dependent upon sex. The hypotheses for sex differences will be discussed at a later point.

Interview Questions

For most of the questions, children showed developmental differences. That is, the older the subjects, the more likely they answered the interview questions correctly and attributed their successes/failures to the Experimenter

(although the developmental change in these attributions was not significant). When sorting the pictures into funny and nonfunny piles, the older groups correctly sorted on the first trial, whereas the preschoolers needed added prompting and instructions in order to correctly sort.

In general, the findings indicate that the older the children, the more aware they become of task demands and of the potential benefit of learning strategies. An additional 30 subjects were solicited from an older age group (i.e., ages 6 years, 9 months to 7 years, 9 months) to determine whether these trends continue to occur with age. Again, with these six- and seven- year-olds, children were highly aware of the task, the importance of the instructions, the variations in types of pictures and the advantages of recall strategies. Therefore, awareness of memory abilities and capacities increases with age, especially when children develop out of the production deficient period to a less egocentric, self-reliant period.

Conclusions and Future Implications

The present study did not replicate the Pressley and MacFadyen (1983) study, as expected. However, in terms of future study in the area of learning strategies, much of the results were relevent and are important to future research. This study did find that elaborative retrieval instructions are no better than simple retrieval instructions referring the subject back to the picture of the paired-associates. Although developmental differences were not found with regard to remembering the paired-associates, they were found in the interview questions.

The interview questions showed that as persons develop, they become less egocentric and adapt their learning strategies to that of the task and the Experimenter's instructions. Given the results found with the additional 30 six- and seven- year-olds, it may be of value to redo this study to assess whether older children benefit from elaborative instructions paired with matching picture-types. In addition, attention should be given to the populations studied between comparison groups. For example, this study relied heavily on comparisons made with the Pressley and MacFadyen (1983) study and design. The children of this study surpassed those children studied in the Pressley and MacFadyen study in that these children remembered more even in the control conditions. In retrospect, the two subject populations were quite diverse. Pressley and MacFadyen's population pool came from city daycare centers and public schools located in Canada. This study's population was drawn from religiously-affiliated, private daycare centers and schools in Virginia. Intuitively, these populations are not similar and may have contributed to the discrepant findings between the two studies.

Furthermore, many factors should be considered when selecting the stimuli for continuation studies. For example, defining the term "bizarre" more concretely would be advantageous. That is, what the Experimenter views as being bizarre or funny does not necessarily reflect the subjects' notions of what bizarre and funny mean. One way to avoid this problem would be to have each individual identify funny items and pictures prior to testing or to have a pilot group of subjects select bizarre and nonbizarre stimuli. Either method would

provide a base rate against which to compare experimental findings. In this study, the Experimenter had selected bizarre materials even prior to the pilot study and assumed that the children would understand what was funny about the stimuli. It wasn't until the main study, that preschoolers were observed to be detail-oriented and noted that even the nonbizarre pictures were funny.

Since the beginning of this study, studies conducted by McDaniel and Einstein (1986) have continued to demonstrate the positive effect of bizarreness in recall with mixed-list designs. These effects are consistent with the idea that bizarreness enhances memory when bizarre materials are used in conjunction with common materials. The strength lies in the view that bizarre imagery would be helpful to recall if it were distinct from other encoding stimuli. This view is consistent with the hypotheses generated in this present study. McDaniel and Einstein's (1986) subjects consisted of college students, and not preschoolers. They were not attempting to discover any developmental trends in acquiring strategies. The present study, then, may work for an older age group.

All in all, this study did support Pressley and MacFadyen's (1983) idea that retrieval instructions are important. In fact, this study contradicted their idea that the effects of bizarreness are determined by instructional manipulation. However, referring subjects back to pictures may be the only necessary elaboration. In fact, elaborating instructions in a variety of means does not necessarily facilitate memory for either bizarre or nonbizarre pictures, when another referrent to the picture remembered is given. In support of the Wollen, Weber and Lowry (1973) study, nonbizarre, interactive pictures were proven to facilitate memory for paired-associates over bizarre, interactive pictures. For future consideration, simply incorporating the referral to picture during retrieval time could facilitate memory for interactive picture-pairs and show developmental trends in learning.

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APPENDIX I

Pilot Study Paired-Associates

Pilot Study Paired-Associates

1. Barn Cow
2. Bed Baby
3. Bell King
4. Branch Bird
5. Car Bus
6. Cat Chair
7. Church Tree
8. Doll Wagon
9. Drum Indian
10. Duck Water
11. Flower Nose
12. Frog Bug
13. Girl Dress
14. Horse Apple
15. House Flag
16. Kite Boy
17. Logs Mouse
18. Man Book
19. Newspaper Dog
20. Pan Egg
21. Pig Pail
22. Plants Window
23. Rabbit Carrot
24. Sign Doctor
25. Table Lamp
26. Train Mountain
27. TV Elephant
28. Umbrella Nurse
29. Woman Box

APPENDIX II

Main Study Paired-Associates

Main Study Paired-Associates

1. Barn Cow
2. Car Bus
3. Cat Chair
4. Church Tree
5. Doll Wagon
6. Drum Wagon
7. Duck Water
8. Frog Bug
9. Girl Dress
10. Kite Boy
11. Man Book
12. Newspaper Dog
13. Pan Egg
14. Plants Window
15. Rabbit Carrot
16. Table Lamp
17. Train Mountain
18. TV Elephant
19. Umbrella Nurse
20. Lady Box

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