A developmental approach to recognition and relocation memory

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A Developmental Approach to Recognition and Relocation Memory

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Running head: Developmental Approach to Recognition and Relocation
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Abstract

This study examined how third-grade children and adults process visual and verbal components of a spatial display, in a memory recognition and relocation task. Subjects viewed either a set of 16 toys or 16 buildings on a display board containing thirty-six squares. Both types of stimuli were presented on the board with names or without accompanying names. Subjects were tested on picture recognition of the physical characteristics of the objects. Spatial memory was tested by relocation tasks. Adults scored significantly better than children on recognition and relocation measures. Toys were recognized and relocated significantly better than buildings by both children and adults. The presence of a verbal label significantly lowered recognition accuracy in both age groups but significantly increased relocation accuracy for adults and children. A significant interaction of name by item resulted. This effect was consistent across age groups. These results are discussed in terms of memory processing strategies and their development in children and adults.
Research has demonstrated that long term memory for visual information is remarkably good in both children and adults. High recognition rates of pictorial material by adults has been reported (Shepard, 1967; and Standing, Conezio and Heber, 1970). High recall ability has also been established (Bousefield, Esterson and Whitmarsh, 1957). Nickerson (1968) found that even with brief exposure to a large number of new pictures, recognition accuracy remained 98% for several days and remained above 50% for up to a year. Additionally, Standing (1970) reported a 95% hit rate for recognition of old pictures. The ability of children to recognize old pictures has approximated that reported for adults (Corsini, Jacobus, and Leonard, 1969). Recognition accuracy for items presented twice was 98% after one day and remained up to 78% for a month (Brown and Scott, 1971).

The visual performance of adults and children and its relationship to the memory processes continues to be a topic of investigation. The present study focuses on three important areas which need further examination. Of interest is how adults and children utilize visual and verbal information to remember objects. The second issue addressed is how verbal labels when presented with visual stimuli effect visual memory. Thirdly, the relationship between memory for the components of a visual array and memory for their spatial location is examined. To shed light on these issues, this
experiment measured children's and adult's memory for name and no-name information with recognition and relocation measures incorporating these different forms of stimuli.

The first issue is how adults and children utilize visual and verbal information to remember objects. Bruner (1964) suggested that an adult has three means by which to extract meaning from environmental experiences. These three means are: representation by physical actions, imagery, or the use of symbols. While the adult has the capability to use all three means the preschool child has little ability to use symbolic representation. If this were true, the preschool child's capacity for storing information in memory would be better for pictures than for words. Underwood (1969) also theorized that sensory attributes are stronger than verbal attributes for 5 to 7-year-olds with verbal attributes becoming more important with age. However, empirical findings do not clearly support the hypothesis that visual encoding predominates among young children. Ducharme and Fraisse (1965) reported that in a free recall paradigm children recalled concrete noun labels better than pictures. In paired-associate tasks where either pictures or words were recalled, Dilley and Paivio (1968) also reported recall of words was better than pictures.

Studies using a "yes-no" recognition task have reported that children like adults, have excellent picture memory compared to word memory abilities (Brown and Scott, 1971,
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Nelson, 1971 and Brown and Campione, 1971). Corsini, Jacobus and Leonard (1969) also reported that pictures were retained better by children than words. They concluded that while young children are better able to encode pictorial input, they have difficulty when certain procedures require them to translate their iconic representation into a verbal response. Bird and Bennett (1974) found that pictures were recognized better than concrete and abstract nouns with 4 and 6-year-olds, and better than abstract nouns with 8 and 10-year-old subjects. Cramer (1976) presented a series of pictures alone, words alone, or pictures and words combined to first and fourth graders. First graders generally made fewer correct recognition responses than fourth graders. Also, for both age groups recognition was better with visual than verbal materials. The controversy remains as to whether or not children have stronger sensory vs. verbal attributes in comparison to adults. The possibility remains that adults and children process incoming information alike but the child experiences translation problems and lacks sufficient training to retrieve the required information.

The second question examined was how verbal labels affect visual memory when presented with visual stimuli. The effect of verbal labels on memory for visual stimuli depends upon the type of verbal label used. Carmichael, Hogan and Walter (1932) reported that when an ambiguous figure
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is accompanied by a verbal label subjects later reproduced the figure with characteristics similar to the applied label. Freund (1971) using pictures of naturalistic scenes and Bostrom (1971), Clark (1965), Daniel (1972), and Ellis (1968), using pictures of nonsense forms, demonstrated that when subjects generated verbal labels for pictures at the time of presentation memory, recognition performance increased for those pictures. In addition when Ss were forced to do a distracting task when looking at the pictures, recognition memory was found to be reduced compared to a verbal rehearsal group (Freund, 1971; Loftus, 1972). Kosslyn and Nelson (1976) reported enhanced recognition memory when four-word labels accompanied realistic and abstract pictures. For adult subjects labeling increased recognition memory only for abstract stimuli. Such labeling increased children's recognition rate of both realistic and abstract stimuli. Although children's performance was increased by labeling adults had higher recognition accuracy than 5-year-olds on labeled abstract pictures, unlabeled abstract pictures, and unlabeled realistic pictures.

In conditions utilizing objects which are automatically named, labels do not appear to assist memory for pictorial materials. Kurtz and Hovland (1953) presented subjects with an array of 16 common objects and had subjects either overtly verbalize or visually attend to the objects. Subjects then received a recognition test with half original
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items pictured and the other half verbal names. Verbal items were recognized better by the verbalization group than the visualization group. On the other hand, recognition of the visual objects alone was poorer in the verbalization than visualization condition. Ducharme and Fraisee (1965) failed to find a facilitative affect of verbalization on picture memory. Subjects were given either pictures of common objects, verbal labels of the objects, or both together. A picture recognition test revealed the group given pictures and their corresponding labels did not differ in accuracy from the group given pictures alone. Bahrick and Boucher (1968) tested name recall and visual recognition of common objects and reported that the probability of recall of object names was uncorrelated with the accuracy of visual recognition of the same objects by the same subjects. Pezdek and Evans (1979) presented subjects with 16 buildings on a spatial display with or without a name label present on each building. Picture recognition accuracy was found to be low in all experimental conditions with the lowest hit rate reported in the label-present condition.

Davies (1969) examined the function of labeling on picture memory using four conditions of presentation including object-imaging and object-labeling conditions utilized by Kurtz and Hovland (1953). Two additional control conditions included a name matching condition and a condition in which the original picture-naming condition was reversed to a
name-picturing condition. Instructions for these 8-10-year-olds did not require them to say the names of the items aloud. The two labeling picture-label and label-picture conditions resulted in significantly better recognition than the two matching name-name and picture-picture conditions. In addition the all-visual picture-matching task produced better recognition than the purely verbal name-matching condition.

The effect of verbal labels on visual memory seems to differ according to the type of stimulus object utilized. Researchers emphasized the need to distinguish inventory information from descriptive information. Handler and Ritchey (1977) found inventory information was better retained over time than descriptive information in organized pictures. Based on these results it is reasonable to assume that the effect of a verbal label on an object automatically labeled would therefore be poor. The information provided by the label is redundant. With uneasily labeled objects, the verbal label would provide additional information thus increasing the encoding strength and probability of retrieval of that particular object.

The third issue addressed in the present study was the relationship between memory for the components of a visual array and their spatial location. Mandler and Johnson (1976) reported that memory for objects in a picture could be distinguished from memory for the spatial arrangement. In sub-
sequent research, however, Mandler, Seegimiller and Day (1977) reported that considerable location information is automatically processed as the components of a visual scene are encoded into long term memory. Results have been reported on incidental memory for location that are contrary to those of Mandler's. Von Wright, Gebhard and Karttunen (1975) reported no differences between incidental and intentional conditions on recall of location information in pictures and words. When 4 and 5-year-olds were tested either intentionally or incidentally for location memory additional research indicated that subjects were more accurate in the intentional condition (Acredolo and Pick, 1973). Reported trade-off factors between word recognition and recall as to where words are situated on the spatial array have resolved the issue for adults (Shulman, 1973). In addition, Pezdek and Evans (1979) using a spatial display comprised of 16 buildings placed in a model city found that spatial location information was not encoded independently of verbal and visual identity information. It would appear that adults automatically process location information with an efficient strategical approach whereas children only do so if given appropriate instruction.

The research literature does not provide a sufficient understanding of how the memory process differs with age in these areas. Numerous theories have described these differences between adults and children in regards to memory
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processing: Underwood's (1969) contention that a child has greater storage ability for visual over verbal cues, Brown and Scott's (1971) comparison of children's high picture recognition accuracy as being similar to adults, and finally, when labels accompany objects, Kosslyn and Nelson (1976) reported increased recognition rates for children with realistic and abstract stimuli but only higher abstract stimuli scores with adults. To examine these proposed differences this study compares adults and children for picture recognition accuracy for two kinds of stimuli presented with and without labels. In addition, Corsini, Jacobus, and Leonard (1969) concluded that a young child is better able encoding pictorial input but has difficulty in translating visual images into a verbal response. Therefore, this experiment utilized a "yes or no" recognition response along with simple object placement in the relocation task. Finally, Pezdek and Evans (1979) have reported that the presence of a name label on each building reduced picture recognition accuracy but improved relocation accuracy for adults. This study will investigate such an interaction effect with respect to children.

The present experiment examined whether verbal labels assist recognition and relocation memory for toy objects and buildings in children and adults. Easily and uneasily labeled objects were utilized in the study in order to dis-
tistinguish between two separate aspects of visual memory as described by Mandler and Ritchey (1977). The experiment included toy items representing common or easily labeled objects such as ball and cowboy. Building stimuli was represented by more difficult items such as church and school which had similar physical makeup but varying descriptive components. The objects, 16 in each class of stimuli, were presented along with a verbal label to test verbal label effects on visual objects. The verbal labels provided with building stimuli were not likely to be automatically generated by subjects and thus permitted independent assessment of verbal and visual memory. Shulman (1973) reported that for adults a trade-off occurred between the time a subject spends rehearsing the name of an object and the time the subject spends rehearsing the physical features of an object. Therefore, the presence of a verbal label was tested for its effect upon an object for later recognition and relocation for adults and children.

It was predicted that children would score lower than adults on the recognition and relocation tests based on previously reported improvements of memory with age. Toy recognition and relocation scores were predicted to be higher than those for building stimuli based on previous findings that inventory information was better retained than descriptive information (Mandler and Ritchey, 1977). The name
effect was predicted to significantly reduce picture recognition accuracy but improve relocation accuracy for adults Pezdek and Evans (1979). No label effects were predicted for children as they would only spend time rehearsing visual cues and not implement the effective memory strategies utilized by adults (Ducharme and Fraisse, 1956 and Bahrick and Boucher, 1968).

Method

Subjects

The adult subjects were 64 college students who volunteered to participate at California State College, San Bernardino, California. The 64 eight to ten-year-olds were students at either Grand Terrace Elementary School, Colton, California, or Perris Elementary School, Perris, California. Each group contained an equal number of males and females. Signed parental consent forms were obtained for each of the 64 children.

Design

The experiment employed a 2X2X2 factorial design. The three independent variables were age, name, and type of stimulus. Sixteen adults and sixteen children were assigned to one of four experimental conditions. The four conditions were defined by the factorial manipulation of name labels present or not and toys or buildings as stimulus items. Subjects in each condition received one of two orders of
object placement on the experimental display in order to control for a position effect. The dependent variables were picture recognition accuracy and accuracy of item relocation on the display board.

**Materials**

The display board was constructed on a flat sheet of ply-wood, 76 cms. X 76 cms., marked off in 36 squares equal in size. This board was placed flat on one of the two tables in a quiet well-lit classroom. A desk chair was placed in front of each table.

Sixteen different toys were placed on the grid. These toys were: button, baby-bottle, ball, candy, car, comb, cowboy, flower, horse, nail, pin, ring, scissors, thread, toothbrush and watch. Each item was selected so that it was functionally unique and each had a distinct shape and color. The toys were approximately the same size, 6 X 5 cm. In the name conditions a name was lettered on a 2.5 X 2.5 cm piece of white paper and taped in front of each toy. The lettering was black on white and measured 1.3 cm. in height.

In the building condition sixteen functionally different models of buildings were constructed and placed on the grid. The photographs were cut out and glued to the front of two cm. thick pieces of wood which were cut to have the same shape of each building. All buildings were approximately 5 X 7.5 cms. In the name condition the name of each building was lettered
on a 2.5 X 5.5 cm piece of white paper and taped in front of the building. The following labels were used in the building's name condition: apartment, capitol building, church, electric company, F.B.I. building, hospital, hotel, house, library, museum, office building, palace, police station, restaurant, shopping center, and school.

Objects were placed on the display board such that there were an equal number in each of the four quadrants. In addition all objects were clearly visible to the subject; no object was placed directly behind another and the shorter objects were not hidden from view by the taller ones.

Four picture recognition test booklets were constructed. Each contained colored photographs of the original 16 buildings or toys plus 16 distractor objects. The distractor colored photographs were similar in physical appearance to each of the other photographs, for example the hospital distractor picture was a picture of another building of a similar shape and architecture. For both the toy and building conditions the 32 test photographs were placed one to a page and were randomly arranged in their respective test booklets. In the object with name conditions the picture-recognition test included the appropriate label positioned below each picture.

**Procedure**

The experimenter ran subjects individually for approxi-
mately one fifteen minute session. Subjects were seated before the display board. One-half of the subjects viewed 16 toys placed on the display board, and the other half viewed 16 model buildings placed on the same display. Subjects were given two minutes to study the display. They were instructed that their task was to remember the items and what each one looked like so that they could recognize them later. Subjects were also instructed to remember where each item was located so that they could later replace it in its original position. Instructions were same in the conditions with and without name labels.

Following the two minute study period, subjects were directed away from the board to another table from which it was impossible to view the display. They were handed several random numbers sheets and instructed to circle all of a particular number one line at a time for two minutes. The delay task was included to insure that the test that followed was a long-term memory test. During this time, the experimenter removed all stimulus objects from the grid.

Subjects were then administered a picture recognition test that corresponded to their particular experimental condition. The recognition test was self-paced but subjects were not allowed to turn back to earlier pages. Subjects indicated to the experimenter verbally whether each item was old or new, and the experimenter recorded the responses.
At the completion of the recognition test subjects returned to the original display board and were instructed to replace the objects on the board in their correct locations. Subjects could move the items around until they felt they were all positioned as accurately as possible. Subjects had five minutes to complete the task.
Results

The mean performance of adult and child subjects in each condition on the picture recognition and relocation tasks is presented in Table I. The dependent measures include the number of pictures correctly recognized and number of objects correctly relocated out of sixteen. The second relocation measure is the displaced relocation distance for sixteen objects from their original positions on the display. The data were analyzed using a completely randomized 2X2X2 factorial analysis of variance. The rejection region for all analysis was p. <.05.

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Insert Table I about here

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Analysis of variance performed on the recognition data indicate that children (x = 12.17) recognized significantly fewer items than adults (x = 12.80), F(1,120) = 4.56, MS_e = 2.73. Toys (x = 13.80) were better recognized than buildings (x = 11.17), F(1,120) = 80.52, MS_e = 2.73, and recognition in the no-name condition (x = 13.03) was greater than in the name condition (x = 11.94), F(1,20) = 13.98, MS_e = 2.73. The item x name interaction was significant F(1,120) = 7.71, MS_e = 2.73. Recognition accuracy for toys was similar in the name and no-name conditions but for buildings the name condition was significantly lower than the
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no-name condition. No other effects were significant with the recognition measure.

Relocation was first measured in terms of number of objects correctly relocated. Results indicated that children (\( \bar{x} = 7.38 \)) were significantly less accurate than adults (\( \bar{x} = 8.92 \)) \( \text{F}(1,120) = 9.18, \text{MS}_e = 8.34 \). Relocation of items in the no-name condition (\( \bar{x} = 7.52 \)) was significantly lower than in the name condition, (\( \bar{x} = 8.78 \)), \( \text{F}(1,120) = 6.15, \text{MS}_e = 8.34 \). Toys (\( \bar{x} = 9.48 \)) were relocated significantly better than buildings (\( \bar{x} = 6.81 \)), \( \text{F}(1,120) = 27.39, \text{MS}_e = 8.34 \). The age x type of stimulus item interaction was significant, \( \text{F}(1,120) = 7.41, \text{MS}_e = 8.34 \). With adults, relocation accuracy was similar for the toys and building. On the other hand children were significantly less accurate relocating buildings than toys. There was also a significant interaction of item x name conditions, \( \text{F}(1,120) = 8.45, \text{MS}_e = 8.34 \). With the toys, relocation accuracy was similar in name and no-name conditions, however, with buildings the name condition was significantly higher than the no-name condition. No other effects were significant with this relocation measure.

A second relocation measure tallied the distance objects were repositioned from their original location on the display. Results were similar for both location scores. Children (\( \bar{x} = 23.13 \)) were significantly less accurate than adults (\( \bar{x} = 16.64 \)), \( \text{F}(1,120) = 10.89, \text{MS}_e = 123.58 \). Toys (\( \bar{x} = 14.73 \))
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were relocated significantly better than buildings ($\bar{x} = 25.03$), $F(1,120) = 27.45$, $MS_e = 123.58$. Relocation scores were significantly lower in reported error distance for name present conditions ($\bar{x} = 16.50$) than no-name conditions ($\bar{x} = 23.27$), $F(1,120) = 11.85$, $MS_e = 123.58$. However, in this second relocation measure the age x item interaction and item x name interaction were not significant. No other effects were significant with this relocation measure.

Discussion

This experiment examined verbal and visual memory in children and adults with two sets of stimuli. The primary result of this study was that picture recognition was lowered when name labels were presented with stimulus objects for both children and adults. This result contradicts other studies that report that the name label improves recognition memory (Kosslyn and Nelson, 1976, Clark, 1965, and Freund, 1971).

A unique aspect of this study was that it included two different sets of stimuli. Subjects could have easily generated labels for the first set of stimuli, 16 toys. However, it is not likely that labels for the second set, 16 buildings, would have been automatically generated by the subjects. Each building was physically and functionally different but not easily characterized by any one label that would successfully distinguish it from other building stimuli. The picture recognition test for the buildings
was therefore an appropriate test of visual memory for the descriptive, physical characteristics of the items presented. Whereas, the easily labeled toy stimulus items would utilize a general inventory type of memory, for which a single label would be sufficient for later recognition. Results were that recognition scores were similar in the name and no-name conditions for toys, but that the no-name condition was significantly greater than the name condition for buildings.

Data from both kinds of stimuli, toy and building, help to explain why picture recognition memory was lowered when an object was accompanied by a label. Apparently subjects in the no-name conditions tried to remember the objects solely by the physical characteristics of each object. In the name condition, however, the objects could be further attended to and rehearsed by a second feature, the name. Pezdek and Evans (1979) had reported, using similar building stimuli, that the separate processing of these two features competed with one another. The time the subject used to rehearse the name was at the expense of the physical characteristics. Analysis of the data for this study support these findings. The name effect was greater for the more complex descriptive building stimuli where more rehearsal was required for picture recognition.

The age x name x item interaction was not significant. These data suggest that children and adults utilize similar
methods to encode and store visual and verbal information.

Significant age effects resulted on all measures with adults performing better than children. Dirks and Neisser (1977) found recognition performance improved with age. The degree of improvement depended on the particular kind of information being examined. Cramer (1976) described adults as possessing superior abilities with regards to higher rehearsal efficiency, organizational strategies, and pattern detection.

In the present study spatial location scores were significantly affected across all conditions of age, type of stimulus and presence of label. The most important result was that while the presence of a label lowered recognition it increased the building relocation scores. Such a finding suggests that with building stimuli the verbal label facilitates location memory but inhibits recognition accuracy. This trade-off effect was also reported by Pezdek and Evans (1979).

The item effect was significant. This data indicates why overall building with-name recognition scores were so low, 64% when only sixteen objects were being studied for a full two minutes. Visual memory results reported in the past have dealt with easily-labeled stimuli and reported high recognition rates of 95% (Standing, 1970). The toy stimuli used in this experiment represented this easily-
labeled inventory type of stimuli. The building stimuli could not easily be labeled requiring the subject to study descriptive components. Mandler and Parker (1976) and Mandler and Ritchey (1977) challenged the generalizability of findings for earlier "visual memory" studies using stimuli similar to the toy condition used here. They found only 70.8% picture recognition accuracy in the immediate retention condition in their first study followed by a second study reporting 73.2%. They also reported that memory for identity and location information remained over time whereas memory accuracy for descriptive and spatial composition information was not maintained. This would explain why picture recognition memory in this study was lower for the descriptive building stimuli than for the inventory stimuli represented with toys.

In conclusion, the present investigation examined whether verbal labels assist recognition and relocation memory for toy object and building in children and adults. Results were contradictory to past findings reporting higher recognition accuracy when objects were accompanied by labels (Kosslyn and Nelson, 1976). Findings from this investigation were similar to those of Pezdek and Evans (1979) which reported that with adults the presence of a verbal label significantly reduced picture recognition accuracy but facilitated building relocation accuracy. This finding was
obtained with adults and also extended to eight to ten-year olds. The age x name x item interaction effect was not significant. This suggests that children and adults utilize similar memory processing methods but that children are less efficient. While testing measures in this study are not appropriate to the pre-school child the implication remains that from eight years on a child can greatly benefit from the learning of more efficient memory processing skills.
TABLE I

Mean Performance in Experimental Conditions

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<thead>
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<th>Number of Pictures Correctly Recognized</th>
<th>Toys</th>
<th>Buildings</th>
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</thead>
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<tr>
<td></td>
<td>Picture</td>
<td>With Name</td>
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<td>Children</td>
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<td>13.56</td>
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<tr>
<td>Adults</td>
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<td>13.75</td>
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<td>With Name</td>
</tr>
<tr>
<td>Children</td>
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<td>9.25</td>
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<tr>
<td>Adults</td>
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<tr>
<td>Adults</td>
<td>13.63</td>
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References


