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Free recall of conceptually related materials by children at three grade levels.

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FREE RECALL OF CONCEPTUALLY RELATED MATERIALS BY CHILDREN AT THREE GRADE LEVELS

by

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ABSTRACT

The present study was undertaken to test two hypotheses suggested by many previous investigators of children's free recall: the detection of categories and the rehearsal of items by groups affect organization and total recall. More explicitly, the following predictions were evaluated: (a) both early detection of categories and rehearsal of items affect the recall of children; and (b) poorer performance of younger children in free recall learning may be due, in part to their failure to detect categories and/or make use of a reorganization strategy.

The independent variables used to test these hypotheses were: (a) presence or absence of explicit identification by the experimenter of the categorized nature of the test materials; and (b) grouped versus random presentation (i.e., for Ss in the Grouped condition, the pictures were arranged in their category groupings).

Subjects used in the study were 120 children from kindergarten, grade 3, and grade 5 (40 from each grade level). All were given 24 test pictures (comprising four categories of six items each) to study for two minutes. One-half of the Ss received the grouped presentation, while the remaining Ss saw the pictures randomly arranged. Also, one-half of the Ss had the categorized nature of the pictures explicitly pointed out to them during a study period. Following the study period, the Ss were asked to recall as many pictures as possible. Three such trials were given. Following the Ss final recall, he was tested for his awareness of the categorized nature of the pictures.

The results indicated that the grouped presentation had a significant positive effect on the organization and total recall of grade 3 and grade 5 subjects, with the former showing the greatest benefit. There was no effect with kindergarten subjects.

For category identification, the only significant effect was found with grade 5 children. It appeared that overall, the provision of category labels was not sufficient to induce organization.

The study also indicated that within the third- and fifth-grade levels, there was a significant positive relationship between organization and total recall. No such relationship was found for younger Ss who appeared to learn the pictures only serially.

In summary, the current study suggested that the observed differences between older and younger Ss are associated with the following factors: (1) detection of the categorized nature of the test; (2) use of efficient organizational strategies; (3) usability of concepts; (4) rate of learning; (5) ability to use available cues; and (6) immediate memory span.

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CHAPTER I

INTRODUCTION

With the increasing emphasis on "grouping" or "organization" factors in human learning for both adults (e.g., Mandler, 1967; Tulving, 1968) and children (e.g., Rowher, 1970; Spitz, 1968), a considerable literature on free recall learning has appeared during the past several years. These experiments all involve the same basic procedure: the subject (S) is presented with a list of words or pictures and is asked to reproduce verbally or in writing as many of the items as he can in any order he wishes.

Using the free recall paradigm, several investigators have shown that children as well as adults group together words that "go together" conceptually, associatively, or syntactically, even though the materials are presented in a random order (e.g., Bousfield, Esterson, and Whitmarsh, 1958; Wicklund, and Palermo, 1965; Rossi and Wittrock, 1971).[1] An examination of the previous studies on children's free recall also reveals that the degree of organization in recall and the amount of total recall is an increasing function of both chronological and mental age. These reported age differences in free recall presumably reflect underlying age differences in both problem-solving strategies at the input phase and retrieval strategies. From this standpoint, it is of

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1. Detailed Review of Literature, and Suggestions for Future Studies, See APPENDIX A.

interest, however, that investigation of the mechanisms which might underly age differences in free recall have begun to appear only recently (e.g., Cole, Frankel, and Sharp, 1971; Moely, Olson, Halwes, and Flavell, 1969). The present study represents an initial attempt to clarify some processes which may underly age differences in children's free recall of conceptually related materials.

Present Study

The point of departure for the present investigation is the recent suggestion that the detection of categories and the rehearsal of items by groups are important factors for clustering in free recall learning (Cohen, 1966; Moely, Olson, Halwes, and Flavell, 1969). Cohen (1966) hypothesized that the free recall of a list of categorized materials by adults typically involves a three-phase process: detection, storage, and retrieval. The initial phase involves the conscious detection by the subjects of the categorized nature of the list. Objective evidence for Cohen's detection phase in children comes from the recent experiment by Moely et al. which was concerned with the "production deficiency" hypothesis.[2] The relevant portions of that study for the current experiment are presented below.

In the Moely et al. study (1969), the Ss (kindergarteners, first-, third-, and fifth-graders) were given a two-minute study period, during which they were allowed to group pictures of categorized objects (manual clustering) which were subsequently to be recalled. During the study period, these investigators observed that several of the fifth-grade children spontaneously rearranged the pictures into category

2. See APPENDIX A.

groups as soon as the items were presented. This spontaneous grouping of pictures may be interpreted as evidence for Cohen's early detection of categories.

For one-third of the Ss in the Moely et al. study, the experimenter initially labeled each category during the study period. With the third-graders, this procedure increased the degree of manual clustering during the study period and the amount of subsequent recall relative to the condition in which the categories were not identified. These findings support the proposition that the initial detection of categories is important in free recall learning, and suggest that spontaneous detection of the categories (as observed only in the fifth-graders) is more characteristic of older children than younger children.

As noted above, the behaviour of the fifth-graders observed during the study period suggested that older children tend to adopt strategies such as reorganization of items into categories as a means of improving their recall. In contrast, the kindergarteners and the first-graders rarely employed systematic category organization during the study period, although they were able to sort the items by categories when asked to do so. Perhaps these younger Ss tend to process information in the order in which it is presented. Under one experimental condition, the Ss were induced to sort the items manually, label the resulting categories, and count the items in each category, with the E providing assistance as needed. These instructions significantly increased both the category clustering in recall and total recall of the younger Ss. From the results of the Moely et al. study, the following hypotheses were developed: (a) both early detection of categories and rehearsal of items by groups affect the free recall of children; and (b) poorer

performance of younger children in free recall learning may be due, in part, to their failure to detect categories and/or make use of a reorganization strategy.

On the basis of these hypotheses, two independent variables were selected for the present investigation in order to analyze whether age-related changes in recall involve different mechanisms. The first is the presence or absence of explicit identification by the experimenter of the categories involved in the test items (category identification presence and absence). The second is the presentation condition factor: the grouped presentation condition in which items of the same category are grouped; and the random presentation condition in which the items are arranged in a random order. Specifically then, the purpose of the present study was to investigate whether older children's superior performance in free recall learning can be attributed to these two factors.

If older Ss readily detect the categorized nature of the test materials, and their predominant strategy is to organize the test materials into their categories, the provision of labels and the grouped presentation condition should not greatly improve the performance of older Ss. On the other hand, if younger Ss are not spontaneously using these mechanisms, but can be induced to employ them, the effects of the selected independent variables on their free recall performance should be greater (than with the older Ss).

The design of the present study (i.e., a standard 3 X 2 X 2 design) may be described as follows: children of kindergarten, grade 3, and grade 5 participated in free recall learning of conceptually related

materials. One-half of the children at each age level were assigned to the identification presence condition, and the remaining half of the children, to the identification absence condition. Within each of the identification treatments, one-half of the subjects were tested under the grouped presentation condition, and the other half of the subjects, under the random presentation condition, resulting in four groups at each grade level.

CHAPTER II

METHOD

Subjects

The Ss were 120 kindergarten ($\bar{X}$ CA = 6.0 yr.), grade 3 ($\bar{X}$ CA = 8.9 yr.), and grade 5 ($\bar{X}$ CA = 10.7 yr.) children. Ten Ss (five boys and five girls) in each grade level were randomly assigned to one of the four experimental conditions.

Materials

The items for the experimental task were identical to those used by Moely et al. (1969), and are presented in Table I in Appendix B. Briefly, there were 24 pictures of common objects belonging to four conceptual categories (animals, transportation, clothes, and furniture), which were named at least once in a multiple-response free association test given to ten nursery school children.

These items were presented as black and white line drawings on 7 cm X 7 cm cards, each containing a single picture (see examples in Figure I in APPENDIX C). All 24 items were presented simultaneously on a piece of cardboard 29 cm X 43 cm (presentation card), containing four rows of six pictures each. For the random presentation condition, three different random presentations of the test pictures were constructed (i.e., there were three different presentation cards), with the only restriction being that two pictures from the same conceptual category could not appear immediately adjacent to each other in the same row or column. For the grouped presentation condition, the pictures

in each row were from the same conceptual category. There were three different presentation cards with the order of categories and pictures within each category randomly determined for each.

Procedure

The Ss were tested individually in a room located within the school building. On entering the testing room, the S was asked to sit at the table beside the E, and was given the following instructions: "We are going to play a memory game. Do you think you are good at remembering? If you study real hard, you can win a prize. I'm going to show you some pictures, and after you have seen them all, I'm going to take the pictures away and ask you to tell me all the pictures you saw."

On the first test trial, the E placed the appropriate test item arrangement (random or grouped) on the table and said: "Now, here is a set of pictures (E points to the card). You watch very carefully, so you see all the pictures, and try to remember them all. You know what most of them are, don't you? When I point to a picture, you say its name for me. What's this?"

The E pointed to the pictures one at a time, going from left to right across the first row, then the second, third, and the fourth row. Only one row at a time was shown in order to focus the attention of the S on the selected pictures.

In addition to the above instructions, half of the Ss at each grade level (category identification condition) were told: "Can you also see that some of the pictures go together or are alike? These, for example, are all animals, these are all furniture or things around the house, these are all transportation or things people ride in, and these are all clothes or things people wear."

The E then allowed the S to study all the pictures on the card. After two minutes had elapsed since the initial presentation of the pictures, the E removed the card, and said to the S, "Okay, try and tell me all the pictures you saw." The S was given two minutes to recall the pictures. If the S stopped reproducing within the first minute, he was urged to continue his recall.

The identical procedure as employed on the first test was used on the two subsequent test trials (three test trials in total), except that different presentation cards were used on each trial (see Materials). All recalls were tape-recorded to counter check the E's written records.

Following their final recall, all Ss were given the 24 test pictures presented in a random order on the table. They were then asked, "Can you point out the pictures that go together or are alike?" Ss were then allowed to rearrange the pictures into groups according to the categories used in this study. Those Ss who were unable to group all the pictures into their respective categories were given the category names and asked which items belonged to each. Each S was then given two pencils as a prize, thanked for participating, and was returned to his classroom.

Within each of the identification presence and absence conditions, one-half of the Ss were tested using the random presentation cards, and the remaining half were tested using the grouped presentation cards.

CHAPTER III

RESULTS

Total Recall

Mean total recall as a function of Category Identification, Presentation Condition, Grade Level and Trials is presented graphically in Figure 2. These data were analyzed using a 2 (Category Identification) X 2 (Presentation Condition) X 3 (Grade Level) X 3 (Trials) mixed analysis of variance. The results of the analysis are summarized in TABLE 2 in APPENDIX B.

The main effects of Category Identification ($F = 6.33$, $df = 1/108$, $p < .05$), Presentation Condition ($F = 10.31$, $df = 1/108$, $p < .01$), Grade Level ($F = 103.94$, $df = 2/108$, $p < .001$), and Trials ($F = 56.57$, $df = 2/216$, $p < .001$) were all significant. The results also indicated a significant Grade Level X Trial interaction ($F = 3.24$, $df = 2/216$, $p < .05$). This interaction, as may be seen in Figure 2 can be attributed to the fact that third- and fifth-graders showed a significant increment over trials ($p < .01$), while the kindergarteners only showed a significant increment in total recall between trials 1 and 2 ($p < .05$). Further analysis (i.e., with a t - test) revealed that, regardless of trials, fifth-graders recalled significantly more than third-graders ($p < .05$), who, in turn, remembered significantly more than kindergarteners ($p < .01$).

Although no other higher-order interactions including Grade Level were significant, in order to examine the effects of the major factors (Category Identification and Presentation Condition) at each grade

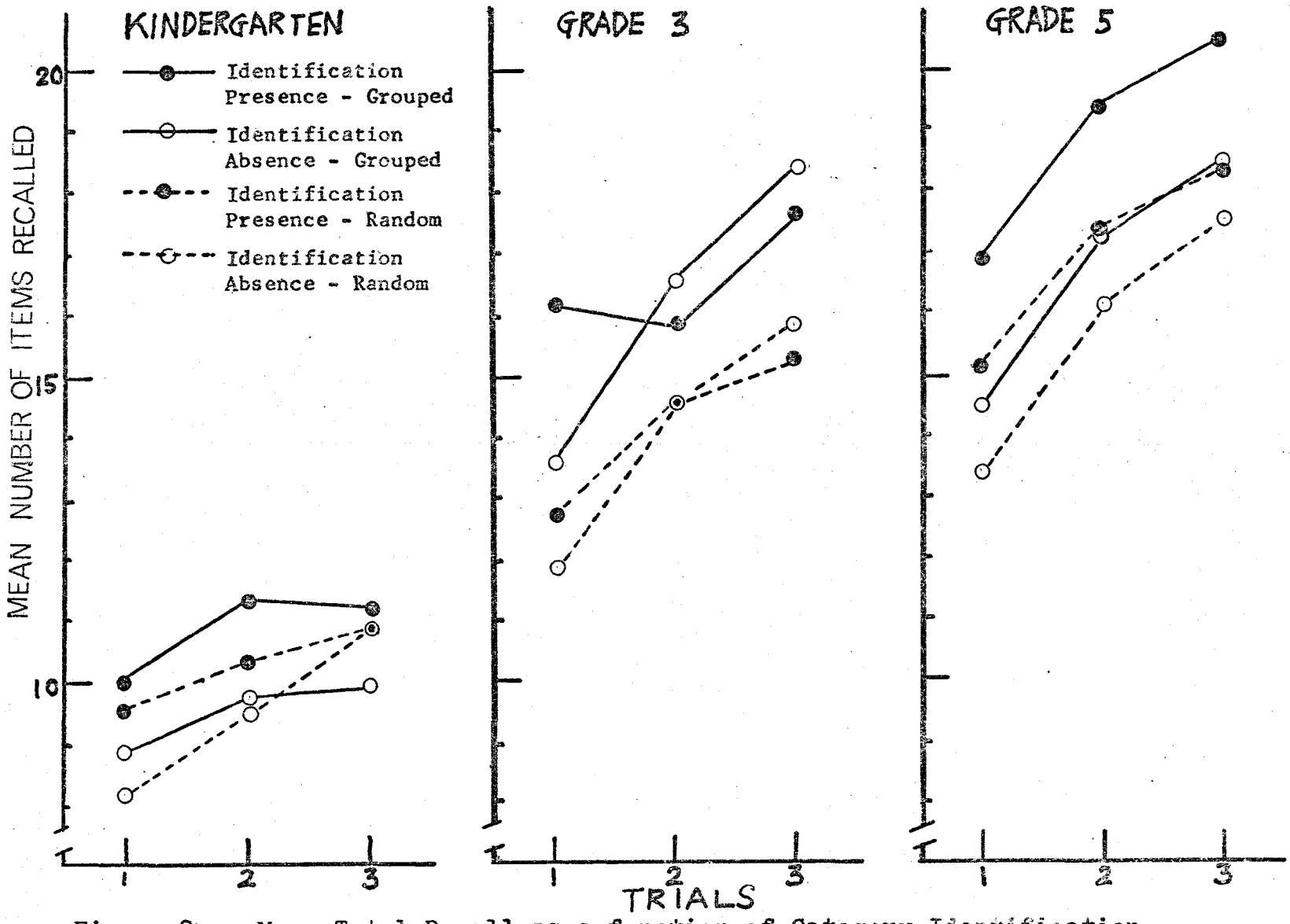

Figure 2 . Mean Total Recall as a function of Category Identification, Presentation Condition, Grade Level, and Trial.

level, the data were further analyzed in terms of a 2 (Category Identification) X 2 (Presentation Condition) X 3 (Trials) mixed analysis of variance at each grade level separately. The summaries of these analyses are reported in TABLE 3.

The results showed: (a) For the kindergarteners, the main effects of Category Identification and Presentation Condition were not significant, indicating that these factors did not facilitate total recall. Only the main effect of Trials was significant ($F = 4.09$, $df = 2/72$, $p < .05$), as was described previously. (b) For third-graders, the main effect of Presentation Condition ($F = 7.12$, $df = 1/36$, $p < .001$) was significant, indicating that the grouped condition ($\bar{X} = 16.6$) performed significantly better than the random condition ($\bar{X} = 14.2$). In addition, the Trials effect ($F = 27.62$, $df = 2/72$, $p < .001$) and the Category Identification X Trials interaction ($F = 3.97$, $df = 2/72$, $p < .05$) were also significant. The significant two-factor interaction can be explained by the fact that Ss in the identification presence condition showed a superior performance over the identification absence condition only on the first trial ($t = 2.11$, $p < .05$), while the two conditions did not differ on the second and third trials. (c) For the fifth-graders, the main effect of Category Identification was significant ($F = 5.45$, $df = 1/36$, $p < .05$), showing that the category identification presence condition Ss ($\bar{X} = 17.7$) recalled significantly more than the category identification absence Ss ($\bar{X} = 16.2$). The main effect of Presentation Condition ($F = 4.06$, $df = 1/36$, $p < .10$) was significant at the borderline level, indicating that, in general, both the provision of category labels and the grouped presentation facilitated the total recall of fifth-graders. The Trials effect was

again significant (F = 32.34, df = 2/72, $p < .001$). All interactions were non-significant.

Organization in Recall

PR Scores. The Proportion of Repetition (PR) was used to measure the organization of items by category in recall. PR is defined as $r/N-c$, where r is the number of pairs of words from the same category that occur contiguously in recall, N is the total number of words recalled, and c is the number of categories used in recall. Repetitions and intrusions were not used in calculating the PR scores.

The mean PR scores as a function of Category Identification, Presentation Condition, Grade Level, and Trials are presented graphically in Figure 3. As with the previous data, a 2 (Category Identification) X 2 (Presentation Condition) X 3 (Grade Level) X 3 (Trials) mixed analysis of variance was performed. The results are summarized in TABLE 4 in APPENDIX B.

The main effects of Category Identification (F = 5.40, df = 1/108, $p < .05$), Presentation Condition (F = 172.56, df = 1/108, $p < .001$), Grade Level (F = 10.08, df = 2/108, $p < .01$), and Trials (F = 6.60, df = 2/216, $p < .01$) were all significant, indicating that the presence of category identification and the use of a grouped presentation increased the organization due to categories, in addition to increased organization as a function of increasing grade level and increased trials.

The results also indicated a significant Presentation Condition X Trial interaction (F = 3.78, df = 2/216, $p < .025$), as graphically presented in Figure 4. This significant interaction reveals that Ss in the random condition showed significant increments in the organi-

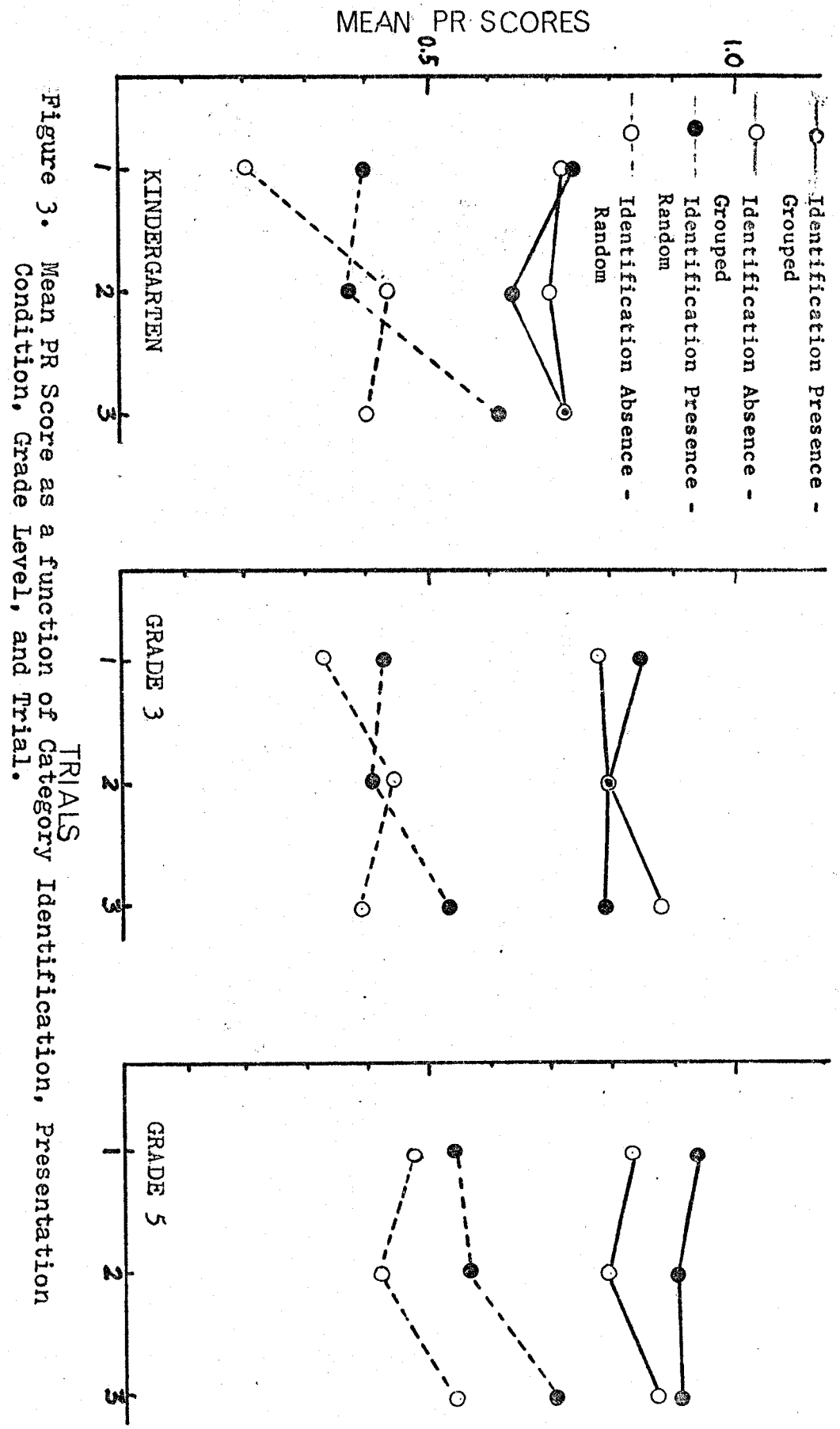

Figure 3. Mean PR Score as a function of Category Identification, Presentation Condition, Grade Level, and Trial.

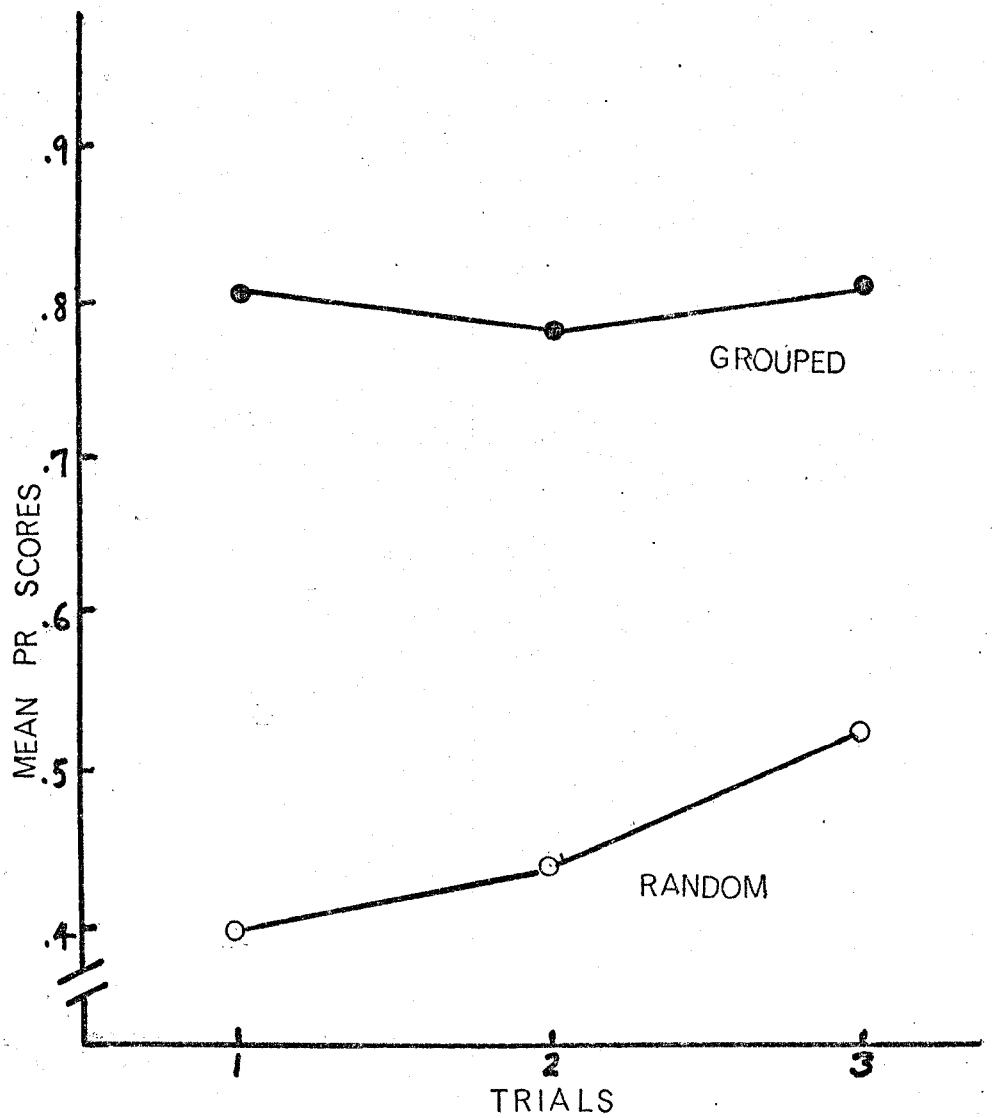

Figure 4. Mean PR Scores as a Function of Presentation Condition and Trial.

zation of recall according to categories between trials 2 and 3, whereas no significant difference between trials was found for the grouped condition. Further analysis indicated that, regardless of trials, the grouped condition organized their recall according to the conceptual categories significantly more than did Ss in the random condition.

Additional analyses at each grade level were performed. The results indicated that the grouped presentation facilitated organization according to categories at all age levels while the provision of category labels (category identification) was significant ($.05 < p < .10$) only for fifth-graders.

OR Scores. Next, the organization of items in recall according to their presentation order (OR) was examined for Ss in the random presentation conditions. The OR is defined as $o/N-u$, where o is the number of pairs of words from the same row that occur contiguously in recall, N is the total number of words recalled, and u is the number of rows in which the test items were presented. Repetitions and intrusions were not used in calculating the OR scores. Mean OR scores for the three grade levels are shown in Figures 5 and 6. In addition, the PR scores for the corresponding random conditions are superimposed on the graphs to allow the reader to directly compare the relative use of the different organizational methods (i.e., organization due to categories and organization due to the presentation order).

It should be clear from Figures 5 and 6 that kindergarten Ss showed organization of recall primarily by means of presentation order at least during the first trial, while grade 5 Ss organized pictures according to conceptual categories. It appears from the data for

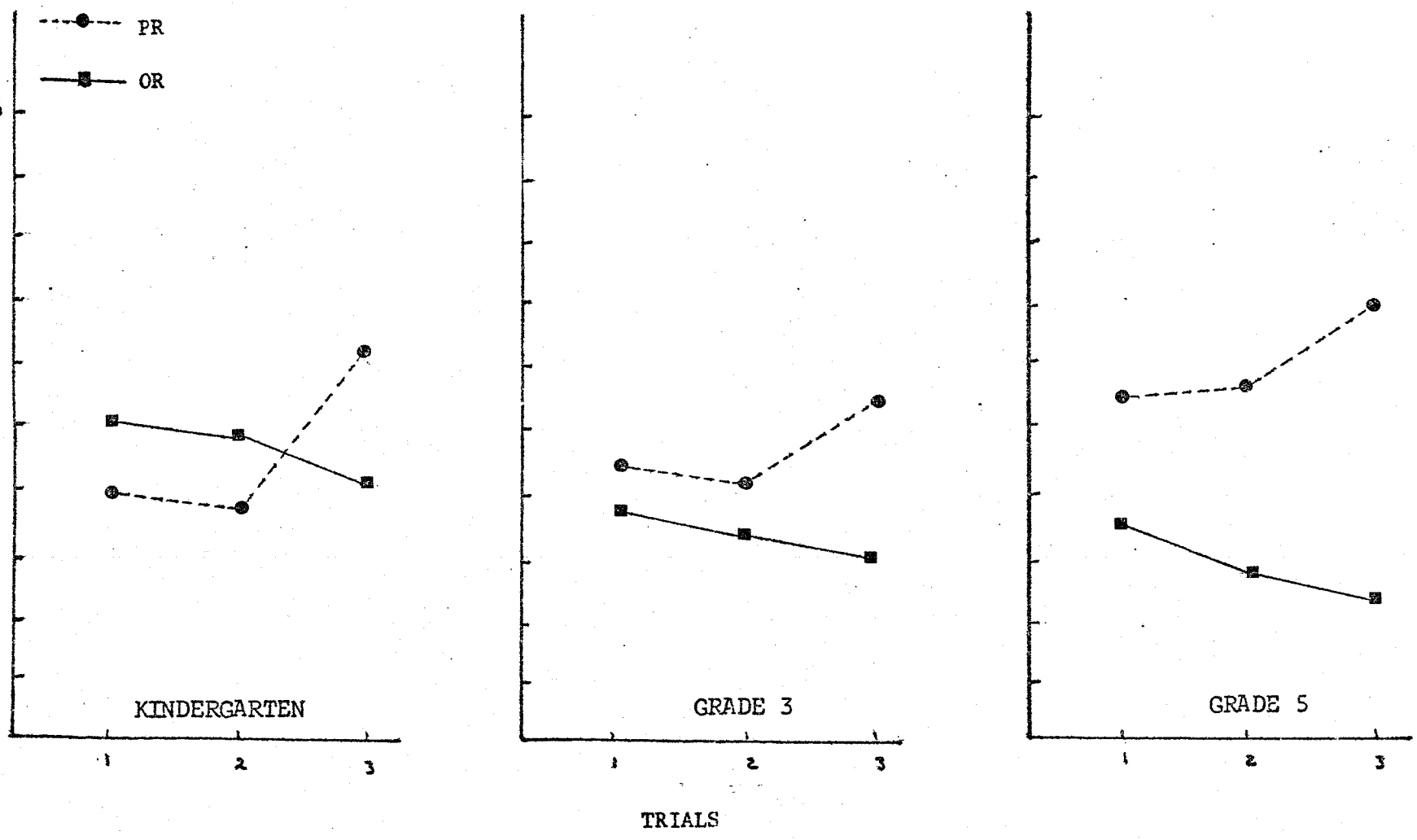

Figure 5. Mean PR and OR Scores for the Category Identification Presence-Random Presentation Condition as a Function of Grade Level and Trial.

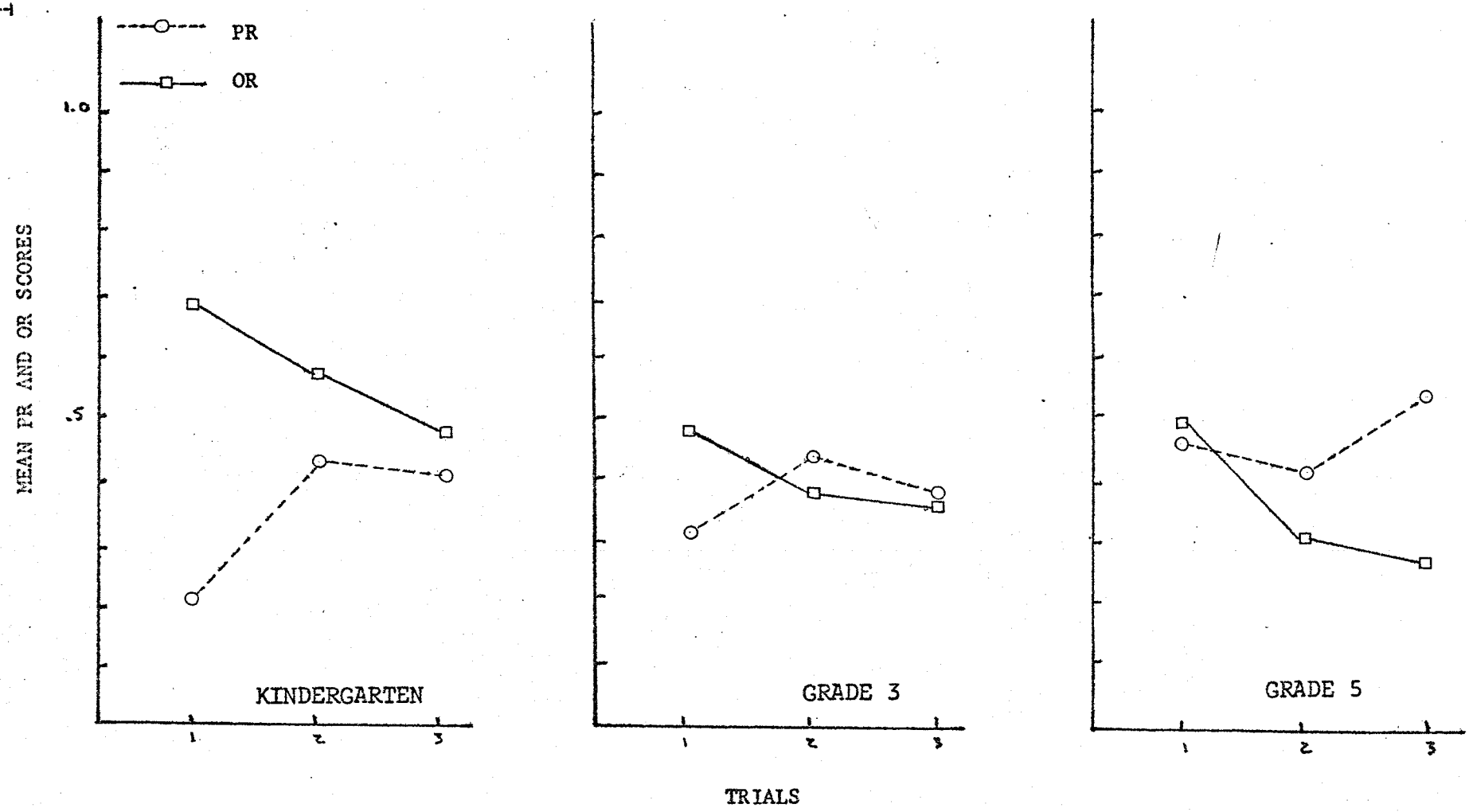

Figure 6. Mean PR and OR Scores for the Category Identification Absence-Random Presentation Condition as a Function of Grade Level and Trial.

grade 3 Ss that they are at the intermediate stage, in which they are beginning to use conceptual organization. An analysis of variance on the OR scores (see TABLE 5) revealed: (a) the provision of category labels tended to diminish the use or organization according to the presentation order ($F = 5.08$, $df = 1/54$, $p < .05$) and (b) as grade level and the number of trials increased, the OR scores decreased (Grade Level, $F = 10.44$, $df = 2/54$, $p < .001$; Trial, $F = 9.96$, $df = 2/108$, $p < .001$).

Additional Data

Relationship Between Total Recall and PR Scores. Correlations between the mean total recall scores and the mean PR scores of each S were computed for each grade level. The results reveal a non-significant correlation for kindergarteners ($r = -.16$), whereas significant positive correlations were obtained for third-graders ($r = .48$, $p < .005$) and fifth-graders ($r = .39$, $p < .01$).

Correlations between the total recall scores and PR scores of each S as a function of Category Identification, Presentation Condition, Grade Level, and Trials were also computed (see TABLE 6).

Within the kindergarten grade level, there were more significant negative correlations than positive ones. Within the third- and fifth-grade level, the trend reversed such that there were more positive correlations than negative, although very few were significant. It should be pointed out that the range of total recall scores within each cell was extremely small (i.e., on the average 4 points). This small dispersion of scores contributed at least in part to the observed low correlations.

Card Sorting Performance. It may be recalled that, following the final test trial, Ss were asked to put the pictures into groups that went together or were alike. The performance of the Ss in the identification absence-random presentation condition should reflect most closely children's tendency to spontaneously categorize the test materials. The percent of pictures categorized by these children according to the four designated categories is reported in TABLE 7, together with the data of the Ss in the other three experimental conditions.

The results for the identification absence-random presentation condition show that as grade level increases, children tend to group the pictures more and more in accordance with the designated categories. In addition, two Ss (kindergarteners) were unable to classify the pictures in any manner. Also, as grade level increased, the number of items within each category increased.

Within the identification absence-grouped presentation condition, kindergarten Ss still were not able to categorize the pictures according to the designated concepts, indicating that the grouped presentation condition did not help these children to detect the categorized structure of the pictures. The data for the two category identification conditions show that the provision of category labels helped all children to organize the pictures according to the categories used in this study.

Finally, it should be noted that when the category names were provided by the E, all the Ss except two (even these two only had minor errors), correctly identified the six pictures in each category. From these results, it may be safe to conclude that the "competence" level across grade levels was equated.

CHAPTER IV

DISCUSSION

According to the hypotheses advanced earlier, younger children's poorer performance in free recall learning is partly a function of: (a) their failure to recognize the categorized structure of the learning materials, and (b) their failure to employ efficient organization strategies. In order to examine these hypotheses, the effects of two independent variables (Category Identification and Presentation Condition) on children's free recall were studied. The initial discussion in this chapter will be centred around the observed differential effects of these variables on Ss recall at the three grade levels.

Presentation Condition

The grouped condition was used to encourage younger Ss to make use of a more efficient strategy rehearsal of items by categorized groups. If the hypotheses of the study were correct it would be expected that the grouped presentation should improve younger Ss' total recall to a greater extent than that of older Ss. The effect of the grouped presentation was noted in the data for the grade 3 and grade 5, with the clearest influence observed in the increased total recall and category organization of grade 3 Ss.[3] If it can be assumed that the presentation of items according to conceptual categories

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3. It is unlikely that these results are due to a ceiling effect. On analyzing the grade 3 and grade 5 data for the category identification-grouped and random conditions only, the same interpretation would be made. Also, the provision of category labels further increased the performance of the grade 5 grouped condition.

(grouped condition) was sufficient for grade 3 Ss to recognize the categorized nature of the test materials,[4] the differential effects of the grouped presentation condition found with grade 3 and grade 5 Ss are consistent with both parts of the hypothesis ((a) and (b) above) on which this study was based.

While the grouped presentation showed facilitative effects on the performance of grade 3 Ss, this variable did not affect item recall at the kindergarten level. There are several possible interpretations for this failure to obtain positive results with the kindergarten Ss. First, it is possible that the number of items in each category exceeded the immediate memory span of the younger Ss, while not exceeding that of older Ss. Second, the results of the organization scores (i.e., PR and OR) indicated that grade 3 Ss were in a transitional developmental stage in which they are beginning to utilize conceptual organization as a grouping strategy (PR versus OR scores for Ss in the random condition, Figure 3). In contrast, the predominant mode of organization for kindergarten Ss was to reproduce the information according to its presentation order. From this, it may be concluded that a training procedure where Ss are taught to group items in terms of conceptual categories may be most beneficial at transitional stages. Third, the results of the post-test interview data (free and induced category sorting) showed that grade 3 Ss readily organized test items according to "cultural codes". Although the "available" contents of

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4. This inference appears to be reasonable because Ss in the identification absence-grouped condition performed as well as Ss in the identification presence-grouped condition (see Figures 2 and 3).

concepts in kindergarten Ss conformed with adult norms, their "usable" contents were quite limited and often different from those of adults. Even after the test items were presented to them in their conceptual groupings, kindergarten children were unable to sort the pictures into their categories (post-test data for identification absence-grouped condition). These differences between grade 3 and kindergarten Ss observed during the post-test interview suggest that in order for the grouped condition, such as used in this study, to be effective, contents of the Ss' concepts should be in agreement with what the experimenter judged appropriate to the categories. Although the grouped presentation significantly improved kindergarten Ss' category organization in recall, the data from the post-test interview also suggest that these Ss were simply rehearsing test items according to the serial order without "consciously" detecting the categorized structure of the test. In light of the above, it is possible that different mechanisms were operating in the Ss minds at different grade levels, even though both the younger and older Ss in the grouped condition named the test items in the same manner. This suggests that even children's simple verbal behaviours (e.g., labeling, rehearsal) cannot be translated into conventional mediational terms, such as "r" and "s", because they seem to be qualitatively different.

The second interpretation discussed above concerned the lack of a reorganization strategy in younger children. The third interpretation referred to differences in the contents of concepts between younger and older Ss. A question can be raised at this time as to whether kindergarten children always use serial order organization in recall

under any test situation. Do younger Ss use category organization to the same extent as older Ss if contents of the concepts are equated among various age groups? If items are selected from children's own categories and then grouped in the test situation according to these categories, do younger Ss readily detect the structure of the test and perform in an analagous manner to the older Ss in the present study? Or, do younger Ss need to sort the cards by themselves in order to detect the categorized nature of the test? These questions should be readily translated into testable form.

Category Identification

The grouped presentation may not be sufficient for the younger Ss to detect the nature of the task. Consequently, the E identified the categories for half of the Ss in this study. An additional interest was to examine whether category identification alone would facilitate children's free recall learning. The effects of this variable on Ss' total recall and category organization in recall were clearly limited to grade 5. No effect of the category identification was found in the results of kindergarten and grade 3 Ss either for category organization or total recall. Such findings are consistent with those of Nelson (1969), who reported that category label training had no effect on the recall of 5 and 8 year old children (comparable to the kindergarten and grade 3 Ss used in the current study). It appears, as discussed in the previous section, that for the grade 3 Ss, the grouped presentation was sufficient for them to detect the categories. Consequently, there was no benefit from the added category labels supplied by the E in the identification presence-grouped condition. For the kindergarten and grade 3 Ss in the random condition, it may be that the

provision of category labels alone was not strong enough to induce reorganization of the test materials; therefore, at this developmental stage, there was no facilitative effect on subsequent recall.

At least one additional interpretation is possible to account for the non-significant findings with kindergarten and grade 3 Ss regarding the effects of category identification. Perhaps they provided their own category labels and therefore the provision of these in the test situation by the E had no effect. However, if one were to accept this position, why then, did this variable show a positive effect on the performance of grade 5 Ss who can also supply the category labels? It should be pointed out that the provision of category labels has at least two functions: (a) facilitate organization at the input phase; and (b) serve as retrieval cues at the output phase. Tulving and Pearlstone (1966), using category labels as retrieval cues, demonstrated an improvement in total recall with high-school students. It may be the use of this latter function of category labels (i.e., as retrieval cues) which differentiated the free recall performance of the older Ss from the younger Ss under the category identification-presence conditions.

Although the two functions of the category labels mentioned above were confounded in the current study, the validity of the interpretation is readily testable in the following manner: grade 5 and grade 3 Ss can be given categorized lists to learn under a category identification presence condition; subsequently, the recall of one-half of the Ss in each grade level can be tested in the presence of category names as retrieval cues, while the remaining Ss recall will not be cued. If older children (i.e., grade 5 Ss) utilize the category labels provided

during the study period as retrieval cues without any additional aid from the E, the difference between the cued and free recall conditions for these Ss should be small when compared to the differences between these two conditions for younger children (i.e., grade 3 Ss).

Relationship Between Organization and Recall

Many investigators (i.e., Tulving, 1968; Mandler, 1967) have suggested that total recall is a function of organization. The present study lends partial support to their positions. Within the third- and fifth-grade levels, increases in organization were accompanied by increases in total recall (see Figures 2 and 3). In addition, the correlation between mean total recall and mean PR showed a significant positive relationship. It was also observed that older children organize more than younger children, in addition to recalling more. These findings are at least consistent with the general proposition in this area, although the present study does not indicate whether increased organization is the cause for improvement in total recall.

On the other hand, at the kindergarten grade level, the improved organization (PR) under the grouped presentation condition did not result in increased total recall scores. In addition, there was a non-significant correlation between organization and total recall for these Ss. It is difficult, however, to use this as negative evidence for the proposition that total recall increases as a function of organization. It is possible that high PR scores for Ss in the grouped presentation conditions simply reflect serial order organization rather than category organization.

Age Changes in Free Recall Learning

The present study raised the question of why older children remember

more in the free recall of conceptually related materials; and under what conditions may young children's memory be improved. Some of the major factors responsible for these age changes in free recall learning have already been suggested in the preceding sections. The observed evidence in the present study suggests the importance of the following factors: (1) detection of the categorized nature of the pictures (e.g., greater improvement in grade 3 Ss under grouped condition when compared to grade 5 Ss); (2) use of efficient organizational strategies (e.g., greater improvement for grade 3 Ss under grouped condition when compared with grade 5 Ss; and predominant use of serial order organization in kindergarten Ss); (3) usability of concepts (e.g., post-test interview indicated older children's concepts closely approximate adults' concepts, whereas such was not the case for kindergarten Ss). Possibly this factor affected category identification, which, in turn, affected the use of organizational strategies; (4) rate of learning (e.g., significant Grade Level X Trial interaction indicated that grade 3 and grade 5 Ss improved their recall over all trials while comparable increments were not present in the total recall scores of kindergarten Ss). These findings replicated the results obtained by two previous investigators (Cole, Frankel, and Sharp, 1971; Nelson, 1969). It is possible that younger children need additional trials (i.e., exposures) to improve their memory; (5) ability to use cues to improve memory (e.g., significant effect for category identification with grade 5 Ss). Older children appear to use all available cues to improve their memory; and (6) immediate memory span. Although not seriously considered in the present study, the age differences in immediate memory span may have contributed to the age differences noted

in free recall. If younger Ss' immediate memory span is smaller than that of the older Ss, perfect organization according to categories by both groups would still not result in identical total recall scores. Younger Ss would not be able to remember as many categories or items within each category when compared with the older Ss.

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APPENDIX A

Review of Literature

This section is designed to function as a non-critical review of studies on free recall by children, which are most pertinent to the present experiment. All the reviewed investigations involve the same basic procedure. Stimulus words or pictures are presented to the subject, after which he is asked to recall as many of the items as he can in any order he wishes. Of the many studies of free recall in children, only one type is presented in this section; experiments involving lists with items which may be grouped into a number of conceptual categories. Studies of "subjective" organization, for example, are not included for the present purpose.

In free recall learning, a widely studied phenomenon is that of categorical clustering in recall. It was first investigated in children by Bousfield, Esterson, and Whitmarsh (1958), using third-, fourth-grade children, and college students as subjects. The essential elements of their method, borrowed from Bousfield and Cohen (1955), involved projecting singly on a screen a randomized list of items comprising five items from each of five generic or conceptual categories (eg. birds, fruit, flowers, nature, and vegetable). Each item consisted of a picture accompanied by its appropriate name underneath. After all twenty-five items have been presented, the subjects were given five minutes to verbally recall, in any order, as many words as possible. Clustering was said to have occurred when at least two words from the same conceptual category were recalled sequentially. The response measure, called the Ratio of Repetition Index (RR), was obtained

using the formula $r/(N-1)$, where r equals the number of clustered pairs and N refers to the total number of words recalled. Their results indicated that both clustering and the extent of total recall increased as the developmental level of the subjects increased.

Using Bousfield's "associative clustering method" described above, Rossi (1964) also traced the development of clustering behaviour in five, eight, and eleven year-old children. In addition, he attempted to investigate whether the presence of verbal mediational terms within the list would facilitate clustering and total recall by making reorganization of the list easier. For half of the subjects at each grade level, the stimulus materials were twenty words comprising five members from each of four categories (eg., animal, body parts, clothing, and food). For the remaining half of the children, the category names (i.e., the verbal mediational terms) were introduced. Procedurally, this was done by inserting the terms "food", "clothing", "body", and "animal" for one item from their respective categories in the original list. The presentation procedure involved the experimenter verbally giving a word, after which the child repeated the word until the list was completed. The child was then asked to recall as many words as he could within a two-minute recall period. Rossi, using the ratio of words clustered to the total number of words recalled as his measure, concluded that there was a significant increase in clustering from five to eleven years of age. He did not find, however, any facilitative effects with the verbal media-

tional terms in the list.

The categorical clustering in free recall was investigated with still younger children by Rossi and Rossi (1965). Twelve stimulus items comprising four conceptual categories (eg., fruit, toys, clothing, and eating utensils) were presented to the subjects whose ages ranged from two to five. One other interesting feature of this experiment is that the investigators employed three modes of stimulus presentation: an auditory presentation, in which the stimulus list was read to the subject by the experimenter; a visual presentation, in which a picture of each item was displayed to the subject while it was named by the experimenter; and an object presentation, in which the real object was presented to the subject while the experimenter named it. The results indicated that the degree of clustering increased from two to five years of age, with even the two year-olds clustering significantly above chance. They also reported that there was a positive relationship between total recall and the age of the subjects and the presentation method (object > picture > words). Although clustering measures for the three presentation modes did not differ significantly, trends did suggest that the best clustering performance for all age levels occurred under the object mode. It should be pointed out, however, that both visual and object presentation modes included the verbal labeling of each stimulus item; "purely" visual or object presentations were not implemented in the study.

One other study (Horowitz, 1969) compared the effects of

the auditory and visual presentation modes on children's free recall learning. The subjects used were slightly older than those in the Rossi and Rossi study. For the auditory mode of presentation, the stimulus words were read by the experimenter for the subjects, and for the visual mode of presentation, pictures of the stimulus items were presented. The study showed that the visual mode was more effective than the auditory mode, and that older subjects did better than the younger subjects in the total recall, both of which are in agreement with the findings of the Rossi and Rossi study. Regarding clustering in recall, however, the study did not show age effects.

The experiments reviewed so far involved normal children. Other experimenters studied categorical clustering in free recall with retarded subjects. Gerjuoy and Spitz (1966) attacked the issue with the hypothesis that the degree of clustering and total recall is a function of mental age. Their subjects were 40 middle or high-grade institutionalized retardates (WISC scores 52.95 to 72; mean CA 14.6), 19 nine year-old normals (mean MA same as retardates), 14 normals of the same CA as the retardates, and 20 college students. The stimulus materials were 20 nouns comprising five members from each of four categories (eg., animal, body parts, clothing, and food). The presentation procedure involved the experimenter verbally giving a word, after which the subject repeated the word until the randomized list was completed. The subject was then asked to recall as many words as possible. Five

trials, with a different random order on each were given. The results indicated that the 14 year-old retardates and nine year-old normals of the same MA did not cluster above chance, whereas normal 14 year-olds and college students did cluster significantly above chance. Total recall followed the same pattern with the latter subjects recalling significantly more than the retardates and normal nine year-olds. There was also an increase in clustering and total recall as the number of trials increased. Another study with retardates (Rossi, 1963) reported that significant clustering was observed for subjects with a mean mental age of 7-6 and above, but not for subjects with a mean mental age of 4-6.

At least one experimenter (Laurence, 1967) compared the free recall of conceptually related verbal materials with that of a "control" list comprised of "conceptually" unrelated materials. Another interesting feature of this study is the wider age range of the subjects. Her subjects were children (from grades three through six), young adults (college students), and elderly adults (mean CA 73 years old). All subjects were given four lists of words presented serially on a memory drum; two lists of which were composed of related words (all words in each list belonging to the same conceptual category), and two lists composed of unrelated words. After each list was presented, the subject was asked to recall as many words as possible. As expected, all subjects recalled significantly more words from the related word lists than from the control lists. Another important finding for our purposes was that

fifth and sixth grade children recalled significantly more than third and fourth grade children.

The experiments reviewed in the previous section have been mainly concerned with the question of whether categorical clusterings could be observed in children's recall. The findings have generally indicated that the degree to which clustering appears is an increasing function of age. A study of Moely, Olson, Halwes, and Flavell (1969) investigated the processes underlying such age differences in recall. They studied clustering and total recall in children to test whether the production deficiency hypothesis proposed by Flavell, Beach, and Chinsky (1966) was, in fact, correct. The hypothesis suggested that there is a period in development during which the child tends not to use symbolic and conceptual skills as a means of coping with a task, even though they are a part of his repertoire.

In order to equate the lists for difficulty, 16, 20, and 24 pictures comprising four conceptual categories (animals, furniture, vehicles, and clothing) were presented to kindergarten and first graders, third graders, and fifth graders, respectively; with the former three groups being divided equally into Control, Teaching, and Naming conditions, while the latter group were used as Control subjects. All subjects had the pictures for their grade level placed in front of them in a random fashion. The subjects in the Control group were told they were free to move the pictures during the two-minute study period; the subjects in the Naming group had the

categories labelled for them and the items comprising each pointed out; and the subjects in the Teaching group were asked to sort the pictures, label the categories, and count the number of items in each category. Their results indicated that, within the Control subjects, there was a significant increase in clustering during recall between third and fifth graders, but no difference between kindergarten, first, and third grade children. Also, in observing the study period behaviour of the Control subjects (their manual clustering score), they found that fifth graders spontaneously grouped pictures belonging to the same category. With younger children (kindergarten, first, and third graders), this type of reorganization strategy was absent. However, if third grade children had the categories identified, they tended to use similar reorganization strategies. In contrast, for the kindergarten and first graders, only the "Teaching" procedure produced any kind of reorganizational strategies. This reorganization is probably one factor producing differential performance in free recall.

The results would seem to indicate that there is a positive relationship between manual clustering, (either induced in younger children or spontaneous in older children), and later free recall performance.

Concluding Remarks

One should be aware that the comparability of the studies reviewed is, at best, very limited. For example, the length of list or number of items varies from study to study (12 to

25 items); and this, in itself, may account for differences in clustering and total recall scores between similar age groups in the different studies. Also, the different number of categories used, and the types of content make reliable comparisons difficult.

Bearing this in mind, the results of the preceding studies generally indicate that the degree of organization in recall and the amount of recall is an increasing function of age, although the differences between adjacent age groups in some studies (eg., kindergarten and first graders, Moely et al., 1969; kindergarten and second graders, Horowitz, 1969) were not significant. There is, however, considerable disagreement as to when clustering as an observable phenomenon begins. It should be noted that the previous studies may have underestimated the degree of organization in recall by young children. Gerjuoy and Spitz (1966), for example, observed that the individual protocols of the retardates revealed many idiosyncratic, but consistent associations.

It also appears that there is a positive relationship between clustering and total recall (Gerjuoy and Spitz, 1966; Moely et al., 1969). Whether this relationship differs as a function of age level, task difficulty, etc. is not clear at this time. For example, is the relationship larger under a Random or Grouped picture presentation procedure?

The following variables, other than age, have been used: presence of absence of category names in the list (Rossi, 1964); auditory versus visual presentation (Rossi and Rossi,

1965; Horowitz, 1969); category identification and category sorting (Moely et al., 1969). The results may be summarized as follows: the presence of category names in the list did not facilitate clustering or total recall with children five through eleven; a visual presentation mode is superior to an auditory presentation regardless of age; and category sorting facilitated both recall and clustering regardless of age, but category identification was effective with third graders only, having no effect on kindergarten and first grade children.

It should also be noted that all of the independent variables previously described are concerned with the input phase of the memory process. It is not difficult to expect that there are also age differences in retrieval strategies. Only one study (Gerjuoy and Spitz, 1966) examined the effects of retrieval cues (the experimenter identified the category names immediately before the subjects' recall). Their results indicated that this procedure had a facilitative effect on free recall performance. However, since their study used only one age level, it is not known how this retrieval cue will interact with age.

There also appears to be a need to compare performance on free recall tasks using a written recall as opposed to the verbal report method used exclusively in the reviewed studies. It is possible that with younger children, such words may act as "pegs" for new responses, improving their total recall.

Lastly, a word should be said about the concept of "clustering", which the author uses rather loosely, as if all

investigators agree on the way to measure it. Most investigators have used Bousfield's Ratio of Repetition (RR), or a slight modification thereof (eg., PR index). However, some investigators exclude intrusions (words not on the list) in calculating the degree of clustering while others may not. Comparisons of the differences between these various methods of measuring the degree of organization in recall should be an important issue.

APPENDIX B

TABLES

TABLE 1

Categories and Stimulus Pictures

Animals	Transportation	Furniture	Clothing
dog	car	table	shoe
cow	truck	bed	hat
elephant	train	chair	mitten
lion	bus	lamp	tie
horse	bicycle	couch	dress
camel	boat	television	sweater

TABLE 2

Analysis of Variance of Total Recall Scores

Source	df	MS	F
Between Ss			
Grade Level (A)	2	1613.14	103.94****
Cat. Ident. (B)	1	98.18	6.33**
Pres. Cond. (C)	1	160.00	10.31***
A X B	2	12.37	<1
A X C	2	37.81	2.44*
B X C	1	9.34	<1
A X B X C	2	.92	<1
Error (b)	108	15.52	
Within Ss			
Trials (D)	2	248.35	56.57****
A X D	4	14.22	3.24**
B X D	2	11.41	2.59*
C X D	2	.40	<1
A X B X D	4	3.16	<1
A X C X D	4	1.14	<1
B X C X D	2	.18	<1
A X B X C X D	4	2.84	<1
Error (w)	216	4.39	

* $.05 < p \leq .10$
** $p < .05$
*** $p < .01$
**** $p < .001$

TABLE 3

Analysis of Variance of Total Recall Scores:

Kindergarten, Grade Three, and Grade Five, Separately

Source	df	Kindergarten MS	Kindergarten F	Grade Three MS	Grade Three F	Grade Five MS	Grade Five F
Between Ss							
Cat. Ident. (B)	1	31.01	1.60	5.20	<1	86.70	5.45**
Pres. Cond. (C)	1	.67	<1	170.41	7.12***	64.54	4.06*
B X C	1	.58	<1	1.31	<1	7.50	<1
Error (b)	36			11.85		15.90	
Within Ss							
Trials (D)	2	23.91	4.09**	106.86	27.62***	97.34	32.34***
B X D	2	1.31	<1	15.36	3.97**	1.68	<1
C X D	2	1.83	<1	.76	<1	.11	<1
B X C X D	2	3.13	<1	2.36	<1	.18	<1
Error (w)	72	5.85		3.87		3.01	

* $.05 < p \leq .10$
** $p < .05$
*** $p < .001$

TABLE 4

Analysis of Variance of PR Scores

Source	df	MS	F
Between Ss			
Grade Level (A)	2	.6278	10.08**
Cat. Ident. (B)	1	.3367	5.40*
Pres. Cond. (C)	1	10.7502	172.56***
A X B	2	.0385	<1
A X C	2	.0598	<1
B X C	1	.1485	2.38
A X B X C	2	.0165	<1
Error (b)	108	.0623	
Within Ss			
Trials (D)	2	.2019	6.60**
A X D	4	.0148	<1
B X D	2	.0414	1.35
C X D	2	.1155	3.78*
A X B X D	4	.0357	1.17
A X C X D	4	.0242	<1
B X C X D	2	.0619	2.03
A X B X C X D	4	.0137	<1
Error (w)	216	.0306	

* $p<.05$
** $p<.01$
*** $p<.001$

TABLE 5

Analysis of Variance of OR Scores

Source	df	MS	F
Between Ss			
Grade Level (A)	2	.6872	10.44**
Cat. Ident. (B)	1	.3345	5.08*
A X B	2	.0069	<1
Error (b)	54	.0658	
Within Ss			
Trial (D)	2	.3198	9.96**
A X D	4	.0236	<1
B X D	2	.0398	1.24
A X B X D	4	.0041	<1
Error (w)	108	.0321	

* $p<.05$
** $p<.001$

TABLE 6

Pearson Product-Moment Correlation Co-efficients Between Recall Scores and the PR Scores for Each S as a Function of Category Identification, Presentation Condition, Grade Level, and Trials

Grade Level	Condition	Trial 1	Trial 2	Trial 3
Kindergarten	ID P-GRPD	.326	.410	.101
	ID A-GRPD	-.568*	-.526*	-.774*
	ID P-RNDM	-.454	.412	-.470
	ID A-RNDM	.104	-.682*	-.295
Grade 3	ID P-GRPD	.800*	.342	.613*
	ID A-GRPD	.346	.058	.201
	ID P-RNDM	.199	.210	-.404
	ID A-RNDM	.068	.493*	.325
Grade 5	ID P-GRPD	.317	-.030	.218
	ID A-GRPD	.093	.295	.291
	ID P-RNDM	.098	.481	-.371
	ID A-RNDM	-.173	.804*	.062

* $p < .01$

TABLE 7

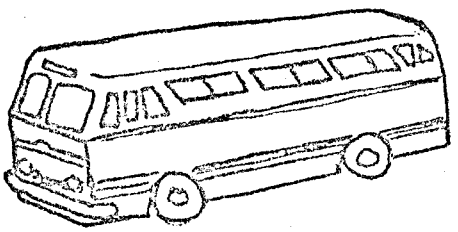
Mean Card Sorting Performance (Expressed as a Percent) as a Function of Category Identification, Presentation Condition, and Grade Level.

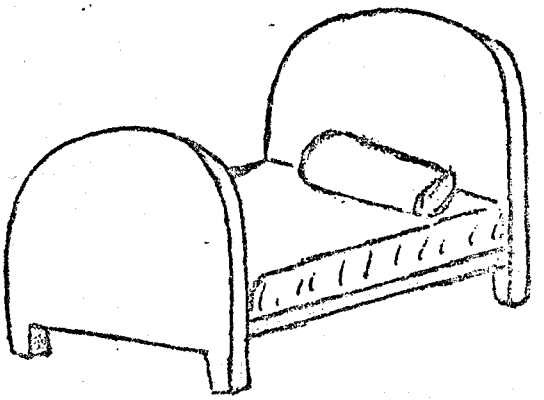
Grade Level	ID P-GRPD	ID A-GRPD	ID P-RNDM	ID A-RNDM
Kindergarten	88.8% (8)	27.9% (2)	90% (9)	37.9% (1)
Grade 3	100 % (10)	88.3% (8)	100% (10)	77.9% (4)
Grade 5	100 % (10)	99.2% (9)	100% (10)	86.2% (7)

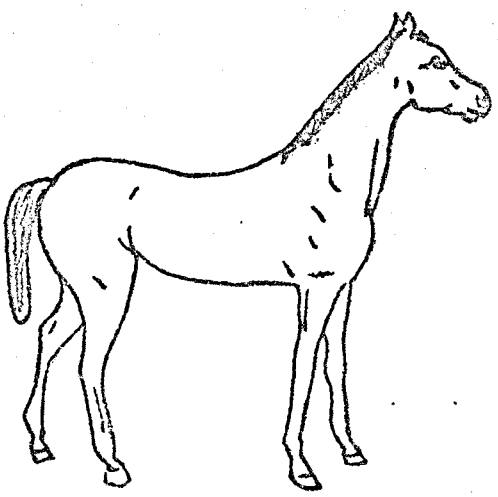
( ) number of Ss who perfectly categorized items.

APPENDIX C

FIGURES







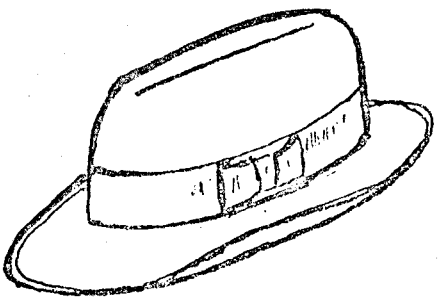


Figure 1. Sample test items.

APPENDIX D

Raw Data

RAW DATA 1

Total Recall Scores for Grade 5:

Identification Presence - Grouped Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
1	5	6	4	4	19	5	6	0	5	16	5	6	6	5	22
2	3	6	5	4	18	5	6	5	5	21	5	6	5	4	20
3	4	5	3	6	18	5	5	5	6	21	5	5	6	5	21
4	5	4	3	6	18	6	6	4	3	19	6	5	4	4	19
5	4	4	2	4	14	4	5	3	5	17	5	5	5	4	19
6	5	6	4	5	20	5	3	5	4	17	6	6	4	6	22
7	4	5	4	5	18	5	6	5	6	22	5	5	6	6	22
8	4	0	4	2	10	5	5	4	4	18	5	4	4	2	15
9	6	0	5	4	15	5	6	6	5	22	5	5	5	5	20
10	4	4	5	5	18	6	4	6	5	21	6	6	6	6	24

Legend:
An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 2

Total Recall Scores for Grade 5:

Identification Absence - Grouped Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
11	5	3	3	1	12	4	3	3	2	12	4	4	4	2	14
12	3	6	3	2	14	5	5	5	2	17	5	6	3	5	19
13	4	4	1	3	12	3	5	5	4	17	4	5	5	5	19
14	4	4	3	5	16	5	4	5	5	19	5	6	5	6	22
15	4	3	3	4	14	5	3	4	4	16	4	4	4	5	17
16	3	4	4	5	16	6	5	4	5	20	4	6	6	5	21
17	4	4	3	6	17	5	6	5	5	21	5	5	6	6	22
18	5	4	5	5	19	5	5	6	5	21	5	5	6	4	20
19	4	3	4	1	12	3	3	4	2	12	4	4	2	3	13
20	3	3	3	3	12	3	4	5	5	17	3	4	5	5	17

Legend: An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 3

Total Recall Scores for Grade 5:

Identification Presence - Random Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
21	5	4	4	4	17	5	4	4	5	18	5	4	4	5	18
22	4	4	3	4	15	3	4	3	2	12	5	5	2	4	16
23	3	1	3	5	12	3	3	3	4	13	3	3	4	4	14
24	5	3	4	4	16	6	5	5	4	20	6	5	6	5	22
25	4	4	4	3	15	4	5	6	3	18	4	5	4	5	18
26	4	3	4	5	16	6	6	6	5	23	5	6	6	5	22
27	3	3	3	3	12	4	5	5	3	17	6	3	3	4	16
28	4	3	5	3	15	5	5	4	4	18	5	5	4	4	18
29	6	2	5	5	18	5	3	5	6	19	5	5	6	4	20
30	2	4	4	5	15	4	4	3	4	15	5	4	5	5	19

Legend:
An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 4

Total Recall Scores for Grade 5:

Identification Absence - Random Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
31	6	4	4	2	16	4	3	4	5	16	4	5	5	4	18
32	3	3	1	4	11	4	4	5	6	19	5	5	6	5	21
33	5	3	4	3	15	4	4	3	3	14	5	4	4	6	19
34	5	1	1	4	11	5	4	4	4	17	6	2	6	4	18
35	3	2	3	4	12	5	3	3	3	14	3	5	2	6	16
36	2	1	3	3	9	3	4	2	4	13	4	5	4	4	17
37	4	2	5	0	11	4	4	5	1	14	3	4	2	3	12
38	4	3	5	3	15	5	3	4	6	18	5	5	5	4	19
39	6	4	4	3	17	5	5	4	4	18	6	3	4	3	16
40	4	5	5	3	17	5	3	5	6	19	5	4	6	4	19

Legend:
An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 5

Total Recall Scores for Grade 3:

Identification Presence - Grouped Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
41	4	3	3	6	16	5	4	0	6	15	4	5	5	6	20
42	5	5	4	5	19	5	4	0	4	13	4	5	4	6	19
43	5	2	4	4	15	4	6	4	4	18	5	6	6	2	19
44	4	3	2	4	13	3	4	0	4	11	6	4	4	0	14
45	5	3	3	4	15	4	3	5	5	17	5	4	5	5	19
46	6	5	6	4	21	5	5	5	6	21	5	4	4	5	18
47	5	5	4	3	17	4	5	5	6	20	3	6	4	5	18
48	3	5	3	5	16	4	5	5	5	19	5	5	0	5	15
49	5	3	4	5	17	6	4	6	6	22	5	5	6	5	21
50	3	3	3	4	13	4	3	3	3	13	5	3	4	1	13

Legend:
An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 6

Total Recall Scores for Grade 3:

Identification Absence - Grouped Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
51	4	0	3	2	9	4	4	2	3	13	0	3	6	4	13
52	0	3	5	5	13	5	5	0	5	15	6	5	5	5	21
53	4	2	4	3	13	5	5	3	5	18	5	6	4	3	18
54	4	5	0	1	10	5	4	4	2	15	5	5	5	2	17
55	5	5	4	4	18	5	4	5	4	18	5	5	5	5	20
56	3	5	2	5	15	5	4	6	4	19	5	4	5	4	18
57	2	4	1	2	9	5	3	3	5	16	6	3	3	6	18
58	3	4	3	2	12	5	4	4	5	18	6	5	6	5	22
59	5	4	3	3	15	5	2	2	5	14	6	4	3	4	17
60	6	6	4	6	22	6	5	4	4	19	5	5	5	5	20

Legend:
An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 7

Total Recall Scores for Grade 3:

Identification Presence - Random Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
61	4	4	4	1	13	5	6	3	3	17	5	5	3	3	16
62	4	3	4	2	13	3	4	1	3	11	4	5	4	2	15
63	4	3	4	3	14	2	4	3	3	12	5	3	2	3	13
64	2	4	1	3	10	2	5	1	2	10	4	6	1	3	14
65	4	2	3	3	12	5	4	4	2	15	5	2	2	3	12
66	4	2	2	4	12	4	5	4	5	18	6	3	3	6	18
67	5	4	1	4	14	4	3	3	4	14	5	4	4	1	14
68	3	4	2	2	11	5	3	4	5	17	6	3	4	5	18
69	3	3	3	5	14	4	5	4	4	17	4	3	5	5	17
70	4	3	3	4	14	2	3	5	5	15	4	4	4	4	16

Legend: An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 8

Total Recall Scores for Grade 3:

Identification Absence - Random Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
71	3	3	4	2	12	5	5	2	4	16	4	5	2	4	15
72	4	2	2	3	11	3	2	2	4	11	4	2	4	4	14
73	3	1	5	5	14	3	4	4	5	16	3	5	4	4	16
74	1	3	3	3	10	3	4	3	3	13	6	6	1	2	15
75	4	3	1	2	10	5	5	2	3	15	5	3	2	4	14
76	4	4	1	2	11	4	4	4	5	17	3	5	5	5	18
77	5	4	2	3	14	5	6	3	1	15	5	3	3	3	14
78	3	3	4	4	14	3	4	3	4	14	5	5	4	4	18
79	3	1	3	4	11	5	4	4	4	17	6	5	2	4	17
80	3	3	1	4	11	3	3	3	3	12	5	4	5	4	18

Legend: An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 9

Total Recall Scores for Kindergarten:

Identification Presence - Grouped Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
81	5	5	3	2	15	4	4	3	3	14	5	2	3	1	11
82	3	0	2	2	7	5	3	3	3	14	4	4	3	0	11
83	4	4	0	4	12	3	2	0	4	9	5	4	3	0	12
84	1	3	2	1	7	2	3	3	0	8	3	2	2	3	10
85	3	1	4	1	9	5	4	3	0	12	3	3	3	3	12
86	3	1	5	0	9	5	2	5	3	15	4	0	4	2	10
87	5	4	0	0	9	3	5	4	1	13	4	5	0	4	13
88	3	1	3	1	8	4	0	2	2	8	3	2	4	2	11
89	3	1	0	6	10	3	3	3	2	11	5	3	1	5	14
90	3	2	3	2	10	4	0	3	2	9	3	0	0	4	7

Legend: An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 10

Total Recall Scores for Kindergarten:

Identification Absence - Grouped Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
91	2	0	0	1	3	3	0	3	3	9	3	0	1	4	8
92	3	3	0	4	10	0	0	3	1	4	1	4	0	0	5
93	4	4	0	0	8	4	2	5	0	11	4	2	2	1	9
94	3	0	2	3	8	3	5	0	0	8	2	4	2	5	13
95	4	5	1	0	10	4	2	3	0	9	5	4	0	0	9
96	5	2	2	3	12	3	3	2	4	12	3	2	3	5	13
97	3	3	2	3	11	4	0	4	3	11	3	2	4	4	13
98	4	1	3	0	8	5	3	3	1	12	6	4	2	1	13
99	4	3	2	0	9	4	3	2	2	11	3	4	1	3	11
100	3	5	0	2	10	4	3	1	2	10	0	0	3	2	5

Legend: An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl.-Clothing
T. - Total

RAW DATA 11

Total Recall Scores for Kindergarten:

Identification Presence - Random Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
101	4	1	3	1	9	3	4	3	0	10	4	3	2	1	10
102	3	4	2	4	13	5	5	4	0	14	5	4	3	2	14
103	2	3	1	3	9	4	1	4	2	11	5	5	5	5	20
104	2	3	2	2	9	0	1	2	2	5	3	1	2	1	7
105	3	0	2	2	7	3	4	3	3	13	5	3	3	0	11
106	3	4	2	4	13	2	5	2	5	14	3	4	3	3	13
107	4	2	5	1	12	1	4	1	1	7	0	1	2	1	4
108	3	0	2	2	7	3	2	2	2	9	3	3	3	3	12
109	1	3	2	4	10	4	3	4	2	13	3	4	2	3	12
110	4	3	2	1	10	3	2	1	2	8	1	1	2	1	5

Legend: An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 12

Total Recall Scores for Kindergarten:

Identification Absence - Random Presentation Condition

Subject No.	Trial 1					Trial 2					Trial 3				
	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.	An.	Tr.	Fur.	Cl.	T.
111	1	1	3	2	7	1	0	1	1	3	2	0	0	1	3
112	2	1	0	0	3	3	1	1	1	6	3	2	2	3	10
113	5	4	0	1	10	2	4	4	3	13	4	4	3	3	14
114	3	0	3	1	7	2	0	0	2	4	2	1	2	2	7
115	3	2	1	3	9	2	1	2	1	6	2	3	2	3	10
116	3	2	2	1	8	4	2	2	4	12	5	2	2	3	12
117	3	2	3	0	8	3	3	2	1	9	5	3	5	4	17
118	2	1	2	2	7	1	2	5	2	10	2	0	2	2	6
119	3	3	2	3	11	6	3	4	4	17	4	3	3	3	13
120	3	1	5	3	12	3	3	6	3	15	1	6	4	5	16

Legend: An. - Animal
Tr. - Transportation
Fur. - Furniture
Cl. - Clothing
T. - Total

RAW DATA 13

Mean PR Scores for Grade 5

Identification Presence - Grouped Presentation Condition

Subject No.	Trial 1 PR	Trial 2 PR	Trial 3 PR
1	1.00	1.00	1.00
2	1.00	1.00	1.00
3	.93	1.00	.71
4	.79	.73	.87
5	1.00	1.00	.93
6	1.00	.92	1.00
7	.93	.95	1.00
8	.86	.78	.91
9	.92	1.00	.75
10	.93	.65	.95

RAW DATA 14

Mean PR Scores for Grade 5

Identification Absence - Grouped Presentation Condition

Subject No.	Trial 1 PR	Trial 2 PR	Trial 3 PR
11	.88	.63	.70
12	1.00	1.00	1.00
13	.63	1.00	1.00
14	.58	.53	.83
15	1.00	1.00	.77
16	1.00	.88	.94
17	.62	.59	.78
18	1.00	1.00	1.00
19	.63	.50	.89
20	1.00	.77	.85

RAW DATA 15

Mean PR and OR Scores for Grade 5

Identification Presence - Random Presentation Condition

Subject No.	Trial 1		Trial 2		Trial 3	
	PR	OR	PR	OR	PR	OR
21	.85	.38	.82	.06	1.00	.14
22	.64	.27	.38	.25	1.00	.25
23	.63	.50	.44	.44	.90	.20
24	.58	.50	.44	.31	.56	.22
25	.36	.18	.43	.36	.50	.21
26	.42	.17	.78	.26	.83	.33
27	.63	.38	.76	.46	.75	.25
28	.27	.55	.36	.43	.36	.36
29	.64	.42	.67	.20	.56	.18
30	.36	.09	.54	.00	.40	.20

RAW DATA 16

Mean PR and OR Scores for Grade 5

Identification Absence - Random Presentation Condition

Subject No.	Trial 1		Trial 2		Trial 3	
	PR	OR	PR	OR	PR	OR
31	.33	.42	.50	.25	.43	.36
32	.14	.71	.40	.53	.53	.18
33	.36	.45	.40	.40	.87	.40
34	.71	.71	.46	.23	.50	.14
35	.38	.50	.30	.20	.58	.08
36	.60	.40	.22	.22	.31	.31
37	.63	.29	.30	.50	.50	.50
38	.55	.45	.50	.29	.60	.13
39	.62	.38	.50	.14	.75	.08
40	.38	.61	.53	.27	.40	.40

RAW DATA 17

Mean PR Scores for Grade 3

Identification Presence - Grouped Presentation Condition

Subject No.	Trial 1 PR	Trial 2 PR	Trial 3 PR
41	.83	.83	.88
42	1.00	1.00	1.00
43	.73	.64	.80
44	.78	.75	.55
45	.64	.46	.80
46	1.00	1.00	1.00
47	.85	.94	.86
48	.92	1.00	.92
49	1.00	.83	.76
50	.67	.44	.44

RAW DATA 18

Mean PR Scores for Grade 3

Identification Absence - Grouped Presentation Condition

Subject No.	Trial 1 PR	Trial 2 PR	Trial 3 PR
51	.83	.67	.89
52	1.00	1.00	1.00
53	.33	.71	.93
54	1.00	.73	1.00
55	1.00	.93	1.00
56	.64	.83	1.00
57	.40	.67	.57
58	.88	.64	.83
59	.72	.90	.54
60	1.00	.87	1.00

RAW DATA 19

Mean PR and OR Scores for Grade 3

Identification Presence - Random Presentation Condition

Subject No.	Trial 1		Trial 2		Trial 3	
	PR	OR	PR	OR	PR	OR
61	.67	.56	.38	.38	.42	.25
62	.33	.33	.00	.57	.55	.55
63	.40	.30	.38	.38	.67	.33
64	.67	.29	.67	.50	.90	.30
65	.25	.13	.45	.27	.50	.38
66	.25	.25	.36	.07	.36	.29
67	.50	.10	.30	.40	.40	.20
68	.14	1.00	.54	.38	.50	.29
69	.40	.27	.62	.31	.54	.15
70	.70	.40	.36	.09	.50	.25

RAW DATA 20

Mean PR and OR Scores for Grade 3

Identification Absence - Random Presentation Condition

Subject No.	Trial 1		Trial 2		Trial 3	
	PR	OR	PR	OR	PR	OR
71	.50	.63	.42	.75	.36	.33
72	.14	.43	.29	.43	.30	.60
73	.10	.70	.25	.58	.25	.25
74	.50	.33	.44	.22	.36	.64
75	.17	.33	.55	.18	.50	.10
76	.14	.71	.62	.46	.29	.21
77	.40	.50	.64	.09	.30	.40
78	.50	.30	.50	.40	.64	.29
79	.57	.57	.46	.31	.31	.31
80	.29	.43	.25	.44	.50	.57

RAW DATA 21

Mean PR Scores for Kindergarten

Identification Presence - Grouped Presentation Condition

Subject No.	Trial 1 PR	Trial 2 PR	Trial 3 PR
81	.82	.60	.86
82	.25	.70	.63
83	1.00	.83	.89
84	1.00	.40	.83
85	.60	.67	.88
86	1.00	.64	.57
87	.86	.89	1.00
88	.50	.40	.43
89	.86	.71	.40
90	.50	.67	.80

RAW DATA 22

Mean PR Scores for Kindergarten

Identification Absence - Grouped Presentation Condition

Subject No.	Trial 1 PR	Trial 2 PR	Trial 3 PR
91	1.00	.83	.80
92	.86	1.00	1.00
93	1.00	.63	.60
94	.60	.67	.78
95	1.00	.50	1.00
96	.25	.63	.56
97	.57	.50	.56
98	.60	.75	.33
99	.83	.86	.71
100	.57	.67	1.00

RAW DATA 23

Mean PR and OR Scores for Kindergarten

Identification Presence - Random Presentation Condition

Subject No.	Trial 1		Trial 2		Trial 3	
	PR	OR	PR	OR	PR	OR
101	.40	.60	.57	.17	.67	.17
102	.22	.33	.82	.20	.90	.20
103	.60	.44	.43	.57	.44	.25
104	.40	.40	.00	.33	.33	.67
105	.25	.75	.56	.56	.63	.29
106	.33	.44	.30	.40	.33	.67
107	.38	.50	.67	.75	1.00	1.00
108	.75	.67	.00	1.00	.25	.50
109	.17	.67	.22	.56	.63	.33
110	.50	.50	.25	.20	1.00	.00

RAW DATA 24

Mean PR and OR Scores for Kindergarten

Identification Absence - Random Presentation Condition

Subject No.	Trial 1		Trial 2		Trial 3	
	PR	OR	PR	OR	PR	OR
111	.33	1.00	1.00	1.00	1.00	1.00
112	.00	1.00	1.00	1.00	.17	.67
113	.43	.33	.33	.56	.40	.30
114	.25	.75	1.00	1.00	.33	.33
115	.20	.67	.00	.67	.00	.33
116	.00	.75	.50	.25	.13	.63
117	.75	.00	.20	.33	.54	.15
118	.00	.80	.17	.17	.67	.67
119	.00	.71	.08	.62	.22	.22
120	.13	.88	.09	.09	.67	.50

VITA AUCTORIS

1946	Born in Windsor, Ontario to Robert and Bernice Middleton.
1951-66	Educated at Bridgeview, J. E. Benson, and A. C. Richards elementary schools; and Herman and Walkerville Collegiate Institutes.
1970	Graduated with the degree of B.A. (Honours Psychology), University of Windsor, Windsor, Ontario.
1971	Registered as full time graduate student at the University of Windsor, Windsor, Ontario.