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CHILDREN'S USE OF CATEGORY LABELS IN RECALL OF CONCEPTUALLY RELATED ITEMS

by

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APPROVAL PAGE

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The purpose of this study was to investigate children's failure to use category labels as cues in the recall of conceptually related items. Previous research has shown that despite the fact that the use of these labels as cues increases recall, children do not use them unless constrained to do so by the experimenter. The premise of this investigation was that young children fail to use cues because they are not kept in active memory during the recall process. Therefore, it was predicted that ensuring the presence of category labels in active memory would improve amount of recall.

In order to determine the degree of assistance needed by children to keep the category labels in active memory during recall, three recall conditions were constructed which varied in the amount of assistance they gave in the task of remembering.

The memory task in this study required children to remember as many items as they could from a set of 18 pictures. The items were first presented by the experimenter and then sorted by each subject into three conceptual groupings with six items each. The three experimental recall conditions were: cue available, in which children were asked to state the category label associated with each group prior to recall;

cue usage, in which children were asked to state the category label and instructed on the use of the label during recall; and cue maintenance, in which children were asked to state the category label, instructed on the use of the label during recall and required to state the appropriate label with each item recalled. Two control conditions were also included. In the grouped condition, children were instructed to recall items group-by-group. In the second control condition, they were given free recall instructions.

Two hundred children in grades one and five were randomly assigned to the conditions.

An analysis of variance yielded statistically significant main effects on amount of recall for grade and recall condition, but no grade x condition interaction. An analysis of covariance with sorting time as the covariate yielded significant effects of grade, recall condition, and grade x condition interaction on amount of recall. The beneficial effect of the covariate was limited in large part to the older children.

A priori comparisons were conducted to test the experimental predictions. It was predicted that amount of recall of first-grade children would be greater in the cue maintenance than in the other recall conditions. This prediction was supported. For fifth graders, it was predicted that amount of recall also would be greater in the cue maintenance condition than in the other recall conditions. This

prediction was not supported. Amount of recall was found to be greatest in the grouped recall condition.

No predictions were supported for the clustering scores. Clustering was high and not significantly different across recall conditions.

It was concluded that forcing children to maintain the cue in active memory positively effects amount of recall of first graders but not fifth graders. Reliance on rote memory was more effective than the use of a cuing strategy by older children in this particular memory task.

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CHAPTER I

INTRODUCTION

A recurring theme in the developmental memory literature is that as children grow older they become increasingly active, deliberate, and strategic in their efforts to study and store information for subsequent retrieval in a memory task (e.g., Appel, Cooper, McCarrell, Sims-Knight, Yussen, & Flavell, 1972; Flavell, 1970; Hagen, 1971; Masur, McIntyre, & Flavell, 1972; Meacham, 1972; Neimark, Slotnik, & Ulrich, 1971). These intentional activities or strategies are typically conceptualized as functioning in two distinct phases: an encoding-storage phase during which external information is processed or translated into internal information and is therefore available in memory; and a retrieval phase during which stored, internal information is brought forth by the subject to meet the response requirements of the memory task (Flavell, 1977; Kobasigawa, 1977).

Over the past decade, investigations of intentional plans used by children to facilitate recall performance have been concerned primarily with strategies that affect the encoding and storage of information with little attention given to the differential effect these intentional storage behaviors might have on subsequent retrieval processes. For example, studies conducted by Daehler, Horowitz, Wynns, and

Flavell (1966), Flavell, Beach, and Chinsky (1966), Keeney, Cannizzo, and Flavell (1967), and Moely, Olson, Hawles, and Flavell (1969), deal with deliberate encoding and storage activities such as verbal rehearsal, labeling, and organization during periods prior to actual recall. In these studies it was demonstrated that increases in these optional activities were accompanied by significant increases in amount of recall. From them, Flavell (1970) coined the term "mnemonic mediators" to refer to those cognitive activities which could be used to facilitate recall. It is by means of these mediating activities that material is organized, transformed, or maintained in such a way that more efficient use of the memory system is insured. Sufficient evidence exists to conclude that as children grow older they become much more skillful in the production and use of mnemonic mediators during the encoding-storage phase of the memory process (Flavell, 1977).

While there is a great deal of research concerned with those activities which put information into memory, there is very little known about the retrieval component of memory. If an event is to be remembered, an individual must not only attend to, interpret, and store it effectively, he must also be able to gain access to what is available (Kobasigawa, 1977). The present paper is concerned with the nature of children's attempts to prepare for, to gain access to, and to retrieve information from memory.

Each of the studies discussed in the following review explores children's construction and/or use of referents to access stored information during retrieval. These referents are referred to as cues and can be externally as well as internally available during retrieval. It is obvious that the availability and use of cues has been of some interest to investigators of children's memory; however, one finding has been of particular interest. The fact that under certain conditions young children are fairly adept in the use of internal conceptual cues such as category labels has recently become of interest to investigators exploring children's recall. The studies dealing with this particular issue are reported in the concluding section of the review and suggest that even preschool children are capable of using conceptual cues to facilitate recall when constrained to do so by the experimenter.

The finding that young children do not intentionally use one activity which is available to them (i.e., the use of conceptual cues) to facilitate another activity is discussed in terms of the "production deficiency hypothesis" and is briefly reported in the context of the review. However, nowhere in the developmental memory literature is systematic attention given to one particular activity. This activity is that of cue utilization during retrieval of conceptually related target items.

Even though the process of cue utilization is not well documented in the study of children's memory processes, a

hypothesis concerning the source of breakdown in young children's intentional or spontaneous cue utilization (a production deficiency) is suggested by Salatas and Flavell (1976). It is suggested in their study that children fail to use cues effectively because they lose their orientation during recall. That is, when faced with the task of recalling related stimulus items, young children fail to maintain the category label in active memory during recall and consequently lose the most efficient means of conducting recall. The experiment suggested at the conclusion of Chapter I is in part a direct test of this hypothesis. In addition, this hypothesis is further set within the framework of a model of cue usage suggested by Kobasigawa (1977). In this model, Kobasigawa argues that the use of conceptual cues during retrieval essentially involves three components: (1) actual storage and therefore availability of the cue, (2) use of the cue to direct entry into recall, and (3) continual use of the cue during recall.

It is argued here that the hypothesis suggested by Salatas and Flavell represents the third component of this model. The purpose of the suggested experiment is thus not only to test the above hypothesis, but also to determine the importance of continual maintenance of the cue in active memory relative to the other suggested components of a retrieval process.

In summary, the suggested experiment includes three recall conditions: cue available (condition 1); cue usage

(condition 2); and cue maintenance (condition 3), each representing one component of Kobasigawa's three-component model. These conditions are further compared to two control conditions in which no cue information is given. These control conditions include instructions to recall according to groups (condition 4) and traditional free recall instructions (condition 5).

The first section of the review of literature discusses research which has been concerned with preparation for future retrieval during the encoding and storage phase of the memory process. The second section is addressed to investigations which have specifically explored activities engaged in during retrieval itself. The problem statement follows the review. To determine the feasibility of using the manipulation suggested for testing the hypothesis suggested by Salatas and Flavell, a pilot study was conducted and is included as Chapter III. Chapter IV contains the methods and procedures used in the main study. Chapter V contains the results of the main experiment and Chapter VI contains a discussion of the results of the experiment.

CHAPTER II

REVIEW OF LITERATURE

Intentional Preparation for Future Retrieval

External cues. One useful method of insuring memory is to select external objects which will be available at the time of recall to serve as cues or "reminders" of what one wishes to recall. In a study designed to assess young children's ability to use readily available external cues, Corsini, Pick, and Flavell (1968) required children in kindergarten and first grade to rebuild from memory a linear sequence of colored wooden geometric forms. The sequence was presented for study and subsequently destroyed. However, during the study period, paper replicas of the geometric forms were presented to each subject and identified as possible memory aids. The subject could thus easily reconstruct a duplicate sequence with the colored paper forms and use it to aid reconstruction of the original pattern. Control subjects were only given the hint that the paper shapes could help them remember. Experimental subjects were given instructions to use the paper pieces to make a copy of the original model. Results showed that there was no significant difference between experimental and control subjects in the first grade in the construction and use of the paper model to help in recall. Both groups successfully took advantage of the

suggestion to use the paper pieces. However, only kindergarten subjects in the experimental condition constructed the models for use in the reconstruction of the linear sequence. The effectiveness of this task for both kindergarteners and first graders is demonstrated by the fact that no child was able to reproduce a randomly patterned sequence without having first made a paper copy of it.

Planful behavior at storage for future retrieval was investigated in even younger children by Ryan, Hegion, and Flavell (1970). Children aged 3.0 to 5.6 years were shown a set of toy animals. A second, duplicate set of animals was placed in one-to-one correspondence with the first set, like-animals being placed together. The children were then instructed to place one member of each animal pair into each of several available cages. After one set of the animals had been placed, a drop-door in each cage was closed so that the caged animals were no longer visible. The experimenter then told the subjects to place each animal from the remaining set in front of the cage containing its proper mate.

After the subjects had matched their animals to what they thought to be the correct cages, the drop-doors were opened and feedback was given as to correct and incorrect placement. No child correctly matched all the animal pairs, thus paving the way for the experimenter to emphasize the extreme difficulty of the task. At this point a set of photographs of the animals was introduced as something that might help in doing the task again.

A second trial followed which was exactly the same as the first. However, the photographs were available and the experimenter suggested that they might be used to help make correct matches. Results showed that significantly more subjects above than below the median age of 4.2 years spontaneously used the pictures to mark locations of the animals. Even though more older children than younger children spontaneously used the pictures to cue locations, 50% of the children between the ages of 3.6 and 4.0 years of age were also able to use the pictures spontaneously to identify animal placement. This second finding is in marked contrast to the finding reported by Corsini et al. (1968) that kindergarten children did not use spontaneously available external cues. This was interpreted by the authors to be the result of a more interesting task and more familiar objects.

Geis and Lange (1976) further explored planful storage behavior. In the first experiment of a two-study experiment, first, third, and fifth graders were instructed to hide a group of people-pictures in containers. Half of the containers bore cues obviously associated with the people's societal role. The societal roles were designated by uniforms or costumes worn. The other half of containers bore cues unrelated to the people's roles. In two of the conditions children were informed that they were to hide each person so that it would be easy for them to find the people later, or so that the experimenter could easily remember where each

person was located. In a third condition, children were not informed that the task was to include a memory phase, but instead were instructed to place each person into the container that "he went best with." After the placements were made and the boxes closed, each subject was given a duplicate set of pictures with the instructions to put the new picture in front of the box where he/she earlier had hidden the picture just like it. After the experimenter opened the boxes and counted the number of correct hide-match congruences, the people stimuli were removed from sight and the child was asked to recall as many of the people as he/she could. Results showed that first-, third-, and fifth-grade children were quite similar in their planful storage activities. Neither the main effect of grade nor the grade x instruction interaction was significant for hiding behavior, thereby suggesting that younger children were no less planful at storage than the older children. Children at each grade level made more appropriate hidings for people's locations when they were initially instructed to put each person in the container that was best for him. Since there was a main effect of instructional condition and subsequent comparisons showed significantly greater recall and correct matching in this last condition, the authors concluded that none of the age groups were maximally planful in the two conditions which included instructions to remember. Analyses also showed that free recall of people's names for the first and third graders

did not differ from one another, but was inferior to that of fifth graders. The proportion of names recalled was significantly greater for people hidden with their related cues than for people who had not been hidden.

In the second study, preschool children (mean age = 4.57 years) were given the same stimuli and instructional sets as the subjects in experiment 1. The mean proportions of appropriately hidden pictures in each instructional set condition were similar to those of the first experiment. Subsequent correct matching was also significantly greater for those children who had placed the picture with its appropriate cue.

In contrast to the first two studies reviewed, Geis and Lange found that even fifth graders failed to use maximally available memory cues in planning future retrieval. One possible explanation for this could be because the stimuli used by Geis and Lange were conceptually much further removed from the to-be-retrieved items than the exact paper replicas or photographs of the hidden objects used in the previous two studies.

Knowledge of the use of external cues as a means of planning for future retrieval. The fact that children do take at least some advantage of opportunities to prepare for a memory task at a later date gives some indication that they have some knowledge of the future memory task requirement. Kreutzer, Leonard, and Flavell (1975) addressed themselves to this issue in an interview study conducted with children in kindergarten,

first, third, and fifth grades. Children at each of these grade levels were asked how many ways they could think of to make sure they would not forget to bring their skates to school the next day. More than half of the 80 subjects in the experiment thought of relying on something other than internal memory processes to ensure bringing the skates to school. Most frequently, manipulation of the skates themselves (e.g., "put the skates in his bag" or "put the skates by the door") was proposed as a means of insuring the availability of the skates in the morning. Although significantly more third- and fifth-grade children suggested using this external retrieval cue, it was also suggested by almost half of the kindergarten and first grade subjects. The older two age groups made significantly more suggestions to use external objects other than the skates themselves as well as more symbolic reminders. Asking other people to remind them and writing a note to oneself were frequently included in suggestions of ways to remember the skates.

The heavy reliance on the object to act as its own retrieval cue by the kindergarten and first grade children perhaps gives some understanding to the trend noted earlier. That is, the more symbolic and less concrete the external cue becomes, the less spontaneously and intentionally it is used by children to prepare for recall. Children can more easily anticipate using exact replicas of stimuli in future retrieval, for this more closely approximates the approach they suggest taking in a real life memory situation.

Use of organization as a means of planning for future retrieval. In a study which did assess children's actual use of even more symbolic activities to prepare for a future recall task, Moely, Olson, Halwes, and Flavell (1969) found that direct instruction was the only effective means of insuring use of the activity during a study period prior to recall. In this study, children in kindergarten, first, third and fifth grades were given instruction to identify a group of pictures of common objects. The fact that the pictures were conceptually related was not pointed out during presentation. After naming each picture, the experimenter told the subject that he was going to leave the room for a few minutes but while he was gone to study the pictures and try to remember them. Just prior to leaving, the experimenter told each subject assigned to the naming condition the category labels and pointed out each category's members. Children in the teaching condition were required to sort the item into groups that went together and to generate a label for each category. They were further told that when they remembered the pictures, they could do it by remembering a category label first and then the category members. The control group received no additional information or instructions. After the subjects had identified the stimuli and performed the task appropriate to his instructional group, the experimenter removed the pictures and replaced them with an identical set. Observations were made of manual clustering during the study period. Using a proportion of

repetition (PR) index to assess manual clustering, results showed that the absolute amount of study period clustering (out of a maximum score of 1.0) for kindergarten, first- and third-grade children in the control group was quite low, clustering scores being .043, .116, and .164, respectively. The teaching condition, however, dramatically affected the amount of clustering observed during the study period for kindergarten and first-grade children. Clustering index scores for kindergarteners increased to .621 and for first graders to .614. The naming condition, while as effective as the teaching condition for third graders, did not significantly affect the clustering activities of the two younger age groups.

It can be concluded from the above investigations that even preschool children can use some external cues spontaneously to prepare for future retrieval. However, intentional use by younger children of external cues in preparation for a memory task appears to depend on the degree to which the cue is related to that which is to be recalled. The further the cue becomes abstracted from its referent, the less likely it will be used to prepare for retrieval.

With the exception of the Moely et al. study (1969), the memory tasks in the studies just discussed were memory for location, e.g., what object was hidden where or what shape followed what shape. It is not clear from the preceding investigations whether or not children will intentionally use concrete, external cues to prepare for memory tasks in which

the subject must generate his own verbal responses. Geis and Lange (1976) did not inform the subjects prior to recall that they would have to remember also what pictures were presented and Moely et al. (1969) did not have externally available memory cues.

Activities Engaged in During Retrieval

Another aspect of the retrieval process involves the use of cues once the recall task has begun. The following section of this review will include not only those studies which observe how subjects spontaneously use cues during retrieval, but also those investigations which manipulate the availability of cues during retrieval.

Use of external cues. Ritter, Kaprove, Fitch and Flavell (1973) investigated the use of externally available memory cues once the memory task had begun. Children from 3½ to 5½ years of age were asked to match pictures of persons depicted as performing certain social roles to objects which were highly associated with this role. The picture-object pairs were then placed in adjoining boxes. The boxes containing the objects were always opened at the top. Each subject was then given a duplicate set of people-pictures and instructed to place each picture in front of the house of its mate. Use of the available cue consisted of simply looking inside the opened box which contained the related object. Results showed no significant age trend in the

spontaneous use of the external cue during this task. At least 50% of each group used toys as cues to picture placement.

A second task was included in the study which required the subject to verbally recall the names of the objects. Immediately after the first task was completed, the experimenter left the room with the toys. On his return, he exclaimed that he had wanted to write down the toys but had forgotten them. He then asked the subject to help him by telling him the toys. The duplicate set of pictures had been turned over and placed face down before the experimenter left the room. In this task, use of available cues consisted of turning over the pictures and naming the associated toys. Even though the experimenter encouraged the children to do anything they wanted to help remember, very few children at any age level spontaneously turned the picture cards over. Only four out of twenty-six children in the 3.6 to 4.5 age range and nine out of twenty-four children in the 4.6 to 5.6 age range intentionally used the external cue.

Kobasigawa (1974) also investigated children's use of external cues during retrieval. In his study, children in grades one, three, and six were each presented with 24 items and told they would have to try to recall them later. The target items represented eight categories, three pictures per category. Also presented with the items were pictures which

represented the categories from which the target items were selected. The items and pictures were presented together and the relationship between them carefully pointed out for each subject in the study. After presentation, the target items and cues were removed from sight. One-third of the subjects at each grade level were immediately given instructions to recall as many pictures as possible (free recall condition). One-third of the subjects were given the set of cue cards and told that they could look at the cards if they thought this would help them remember (cue condition). The remaining subjects were shown the cue cards one by one and required to recall as many pictures per cue card as possible (directed or constrained cue condition). Analyses of the recall data showed that recall was equally high, and not significantly different for the three grade levels in the constrained cue condition. Only at grade six did the cue condition (suggestion to use cues) result in recall equal to that of the constrained cue condition and significantly greater than that in the free recall condition. The number of items recalled by first- and third-grade children in the cue condition was not significantly greater than that of children in these grades in the free recall condition. At the sixth-grade level, only one child in the cue condition failed to use the cue during retrieval whereas only one-third of the first graders and one-fourth of the third graders used the cue in this condition.

The two studies reviewed above each investigated children's use of external cues during retrieval. In situations in which memory for location is the ongoing retrieval task, even 3½-year-old children take advantage of external memory cues. However, in memory tasks in which the subject must generate verbal responses, older children are much more likely than younger children to use external cues. The trend noted in studies investigating preparation for future retrieval is thus also found in the actual use of cues during retrieval. The more abstract the cues and the more complex the memory task, the less likely the external cues will be used.

Use of verbal cues. The use of verbal cues in recall tasks has most frequently been investigated in studies exploring organization in memory. Because of its obvious relationship to cognitive development in general, the generation and use of categories and referents for these categories have been the focus of some developmental research. As a result of this research, there is some evidence to support the facilitative effect category labels, when used as cues, have on the recall of conceptually related items.

An early investigation of children's use of verbal cues during recall was conducted by Scribner and Cole (1972). In their study, children in second, fourth, and sixth grades were read lists of randomly organized words which could be grouped into four categories with five members each. All

children were told the specific categories contained in the lists prior to item presentation. Children in the cue condition were reminded of the category names after list presentation, but were given no further instructions concerning the use of these cues. Children in the constrained cue condition were given category labels by the experimenter and required to recall items belonging to each category as it was presented. Recall was measured on three trials, the procedure being the same for each instructional group on each trial. Results showed that at every grade level more words were recalled by children in the constrained cue condition than by children in the cue condition. Children in the constrained groups also made more substantial gains over trials in amount recalled than those in the cue group. On a fourth trial, all children were given free recall instructions. Children trained under the constrained cue condition showed some decline in performance but continued to recall significantly more words than children in the cue condition. On a fifth, or transfer trial, a list containing new categories and items was introduced as before. Once again a free recall procedure was instituted for all children. There were no significant differences between the cued and constrained groups in the number of words correctly recalled.

In another study in which retrieval instructions were varied (Halperin, 1974), the experimenter read categorically arranged lists of words to six-, nine-, and twelve-year-old

children. Each group of words was preceded by their category's label. Subjects in the free recall condition were told to recall as many words as they could. For subjects in the constrained cue condition, the experimenter repeated the names of all the categories and then requested that items be recalled according to each category as it was presented again. After one trial, subjects heard the list again, and recalled items according to the same experimental conditions. Recall was significantly greater for subjects in the constrained cue condition at all grade levels. This finding held true for both trial 1 and trial 2.

An investigation conducted by Eysenck and Baron (1974) also reported the effects of holding encoding-storage constant and varying recall conditions. Earlier findings of significant effects due to a constrained cue procedure were replicated with five- and eight-year-old children.

The procedure of only varying the retrieval conditions was also used in a study conducted by Worden (1974). In her study, free, informed (cued), and blocked (constrained cue) retrieval schemes were compared. During item presentation, the experimenter not only identified categorical membership of each stimulus item, she also requested subjects to sort a duplicate set of pictures into the groups just identified. Subjects in the free recall condition were asked to recall as many pictures as they could. Subjects in the cue condition were reminded that the pictures had been presented in

groups and once again told the category labels. In the constrained cue condition, subjects were required to recall category members as the experimenter stated each category label. Contrary to the findings reported in other studies varying retrieval conditions, there was no significant effect due to the constrained cue procedure. Children at each grade level showed similar amounts of recall within grade level under each recall condition.

Geis and Hall (1975) also found no age differences in constrained recall for first-, third-, and fifth-grade children. In their study, children were explicitly informed during item presentation about the categorized nature of the list. Prior to item presentation, they were told what the categories would be and were reminded of the category label when each new group of words was introduced. They were further reminded that they would have to remember the words that went with each category label during recall.

In the preceding five studies, verbal cues were introduced during stimulus presentation and their availability manipulated during retrieval. The following few studies not only varied the availability of the cue during retrieval, but during encoding-storage as well.

In one such study, Lange (1973) investigated the effect of cue availability and use on the recall of children in kindergarten, fifth, and ninth grades. Pictures of familiar but not highly associated, categorizable items (e.g., mouse,

rabbit) were presented simultaneously to children in the two cue-available conditions. To insure that the relationship between the stimulus items and categories was recognized, during item presentation, children in each of these groups were instructed to point to and name each of the category instances as the experimenter produced the label. Children in the labeling free recall condition were asked to recall the items in any chosen order. Children in the labeling cued recall or constrained cue condition were asked after item presentation to learn conceptually related items together and were told that they would have to remember them in this way when it was time for recall. During recall, the experimenter stated each category and required the subject to recall members belonging to each category as it was presented. Recall was measured over three trials with three sets of stimuli, each of which contained different instances of the same set of categories. Thus, category labels which were correctly identified on one set of items were equally appropriate for the items of subsequent sets. The labeling and cued recall procedures were operative only for the children's first-presented set of stimuli. Procedures for the last two sets of stimulus pictures in the labeling free recall and constrained cue conditions were identical to those found in a traditional free recall condition.

Analyses of data from this study showed that recall performance of subjects in the labeling free recall condition

was not significantly different from that of a free recall group at any grade level, nor was there a significant difference in the amount of recall produced within groups across the three trials. Tests also showed that for the first-presented set of stimuli, subjects in the constrained cue condition recalled significantly more items than the subjects in the labeling cue condition or the free recall (control) condition. However, for children in the constrained cue condition, removal of the constraints imposed by the experimenter on recall resulted in dramatic and significant decreases in the amount recalled on the second and third trials. Further analysis of this data revealed that most of the decline in recall occurred between stimulus sets 1 and 2 with no significant declines occurring thereafter.

Williams and Goulet (1975) also conducted a series of experiments in which cue availability was manipulated during both encoding-storage and retrieval. In their first experiment, nursery school children were shown categorically related pictures. Subjects receiving pre-presentation cuing instructions were told prior to seeing the stimuli that the pictures could be grouped and that it would help to remember the items in the groups. Subjects in the no pre-presentation cueing condition were not given any information concerning the nature of the stimulus pictures. Recall proceeded over 7 trials. For the first two trials, subjects in both conditions were given typical free recall instructions. A

constrained cue recall procedure was instituted for one-half the subjects in each of the presentation conditions prior to recall in trial 3. For the other subjects, this procedure was instituted prior to recall in trial 5. Results showed no significant effects for cue information given during item presentation. However, a significant effect was found for imposing a constrained cue procedure across each presentation condition. Varying the trial on which the constrained cue procedure was instituted did not significantly change its subsequent effect. Regardless of the trial on which this procedure was imposed, resulting effects were significant and similar.

The second experiment in this series was conducted in much the same manner as the first. However, category information and grouping instructions were given to half of the subjects after stimulus presentation rather than before, and recall commenced immediately thereafter. A task was also included to assess children's ability to transfer constraint instructions. Analyses of these data showed that changing the point at which the cuing information was made available did not significantly affect recall. Children continued not to use this information. The analyses also revealed that beneficial effects were not maintained when experimenter's constraints on recall were dropped.

The discussion of research in this section focused on children's actual use of verbal cues during retrieval.

Verbal cues in these studies were synonymous with category labels and presumably stored during the encoding-storage phase of the memory process. No pictorial or concrete referents were used as cues in the studies just reviewed even though the stimuli used were often pictures.

It can be concluded in examining data from the free, cued and constrained conditions that effective, spontaneous use of category labels for cues during recall is difficult even for children in the upper elementary grades. This conclusion must be qualified, however, by the finding that older children generally do not benefit as much from a highly controlled retrieval procedure as younger children do. The fact that the amount of recall does not increase as dramatically for older children and is significantly greater than the recall of younger children in the other retrieval conditions gives some evidence that available cues are used more spontaneously to some extent by these older children.

The above studies can also be used to suggest that the production deficiency hypothesis first proposed by Flavell, Beach, and Chinsky (1966) is operational during the retrieval phase of the memory process. This hypothesis states that, although young children may possess certain task-appropriate skills, they fail to bring these skills into play spontaneously during task performance. The fact that young children do not take advantage of verbal cues to help in retrieval is confirmed by the effect of the constrained cue condition.

When forced to use the cues to direct recall, the amount of recall is significantly increased. The finding supports the assumption that more information is available in children's memory than is often recalled, and that with the use of cues, this information can be retrieved.

Studies by Worden (1974), Geis and Hall (1975) and another study discussed in an earlier section by Moely et al. (1969) contradict the frequent finding that requiring children to conduct their retrieval according to cues provided by the experimenter produces significant increases in recall. In the Worden (1974) study, children were not only told the category associated with each item, they also observed the experimenter group the items. In addition, these children were required to group a duplicate set of the stimuli prior to recall. Subjects in the Moely study did not observe the experimenter group the stimulus items, but were instructed to group the items themselves. In addition, these children, as well as the children in the Geis and Hall study also received instructions to the effect that they should recall the items in the groups which were either made or stressed during encoding and storage. In each of these studies recall was similar under free, cued and constrained cue retrieval instructions.

Giving children elaborate information concerning the related nature of the stimulus materials, and/or an opportunity to rehearse sorting, and directions on how to conduct

retrieval, result in free recall similar to that found in a constrained cue condition. It is not clear, however, how the cue is used during recall by subjects who have received such elaborate instructions during stimulus presentation. In the studies conducted by Moely et al. and Geis et al., both gave directions to remember the category label or cue and then the items that went with it. Lange (1973) used the same technique with categorically related but low associate items. He did not find similar results. Recall was significantly greater for subjects in a constrained cue condition than for those subjects in a free recall condition, although each group was given the same directions on conducting retrieval during storage. Because Lange's directions were similar to those used in studies which reported no differences due to recall conditions, it can be argued that the nature of the stimulus items themselves affected recall more than instructions on how to use the cue. Greater recall and clustering of subjects given much exposure to the grouped nature of the stimuli and/or directions to group the stimuli category by category during recall may thus be reflective of strong associations formed between categorical items rather than of intentional use of cues during retrieval. In studies in which the associational nature of items is emphasized enough, just reminding children to remember items in the groups into which they were classified might preclude the need to use cues during retrieval.

The Present Problem

The preceding review suggests that children's use of cues to assist in the retrieval process has become an area of active interest in developmental memory research. A general finding in these investigations was that younger children did not spontaneously use verbal cues made available to them by the experimenter either during encoding-storage or just prior to recall to direct and aid free recall (e.g., Lange, 1973; Scribner & Cole, 1972). Recall in the cue-available condition in these studies was not significantly greater than that in a free recall condition.

It was apparent, however, from other experiments that younger children were capable of using these available cues to facilitate recall. In investigations in which the experimenter constrains recall to proceed category-by-category, young children's recall levels were significantly greater than those obtained in a free recall condition (e.g., Eysenck & Baron, 1974; Halperin, 1974; Kobasigawa, 1974; Lange, 1973; Scribner & Cole, 1972; Williams & Goulet, 1975). In these studies, a superordinate label, which could be used as a cue during recall, preceded each group of categorically related items during presentation in each condition. Because the opportunity for encoding and storing items and labels was held constant across conditions, the enhancing effect of the experimenter-constrained recall is argued to reflect a deficit in the retrieval process.

In an attempt to understand why cues were not used maximally in the retrieval process, Kobasigawa (1974) suggested that younger children failed to use these available cues spontaneously during recall because they had difficulty focusing their attention simultaneously on the cue and the target words associated with the cue. Attention was focused only on the target items or the cues, but not on both. In his study, children in grades 1, 3, and 6 were given a task in which recall items were presented with conceptually related pictures, cues which remained visible throughout the experimental session.

Salatas and Flavell (1976) suggested an alternative interpretation of young children's failure to use cues during retrieval. In their study, subjects in kindergarten, third grade, and college were required to encode conceptually related items until all groups of items could be recalled in the presence of the category labels. The subjects then were directed to recall only those items which could be classified under a new label or cue, e.g., "things which can be used outside." Salatas and Flavell hypothesized that significant clustering scores of items retrieved under this new cue would reflect a systematic search through the already accessible categories. That is, a good strategy for insuring that all items belonging to the new category were retrieved was to proceed through the already stored items, category by category. If a subject used the already existing organization to

direct recall, then items which fit into the new category "things that can be used outside" should continue to be clustered according to the old organization. For example, given the category "toys," all toys appropriate for outside use should be reported together, etc. However, results showed that even though the mean number of words missed for kindergarten subjects was only 3.96 (out of 9.0), clustering scores for the items retrieved according to the new cue were not significant. Nevertheless, in a condition in which the experimenter constrained subjects to recall verbally items according to the original groupings and then state whether or not it would be accepted or rejected under the new cue, kindergarten children showed significant clustering according to the new category.

Salatas and Flavell suggested that failure to recall according to the new cue results more from incomplete search within categories than inability to maintain category order during search. They argued that the incomplete search results from a loss of orientation to the task. In other words, these younger children failed to maintain the cue in active memory. The requirement that an overt verbal judgement consistently be made concerning the acceptability of retrieved items apparently insured the cue's accessibility and consequently allowed an orientation during recall to be maintained. Kindergarten children were thus able to conduct a more systematic and exhaustive search of the memory store.

Kobasigawa (1977), in a proposed model of the retrieval process, suggested that cues are first used to restrict the range of the memory search. A second function of the cue is to establish a criterion against which a decision is made as to the acceptability of the retrieved item for recall. The results of the covert search instructions in the Salatas and Flavell (1976) study indicated that this second component of Kobasigawa's model may maintain the availability of the cue in active memory. Therefore, a possible explanation of children's failure to use available cues during recall is that once recall begins, the cue ceases to be available. Children in effect remove the cue from the retrieval process by failing to use it to evaluate the acceptability of each item retrieved for recall. This results in a loss of orientation during recall and consequently the recall of fewer items than are available in memory.

The following study was proposed in order to determine the effect of forcing children to identify the categorical membership of each item recalled. It was hypothesized that this procedure would result in the continuous accessibility of cues and therefore insure continued orientation during the retrieval process. The result of this was expected to be recall similar to that found in an experimenter-constrained condition.

The above hypothesis was proposed in the context of Kobasigawa's suggested model of retrieval and therefore must

be looked at in relationship to the whole model. An assumption of this model and all studies investigating the use of cues during retrieval is that the cue is available in the memory store at the beginning of memory. Including cue availability as a necessary feature, a three-component model of retrieval is created: (1) availability of the cue, (2) use of the cue to begin retrieval, and (3) use of the cue to evaluate retrieved items.

The following study was comprised of five treatment groups. Three treatment groups represented each of the three components of Kobasigawa's model of retrieval. In the cue available condition subjects were asked to recall category labels prior to recall of individual stimulus items. In the use of cue condition, subjects were asked to recall the category labels prior to recall of list items and instructed on how to use the labels to aid recall. In the cue maintenance condition, subjects recalled category labels prior to recall of list items, were instructed on the use of cues during recall, and were further required by the experimenter to identify the category membership of each item remembered during recall. These three components were operationalized in terms of instructions given for conducting recall and were constructed to represent least-to-greatest amount of assistance given to keep the category labels in active memory during recall. Fourth and fifth conditions included a grouped recall condition in which no category labels were

verbalized by subjects and recall instructions were to recall items by groups. Fifth condition was traditional free recall. Both of these conditions were used as comparison groups.

Procedures similar to those frequently found in developmental studies were used. In order to look systematically at recall at two ages, subjects at two grade levels were asked to identify and then sort pictures of familiar items into easily recognizable groups which were identified by the experimenter. Once the pictures had been identified and sorted, they were removed from view and the subject was given recall instructions appropriate to his/her recall condition.

Based on the argument that the cue must be continuously maintained in active memory in order to be successfully used, it was predicted that first-grade children in the cue maintenance condition would have greater recall and clustering scores than children in the cue available, cue usage and free recall conditions. Because no data were available concerning the effect of grouped recall instructions, no predictions were made between the grouped recall and other four conditions.

The results of the Kobasigawa study (1974) did show an increase in recall scores for upper elementary school children in the condition in which cues were available prior to recall. Therefore, it was predicted that fifth-grade subjects in the cue usage and cue available conditions would have significantly greater recall and clustering than

children in the free recall condition. It was also predicted that fifth-grade children in the cue maintenance group would have significantly greater recall than children in the cue available, cue usage and free recall conditions. In this case as well, no difference was predicted between the grouped recall and other four conditions.

Based on studies by Lange (1973) and Kobasigawa (1974) in which young children (ages 6 and 7) did not use re-presented cues, it was predicted that first-grade children in recall groups in which the cue was re-presented (cue available, cue usage, cue maintenance) would not have greater recall and clustering than those children in groups which did not have re-presented cues.

Based on several other studies (Moely et al., 1969; Moely et al., 1974; Worden, 1974) in which subjects in primary and elementary grades who were given instructions to use the cue during recall, it was predicted that children in the cue usage and cue maintenance conditions would have greater recall and clustering than children in the other recall groups.

Recall and clustering in the cue maintenance condition were also predicted to be greater than recall in the other four as compared to three recall groups. Recall and clustering were predicted to be less for children in the free recall condition when compared to those children in the other four recall conditions. These predictions are summarized below.

1. For first graders: recall and clustering scores would be greater in the cue maintenance condition than in the cue available, cue usage, and free recall conditions.
2. For first graders: no prediction was made between grouped recall and the other four recall conditions.
3. For fifth graders: recall and clustering scores would be greater in the cue available and cue usage than in the free recall condition.
4. For fifth graders: recall and clustering scores would be greater in the cue maintenance condition than in the cue available, cue usage and free recall conditions.
5. For fifth graders: no prediction was made between grouped recall and the other four recall conditions.
6. For first graders: no difference would be found in recall and clustering scores between the cue available, cue usage, cue maintenance conditions and free and grouped recall.
7. For first graders: recall and clustering scores would be greater in the cue usage and cue maintenance condition than in the cue available, grouped and free recall conditions.
8. For fifth graders: recall and clustering scores would be greater in the cue usage and cue maintenance conditions than in the cue available, grouped and free recall conditions.

9. For first and fifth graders: recall and clustering scores would be greater in the cue maintenance than the other four conditions.

10. For first and fifth graders: recall and clustering scores would be less in the free recall condition than in the other four conditions.

CHAPTER III

PILOT STUDY

Since no previous studies have examined the effect of the cue maintenance manipulation, a pilot study was conducted. Recall and clustering scores of the cue maintenance and free recall subjects were compared. Only younger subjects were included. It was reasoned that if no significant effect was found as a result of this manipulation in the younger age group, there would be no point in conducting the main experiment.

Method

Subjects

Twenty females entering grade one in the fall were selected from day care centers in Greensboro, North Carolina. Subjects were described by their caregivers to be of normal intellectual ability. Mean age for the sample was 74.6 months.

Design

Using a randomized block technique, the twenty subjects were assigned to one of two recall conditions: free recall or cue maintenance. After assignment to recall condition, another randomized block technique was used for list assignment within condition. The design was a 2 x 2 factorial with two lists (A & B) and two experimental conditions (free recall and cue maintenance).

Materials

The stimuli consisted of 24 black and white line drawings of familiar items representing six conceptual categories. The items were divided into two presentation lists, each containing three conceptual categories with four items in each category. The categories and items in List A were: Animals: horse, cat, bear, cow; Furniture: bed, chair, lamp, table; Body Parts: teeth, foot, eye, hand. The categories and items in List B were: Clothes: dress, tie, hat, shoe; Toys: bicycle, kite, wagon, ball; Foods: hot dog, pie, bread, ice cream cone. The items within categories and between stimulus lists were counterbalanced according to frequency norms established by Thorndike and Lorge (1944).

Procedure

Each child was brought into a small room located in the day care center and tested individually while sitting at a table beside the experimenter. The following instructions were given for a practice trial which was administered to familiarize the subject with the sorting and recall tasks:

> I have a group of pictures here that I would like for you to name. After you name them for me, I want you to put the pictures together into groups of things that belong together. Then I am going to take them away and find out how many you can remember. Here they are. You tell me the name of each picture as I show it to you.

The experimenter showed six pictures to the subject, one at a time. The pictures for the practice trial were chosen from the unassigned stimulus list and were selected so that two

categories with three items each were represented. As soon as a picture was labeled by the subject, it was placed face-up on the bottom edge of a plastic cloth covering the table. Two rectangles made of black tape were visible on the cloth above the stimuli. As soon as all the pictures had been correctly identified, the subject was told:

> Before I take away all the pictures and ask you to tell me the ones you remember, I would like you to put them together into two groups. The boxes on the cloth are to help you keep your groups straight. In one box, put all the _____ together (the experimenter provides the appropriate label). In the other box, put all the _____ together (the experimenter again provides the appropriate label).

After the subject successfully completed his sorts, the experimenter said:

> Good, now you have made two groups. You put all the _____ together into one group and all the _____ together in another group.

The items were then removed from sight and each child was asked to identify a group of numbers written on a 5 x 8 note card. As soon as the distractor task was completed, the experimenter asked the subject to freely recall the names of as many pictures as he could remember.

After the practice trial, the experimenter told the subject that he would be shown even more pictures this time and that he would have more groups to make. The table covering was turned over so that the side containing three rectangles was visible. The 18 experimental stimulus items were randomly arranged and presented one at a time to the subject. The directions for labeling and sorting were the same as in the

practice trial again with the experimenter providing the appropriate category labels. Prior to sorting, however, the subject was shown the stop watch and told that this was just to tell the experimenter how long it took to put his pictures into groups. After labeling and sorting the pictures, the stimulus items were once again removed and the distractor task administered. Subjects in the free recall condition received the same recall instructions as all subjects in the practice trial. Subjects in the cue maintenance condition received the following directions:

> You did such a good job putting your pictures into groups, that before you tell me the pictures you remember, I want you to tell me the names of the groups you made. You know, what kinds of pictures did you put together.

After the subject named the groups into which the pictures had been sorted, the experimenter continued:

> Good, now that you have told me the group names I want you to use the group names to help you remember. Think of a group name, then tell me the pictures that go with that group. Do this for all the groups you made and all the pictures you saw. To help you remember better, each time you tell me a picture, tell me the group that picture belongs to. So, you will be telling me two things at a time: the picture you saw and the group it goes with.

All subjects were allowed two minutes for recall during which time the experimenter wrote down the items as they were recalled. Some children had difficulty recalling an item and then a label. These children were reminded to remember "two things at a time." This was enough of a probe to establish the required recall pattern. After recall was terminated, the

experimenter thanked each child for playing the game and stated that he had done a very good job remembering the pictures. This was the only reinforcement given during recall. To control for number of probes given by the experimenter, children in each group were asked three times during recall if they could remember more items.

Results

Before the analyses are reported, it should be noted that no subject in the cue maintenance condition had difficulty recalling category names. The first analyses were concerned with the amount of recall under the two recall conditions and two stimulus lists. A two-way ANOVA yielded significant effects for recall condition, F (1, 16) = 9.80, $p < .01$ and for List, F (1, 16) = 5.77, $p < .05$. There was no significant effect for the condition x list interaction, F (1, 16) = 1.71, $p > .05$. A summary of subjects' recall is presented in Table 1. The cue maintenance condition was not only significant well beyond the .01 level, but also resulted in lower average within-subject variance. Collapsed across lists, the within-subject standard deviation for the cue maintenance condition was .96. For the free recall condition, the within-subject standard deviation was 2.46.

Clustering was measured with the proportion of repetition (PR) (Mandler, 1969; Moely et al., 1969) which measures clustering with reference to sorting categories. After arcsine transformations were performed on the percentage scores, a

Table 1

Mean Number of Words Recalled by Condition and List

	Stimulus Lists		
Recall Condition	A	B	Mean
Free Recall	8.57	5.60	7.18
Cue Maintenance	9.00	9.14	9.07

two-way ANOVA was performed to compare clustering under the two recall conditions and two stimulus lists. A significant effect was found for recall condition, F (1, 16) = 8.31, $p < .01$. No list or list x recall condition effects were found.

Although subjects in the cue maintenance condition took more time to sort their pictures than those in the free recall condition, the sorting time variable does not account for the outcomes of the two recall conditions. A two-factor analysis of covariance, with sorting time being the covariate, also yielded a significant effect for recall condition (F 1, 15) = 6.88, $p < .05$. The list effect and list x recall condition interaction were not significant, F (1, 15) = 2.17, $p > .15$ and F (1, 15) = 1.01, $p > .30$, respectively.

In order to determine the strength or magnitude of the association between the experimental manipulation and the resultant amount of recall, a utility index was computed for recall condition. The variability due to this experimental manipulation accounted for 23% of the total variability in the study.

Discussion

A major finding of this study was that first-grade children can significantly increase the number of items they remember by continuous reference to the cue during recall. Apparently, forcing children to state the group membership of each item recalled produced an orientation during retrieval which enabled children to stay within categories. This resulted

in more exhaustive category-by-category recall. The significant level of clustering also supports this interpretation.

The small within-subject variance found in the cue maintenance condition likewise contributed to the overall improvement in recall performance. When compared to subjects in a free recall condition, subjects in the cue maintenance condition had quite similar recall scores with a standard deviation of .96, compared to a standard deviation of 2.46 for subjects in the free recall condition.

These results were also interpreted to reflect a more systematic and exhaustive search in the cue maintenance condition. This interpretation was particularly true for subjects who would have otherwise produced low to moderate amounts of recall. The range for free recall subjects was 3-11 items recalled. The range for subjects in the cue maintenance condition was 8-11 items recalled. Therefore, the cue maintenance manipulation effected low to moderate scores.

The list effect was not expected and is therefore difficult to interpret. There was no list x treatment effect for the 2-way ANOVA and no significant list effect for the Analysis of Covariance. List effects were therefore systematic across conditions. Subjects simply had more difficulty recalling from one list than another.

The utility index also lends support to the effect of the cue maintenance manipulation. With 23% of the total variance attributable to the experimental manipulation, the effect seemed powerful enough to warrant further investigation.

The main experiment was conducted next to look at the effects of cue manipulations corresponding to the components of a proposed model of retrieval. In order to investigate these effects at two ages, roughly corresponding to two developmental periods, beginning first graders and fifth graders were used as subjects in the study.

CHAPTER IV

MAIN EXPERIMENT

In the previous experiment, forcing young children to identify the categorical membership of each item recalled significantly facilitated recall and clustering scores. In the present study, this effect was compared to the effects of four other recall conditions. These conditions have been earlier identified as the cue available, cue usage, grouped recall and free recall conditions (see Chapter III for operationalization of these conditions).

Method

Subjects

In order to increase generalizability, both male and female subjects were used. A post-hoc power analysis was performed on the mean recall scores of the pilot data to determine appropriate sample size. In order to ensure a 92% probability of a significant treatment effect (at the .05 level), twenty subjects per cell would be necessary. Therefore, the total sample size consisted of 200 children. One hundred males and one hundred females, 50 of each sex at the first and fifth grades, were chosen from North Carolina public schools. Subjects were described by their teachers to be of average intellectual ability and performing at grade level in their school tasks.

Design

Using a randomized block technique, subjects were assigned to one of five recall conditions: cue available, cue usage, cue maintenance, grouped recall and free recall. After assignment to recall conditions, another randomized block technique was used for list assignment within condition. The design was thus a 2 x 5 factorial with two grades (A & B) and five experimental conditions.

Materials

Due to low recall, the category "body parts" was dropped from the experimental list and replaced by the category "vehicles." In order to avoid a ceiling effect for older children, the number of items per category was increased to six. Each stimulus list therefore included 18 items. For practical considerations, some stimulus items in the original lists were replaced. List A now included: Animals: mouse, zebra, pig, cat, sheep, raccoon; Furniture: chair, lamp, stove, desk, stool, table; Vehicles: car, train, bus; ambulance, truck, motorcycle. List B now included: Clothes: dress, tie, hat, jacket, gloves, socks; Toys: kite, wagon, ball, crayons, balloon, drum; Foods: hot dog, bread, pie, eggs, ice cream, banana.

Procedure

The directions and procedure for the practice trial, free recall and cue maintenance conditions were identical to

those used in the previous experiment. Directions for these recall conditions were given after completion of the practice trial and the labeling and sorting of the experimental stimuli. Directions for recall were given after the stimulus items had been removed and the distractor task completed. The instructions for recall conditions were as follows:

Cue Available:

> You did such a good job putting your pictures into groups, that before you tell me the pictures you remember, I want you to tell me the names of the groups you made. You know, what kinds of pictures did you put together?

After the subject named the groups into which the pictures had been sorted, the experimenter continued:

> Good, now that you have told me the group names, tell me as many pictures as you can remember.

Cue Usage:

> You did such a good job putting your pictures into groups, that before you tell me the pictures you remember, I want you to tell me the names of the groups you made. You know, what kinds of pictures did you put together?

After the subject named the groups into which the pictures had been sorted, the experimenter continued:

> Good, now that you have told me the group names, I want you to use the group names to help you remember. Think of a group name, then tell me the pictures that go with that group. Do this for all the groups you made and all the pictures you saw.

Grouped:

> I want you to tell me the pictures in groups. Tell them to me just the way you put them together, group-by-group.

Dependent Measures

The dependent measures used in this experiment were the number of items recalled (amount of recall), determined by counting the number of correct pictures verbally stated by the child during the time allotted for recall; the amount of clustering, determined by counting the number of same-category items recalled together; and sorting time, determined by counting the number of seconds each child took to establish his categories prior to recall. This last measure was treated as a covariate.

CHAPTER V

RESULTS

Recall

Children's mean recall scores (minus repetitions and intrusions) arranged by grades and recall conditions are presented in Figure 1. An analysis of variance with grades and recall conditions as independent variables (Table 2) yielded a significant main effect for grade, F (1, 190) = 62.77, $p < .0001$, and also a significant main effect of recall condition, F (4, 190) = 3.66, $p < .007$. The interaction of grade x recall condition was not significant, F (4, 190) = 1.97, $p > .10$.

A two-factor analysis of covariance (Table 3), with sorting time as the covariate, also yielded a significant effect for recall condition, F (4, 189) = 4.39, $p < .002$, grade F (1, 189) = 130.81, $p < .0001$, and interaction of treatment x grade, F (4, 189) = 2.65, $p < .03$. Recall also varied significantly with sorting time, F (1, 189) = 20.70, $p < .0001$. The correlation between sorting time and recall was .31 ($p < .0005$).

One-way analyses of covariance were then carried out on each grade (Tables 4 and 5). Recall condition was found to be significant at both grades. For the first graders, F (4, 94) = 5.65, $p < .0004$, with the correlation between

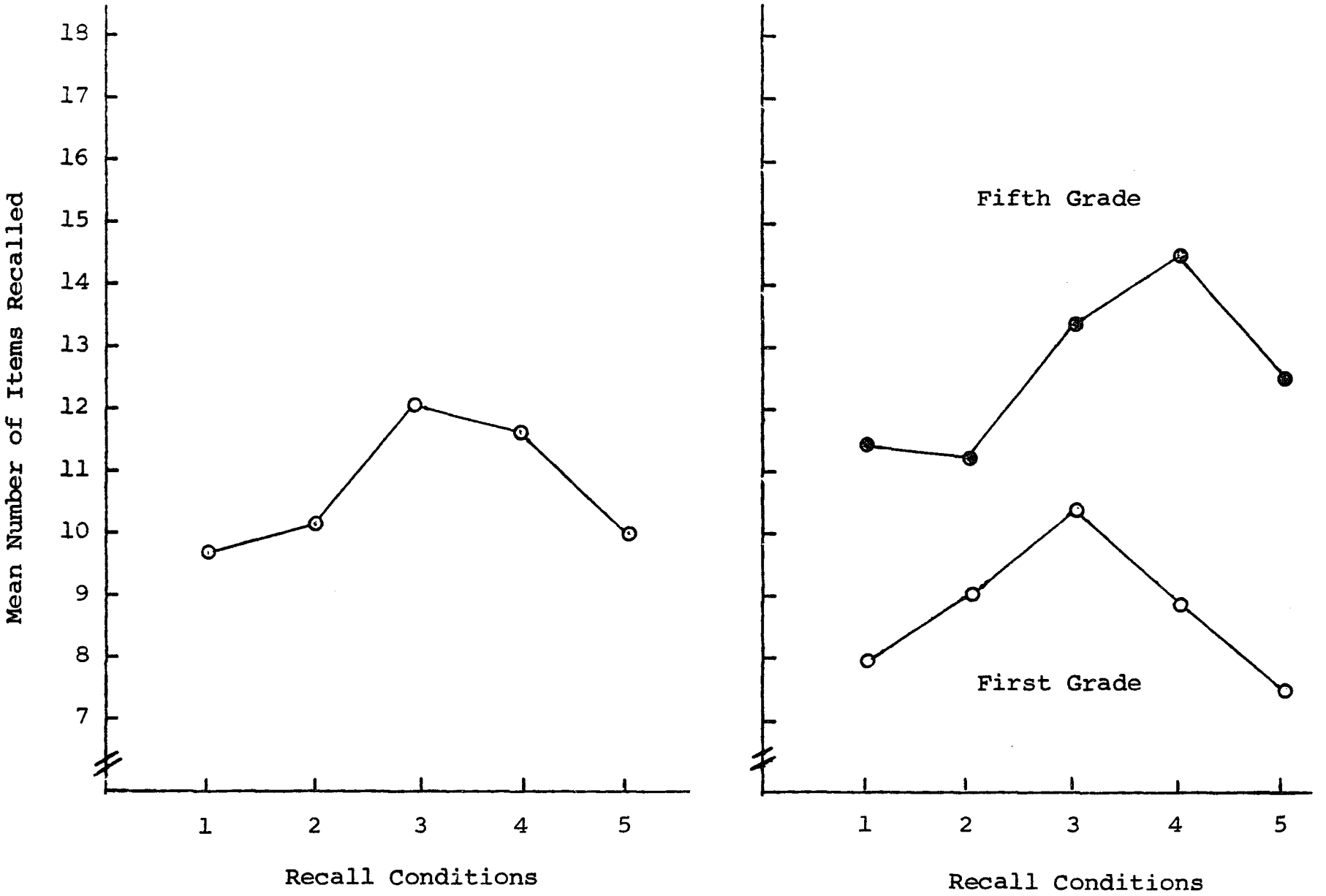


Figure 1. Mean number of items recalled by condition and by condition by grade.

Table 2

Two-Way Analysis of Variance with Recall Condition and Grade as Independent Variables and Recall as the Dependent Variable

Source	SS	df	ms	F	p
Total	3233.12	199			
Grade	737.28	1	737.28	62.77	.0001
Recall Condition	171.72	4	42.93	3.66	.007
Recall Condition x Grade	92.52	4	23.13	1.97	.1008
Error	2231.6	190	11.75		

Table 3

Two-Way Analysis of Covariance with Recall Condition and Grade as Independent Variables, Recall as the Dependent Variable, and Sort Time as the Covariate

Source	SS	df	ms	F	p
Total	3233.12	199			
Sort Time	181.49	1	181.49	20.70	.0001
Grade	1147.14	1	1147.14	130.81	.0001
Recall Condition	153.94	4	38.47	4.39	.002
Recall Condition x Grade	93.13	4	23.29	2.65	.034
Error	1657.43	189	8.77		

Table 4

One-Way Analysis of Covariance with Recall Condition as the Independent Variable, Recall the Dependent Variable, and Sort Time as the Covariate (First Grade)

Source	SS	df	ms	F	p
Total	573.00	99	4.88		
Sort Time	4.10	1	4.10	.84	.36
Recall Condition	110.05	4	27.51	5.64	.0004
Error	458.85	94	4.88		

Table 5

One-Way Analysis of Covariance with Recall Condition as the Independent Variable, Recall as the Dependent Variable and Sort Time as the Covariate (Fifth Grade)

Source	SS	df	ms	F	p
Total	1930.51	99			
Sort Time	1029.17	1	1029.7	122.33	.0001
Recall Condition	110.53	4	27.63	3.28	.01
Error	790.80	94	8.41		

recall and sorting time being .09 ($p > .10$). For the fifth graders, F (4, 94) = 3.28, $p < .01$, with the correlation between recall and sorting time being .75 ($p < .0001$) and accounting for 56% of the variance at this age level.

In order to examine specific hypotheses, a priori comparisons were conducted on different groups of treatment means (Keppel, 1973; Winer, 1971). Recall of first-grade children (Table 6) in the cue maintenance condition ($\bar{X}$ = 10.50) was found to be superior to that of first-grade children in the cue available, cue usage and free recall conditions ($\bar{X}$ = 8.1), F (1, 95) = 17.70, $p < .0001$. Recall of first-grade children in the grouped recall condition ($\bar{X}$ = 8.70) was not significantly different from the mean for the other four recall conditions ($\bar{X}$ = 8.70), F (1, 95) = 0, $p < .05$. The initial finding was in the predicted direction.

Comparisons were first conducted on three different combinations of recall groups for the fifth-grade children (Table 7). Recall of children in the cue maintenance condition ($\bar{X}$ = 13.20) was not significantly different from that of children in the cue available, cue usage, and free recall conditions ($\bar{X}$ = 11.65), F (1, 95) = 1.94, $p > .05$. Fifth-grade children in the cue usage and cue available conditions ($\bar{X}$ = 11.28) did not have greater recall than children in the free recall condition ($\bar{X}$ = 12.40), F (1, 95) = .91, $p > .05$. When the third prediction concerning recall of fifth-grade children was tested, recall in grouped recall ($\bar{X}$ = 14.55)

was found to be greater than that of the other four conditions ($\bar{X}$ = 12.04), F (1, 95) = 5.43, $p < .02$.

The results of these comparisons did not confirm the predictions for the fifth-grade children. Fifth graders in the cue maintenance condition did not recall significantly more items than children in the cue available, cue usage and free recall conditions. Likewise, fifth-grade children in the cue usage and cue available conditions did not have greater recall than children in the free recall condition. The recall of children in the grouped condition was also not predicted to be greater than the mean recall of the other four conditions.

Comparisons on the above groupings of recall conditions were also conducted for both first and fifth graders once sorting time was accounted for. The original comparisons did not change for the first graders (Table 5). However, recall for fifth graders in the cue maintenance condition ($\bar{X}$ = 13.20) was significantly greater than that of fifth-grade children in the cue available, cue usage and free recall conditions ($\bar{X}$ = 11.65), F (1, 94) = 4.29, $p < .04$.

Based on the original predictions, four additional a priori comparisons were made on the recall data (see Tables 6 and 7). Recall in the cue available, cue usage, and cue maintenance conditions ($\bar{X}$ = 9.12 for first graders; $\bar{X}$ = 11.92 for fifth graders) was compared to that of recall in the grouped and free recall conditions ($\bar{X}$ = 8.06 and 13.46

Table 6

A Priori Comparisons for First Graders' Recall

	Recall Conditions								
	Cue Available	Cue Usage	Cue Maintenance	Grouped	Free	ANOVA F(1, 95)	p<	ANCOVA F(1, 94)	p<
1.	-	-	+		-	18.07	.0001	17.70	.0001
2.	-	-	-	+	-	0	NS	0	NS
3.	+	+	+	-	-	3.09	NS	3.08	NS
4.	+	-	-	+	+	14.38	.0005	14.35	.0005
5.	-	-	+	-	-	16.63	.0001	16.59	.0001
6.	-	-	-	-	+	8.02	.005	8.00	.005

Note. Comparisons are in the form of t-tests in which recall conditions with the same sign are grouped together. The two new groupings are then compared.

Table 7

A Priori Comparisons for Fifth Graders' Recall

	Recall Conditions								
	Cue Available	Cue Usage	Cue Maintenance	Grouped	Free	F(1, 95)	p<	F (1, 94)	p<
1.	-	-	+		-	1.94	NS	4.29	.04
2.	+	+			-	.91	NS	2.00	NS
3.	-	-	-	+	-	5.43	.02	12.09	.001
4.	+	+	+	-	-	3.13	NS	6.93	.01
5.	+	-	-	+	+	.42	NS	.92	NS
6.	-	-	+	-	-	.59	NS	1.29	NS
7.	-	-	-	-	+	.03	NS	.06	NS

Note. Comparisons are in the form of T-tests in which recall conditions with the same sign are grouped together. The two new groupings are then compared.

for first and fifth grade respectively). No significant differences were found for first graders, F (1, 95) = 3.09, $p > .05$, nor for fifth graders, F (1, 95) = 3.13, $p > .05$. Another comparison was made between those conditions which gave instructions on the use of the cue during recall (cue usage and cue maintenance) and those which did not give instructions for cue usage during recall (cue available, grouped and free). The former were significantly greater than the latter for first graders, $\bar{X}$ = 9.73 and $\bar{X}$ = 8.02, respectively, F (1, 95) = 4.38, $p < .0005$, but not for fifth graders, $\bar{X}$ = 12.2 and $\bar{X}$ = 12.77 respectively, F (1, 95) = .42, $p > .05$. Recall in the cue maintenance condition was compared to that of recall in the other four conditions. Recall was also found to be significantly greater in the former for first-grade children ($\bar{X}$ = 10.50 and $\bar{X}$ = 8.25), F (1, 95) = 16.63, p .0001, but not for fifth graders ($\bar{X}$ = 13.20 and $\bar{X}$ = 12.38), F (1, 95) = .59, $p > .05$. A final comparison was made between free recall and the other four recall conditions. This analysis revealed that first-grade children performed significantly better in the four recall conditions ($\bar{X}$ = 9.01), F (1, 95) = 8.02, $p < .005$, than in the free recall condition ($\bar{X}$ = 7.45). There was no significant difference in performance of fifth-grade children in the free recall condition ($\bar{X}$ - 12.40) and the other four conditions ($\bar{X}$ = 12.58), F (1, 95) = .03, $p > .05$.

These comparisons were also conducted once sorting time had been accounted for (Tables 6 and 7). The only

significant change was that fifth graders in the cue available, cue usage, and cue maintenance conditions recalled more than fifth-grade children in the grouped and free recall conditions, F (1, 95) = 6.93, $p < .01$.

In conclusion, the comparisons supported the predictions for first graders that recall would be significantly greater in the cue maintenance condition than in the other recall conditions. These analyses also found that requiring first-grade children to recall according to the groups established during sorting did not result in significantly greater recall. The prediction for fifth graders that recall would be greatest in the cue maintenance condition compared to cue available, cue usage and free recall was supported once sorting time was accounted for. The prediction that recall would be greater in the cue available and cue usage conditions when compared to free recall was not supported. The finding that grouped recall was greater than recall in other conditions was not originally predicted.

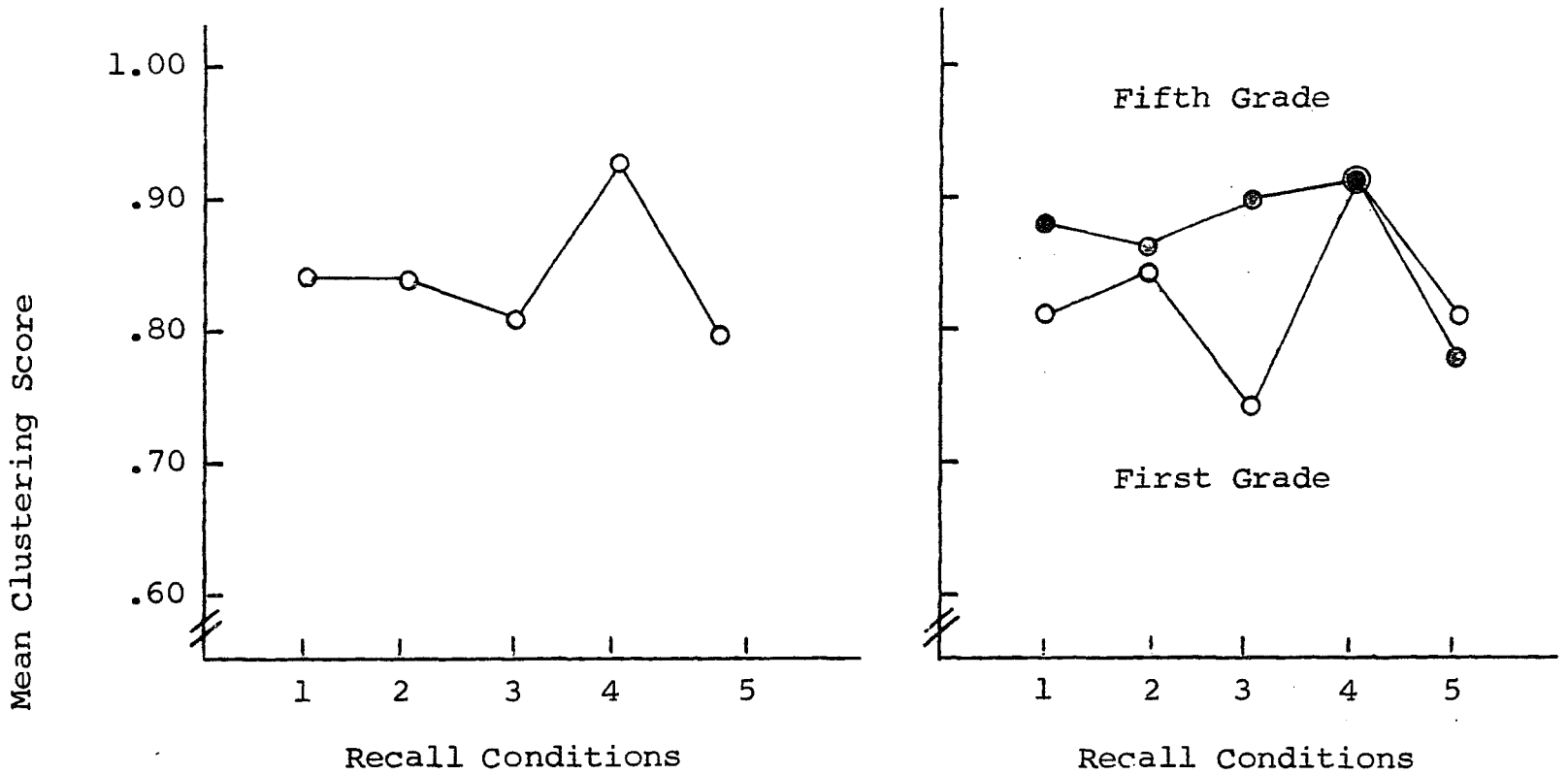
The prediction that conditions which required the reintroduction of the cues prior to recall (cue available, cue usage, and cue maintenance) would result in higher recall when compared to conditions which did not require reinstatement of the cues prior to recall (grouped and free) was supported only for fifth graders, once sorting time was accounted for. The prediction that conditions which gave instructions on the use of the cues during recall (cue usage and cue

maintenance) would show greater recall was supported only for first graders. Recall for fifth graders in the cue maintenance condition was not significantly greater once grouped recall was included in the other comparison conditions. This was not found for first graders. Finally, the mean free recall for fifth graders was not found to be significantly different from the combined mean recall of the other four conditions. For first graders, the combined mean recall in the cue available, cue usage, cue maintenance and grouped recall conditions was found to be significantly greater than that of the free recall condition.

Clustering

Clustering scores were computed using the proportion of repetitions, or PR measure (Mandler, 1969; Moely et al., 1969).[1] This measure is defined as R/(N-C), where R equals the number of clustered pairs (from the same conceptual category), N equals the total number of items recalled, and C equals the number of categories represented in recall. The clustering means, arranged by grade and recall condition, are presented in Figure 2.

Arcsine transformations were computed for each clustering score. Clustering data were then submitted to an analysis of variance with grade and recall condition as independent variables (Table 8). No significant effects were revealed for grade, F (1, 190) = .41, $p > .52$, for recall condition, F (4, 190) = 2.11, $p > .08$, or for the



Note: Maximum score = 1.00

Figure 2. Mean clustering scores by condition and by condition by grade.

Table 8

Two-Way Analysis of Variance with Recall Condition and Grade as Independent Variables and Clustering as the Dependent Variable

Source	SS	df	ms	F	p<
Total	116.47	199	.58		
Grade	.24	1	.24	.41	.52
Recall Condition	4.85	4	1.2	2.11	.08
Recall Condition x Grade	2.15	4	.54	.94	.44
Error	109.23	190	.57		

grade x recall condition interaction, F (4, 190) = .94, $p > .44$.

Referring to Figure 2, clustering for first graders was lowest in the cue maintenance condition (.74). This was also the lowest overall clustering score. Lowest clustering scores for fifth graders was found in the free recall condition (.77). Clustering scores were highest for both grades in the grouped recall condition (.93 for both first and fifth graders). It may be concluded that clustering scores were high across recall conditions.

A two-factor analysis of covariance (Table 9) with sorting time as the covariate yielded no significant effect for grade, F (1, 189) = .07, $p > .79$), for recall condition F (4, 189) = 2.32, $p > .06$), nor for the grade x recall condition interaction, F (4, 189) = .98, $p > .42$.

A two-factor analysis of covariance, with recall time as the covariate made essentially no difference when compared with the original grade x recall condition analysis of variance; for grade F (1, 189) = .35, $p > .56$, for recall condition F (4, 189) = 1.69, $p > .15$, nor for the recall condition x grade interaction F (4, 189) = 1.25, $p > .29$.

Table 9

Two-Way Analysis of Covariance with Recall Condition and Grade as Independent Variables, Recall as the Dependent Variable, and Sort Time as the Covariate

Source	SS	df	ms	F	p<
Total	116.47	199	.59		
Sort Time	.25	1	.25	.44	.51
Grade	.039	1	.039	.07	.79
Recall Condition	5.33	4	1.33	2.32	.06
Recall Condition x Grade	2.24	4	.56	.98	.42
Error	108.60	189	.57		

CHAPTER VI

DISCUSSION

The purpose of this investigation was to explore the role of cues in the recall of categorically related items. Based on research investigating retrieval processes in memory, three recall conditions were selected to represent a range of minimum to maximum availability and use of cues during recall: cue available, cue usage, and cue maintenance. These conditions also represented the components of Kobasigawa's model of retrieval. In particular, this investigation attempted to determine whether or not support could be found for the hypothesis that young children do not effectively use cues which are available to them because they do not maintain these cues in active memory during recall. It was predicted that first- and fifth-grade children would recall the most items when instructed to associate verbally each item recalled with its appropriate category label or cue (cue maintenance condition). Clustering scores were also expected to be significantly greater for children who were required to conduct recall in this manner.

For the reader's reference, a summary of the recall conditions is presented in Table 10.

As predicted, overall recall performance was significantly influenced by recall instructions with overall mean recall

Table 10

Summary of Recall Conditions

	Components of the Recall Conditions				
	Instructions to recall labels	Instructions to use labels	Instructions on how to use labels	Instructions to repeat labels	Instructions to order recall
1. Cue Available	+	-	-	-	-
2. Cue Usage	+	+	+	-	-
3. Cue Maintenance	+	+	+	+	-
4. Grouped	-	-	-	-	+
5. Free	-	-	-	-	-

Note. "+" indicates that instruction was included in the condition; "-" indicates that instruction was not included in condition.

greatest in the cue maintenance condition. The initial analysis of variance did not reveal a grade x condition interaction; however, once sorting time was accounted for, a grade x condition interaction was found. This interaction can be attributed to the superior recall of fifth graders in the grouped recall condition. Giving directions to reconstruct the encoding situation evidently maximized recall for these fifth-grade children. This finding suggests that, at least for older children, recall of associated items which have been grouped during encoding is conducted more effectively by the use of rote memory than with the strategic use of cues during the retrieval process.

The planned comparisons conducted on data for first-grade children confirmed the hypothesis that forcing children to maintain the cue in immediate memory significantly affected recall. This is of particular interest due to the finding that clustering scores, while predicted to be significantly greater in this condition were similarly high in all conditions. Therefore, the organized manner of recall alone could not account for greater recall. Maintaining the cue in active memory consequently enabled these children to extend their memory search and not rely on a less efficient rote approach to retrieval. This finding also suggests that an associational explanation such as that proposed by Lange (1973) would not account for higher recall for first-grade children.

In regard to clustering, it is also interesting to note that first-grade children in the cue maintenance condition had the lowest overall clustering score (.79), which again would indicate reliance on something other than a rote approach to recall. In this condition, five children at the first-grade level conducted recall by recalling only one item from each of the three categories successively and then repeating this recall pattern (this pattern was also noted by Kobasigawa, 1974) until their memory store was exhausted. The effect of this pattern of retrieval was to effectively reduce clustering scores. Because monitoring the memory store is much more difficult when using this technique, it would seem that this would not be the most efficient manner of conducting recall. However, it did facilitate the amount recalled by these younger children, and is perhaps reflective of the difficulty children this age frequently have with class inclusion problems in general. The association of one item with one label rather than several items with one label could be more representative of the cognitive processing of first-grade children.

The frequent finding that younger children do not use cues in conducting recall, even though they are instructed to do so (e.g., Kobasigawa, 1974; Lange, 1973) was not supported by this study. First graders who received instructions on how to use cues, in addition to directions to use them, recalled significantly more items than those children who

received no instructions involving use of cues. This is consistent with findings by Geis and Hall (1975) and again points out that younger children must not only be made aware of the organized nature of the stimuli, but also must be instructed how to take advantage of this organization during retrieval. The finding that having first-grade children recall items group-by-group or with just a reminder of category labels just prior to recall did not result in significantly greater recall also supports the above conclusion.

The fifth grade data were interesting because of two non-predicted findings, namely, the effect of grouped recall instructions and the influence of sorting time.

Recalling items group-by-group most nearly matched the encoding situation, and was apparently the most efficient means for these older children to conduct recall. It is possible that this condition was so salient that directions to do anything other than reproduce the encoding situation exactly interfered with the recall of these fifth-grade children. The heavy reliance on rote memory skills required by most elementary school curricula could also help explain this finding.

The effect that grouping items during encoding had on the recall of this age group was emphasized further by the tremendous amount of variance accounted for by sorting time (56%). For example, in comparisons which included the grouped condition, the influence of the cue was seen only when sorting

time is taken into account. Once this variable is controlled for, just restating the category labels can be reminder enough for fifth graders, who have grouped items prior to recall, to recall items in a systematic and exhaustive manner.

In conclusion, it appears that the continuous availability of cues in active memory is helpful in recall of younger children, even though they may not be used to conduct category-by-category recall but item-by-item recall. From these findings, it is argued that the loss of the cue during retrieval does result in disorientation during the memory search and thus inefficient recall. For fifth graders, it is difficult to determine the effect of cues per se. Due to the finding that sorting time in which concept groups were established accounted for more variance than any other factor in this age group, it would be of particular interest to gather data using the recall conditions defined in this experiment in the absence of the sorting directions. Only then could a clearer picture of cue usage in general and in the cue maintenance condition in particular be seen with older children.

In respect to Kobasigawa's model for retrieval of categorically related items, this study demonstrated that required cues are available to initiate and conduct retrieval. However, it can not be concluded from these data that using these cues to conduct group-by-group recall is necessarily the most efficient means of directing recall. A more reliable

assessment of this would have been the inclusion of a constrained cuing condition in which the experimenter produces category labels, one at a time, and requires recall to proceed group-by-group as the label is presented.

Because of the unpredicted high clustering scores which were in each condition, the utility of the cue maintenance manipulation could perhaps be more accurately assessed not only with the removal of sorting directions but also with the removal of instruction as to the use of the category label during recall.

FOOTNOTE

[1]The ratio of repetition (RR) measure was also used to compute clustering scores. Results were very similar to the PR measure reported.

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APPENDIX

S NAME _____ NUMBER _____ DATE _____

CONDITION _____ CLASS _____ LOCN _____

SORTS: Group Names/_____/ /_____/ /_____/

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

Sort Time/_____

RECALL:

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