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Young children's memory: The effect of task goal and item organization on immediate and delayed recall

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YOUNG CHILDREN'S MEMORY: THE EFFECT OF TASK GOAL AND ITEM ORGANIZATION ON IMMEDIATE AND DELAYED RECALL

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
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By

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ABSTRACT

The effectiveness of strategies in enhancing memory performance has been well documented but the issue of whether young children can demonstrate early forms of strategic behavior remains unresolved. This study assessed the impact of an explicit goal to remember on the behavior and recall performance of preschoolers, and explored the effect on recall when items to-be-remembered are organized thematically. It has been suggested that children organize information schematically, based on their daily routine experiences. Thus, material compatible with schematic knowledge structures should facilitate recall of young children.

Forty-three preschoolers were instructed either to remember or to play with a set of 12 toy objects. The items for half the children in each condition were linked to a beach picnic theme and the alternate array was comprised of familiar but unrelated objects. Children in the remember condition were told to remember the items for later "purchase" at a pretend store. Following the two-minute exposure period, children in the play group were told to get the items from the store.

The characteristic pattern of children told to play was to physically engage the items in contrast to the remember group who spent considerable time not obviously interacting with the objects

but apparently still involved in the task, and some time looking at the items and naming them. Differences in the behaviors of the two groups and the nature of the behaviors of the remember children, suggest that precursors of mnemonic strategies are available to preschoolers. However, only naming of items was predictive of recall. Thus, although the remember group had higher recall scores, the differences were only marginally significant.

Item organization did not affect immediate recall scores, but only children exposed to the beach array maintained their level of recall following the one-week delay interval. With recency of exposure no longer aiding recall, children in the non-thematic group had to rely on memory of individual items. Children who had been exposed to the thematic set could use the beach theme to trigger recall of the array. The data are compatible with the notion that schemas influence retrieval rather than encoding.

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CHAPTER I

INTRODUCTION

As Flavell (1985) points out, memory development is one of the more active areas of research in contemporary developmental psychology. This upsurge of interest in the development of memory began in the 1970's with the shift towards emphasis on understanding the cognitive underpinnings of memory rather than focusing primarily on memory performance per se. Memory research now tends to be viewed as a means of understanding cognitive development in general (Kail & Hagen, 1982). This change in focus is reflected in the latest edition of the Handbook of Child Psychology, in which memory research forms the primary data base for the chapter on learning, remembering and understanding (Brown, Bransford, Ferrara, & Campione, 1983).

Two main themes have dominated the research on memory development since the early 70's--the development of mnemonic strategies and the role that the expanding knowledge system or knowledge base plays in the improved memory performance consistently demonstrated by older versus younger children (Ornstein & Naus, 1985). The study of strategy development has more recently included the issue of whether very young children can be strategic or deliberate in situations requiring remembering (e.g., Wellman, in press). The notion of knowledge base can refer to general world knowledge or to degree of expertise in specific content areas (e.g., Chi, 1978, Chi & Koeske, 1983) as well as to the ways in which

knowledge is organized (e.g., Bjorklund, 1985; Nelson, Fivush, Hudson, & Lucariello, 1983).

As Naus and Ornstein (1983) noted and then expanded upon (Ornstein & Naus, 1985), the development of strategies and the development of the knowledge base have typically been treated as independent components of memory development. In their view, however, these elements are interactive and should be studied concurrently in order to understand memory development. The primary focus of their work, as well as that of others they cite, has been on the school-age child. The view that the use and effectiveness of memory strategies may be linked to the knowledge organization imposed or made available to the rememberer has not been explored with very young children. The failure to extend this perspective to the preschool-age child undoubtedly derives from the fact that children at this age are typically not viewed as strategic (e.g., Myers & Perlmutter, 1978; Perlmutter & Myers, 1979).

Despite the general tendency to view very young children as non-strategic, recent research provides contrary evidence (e.g., Baker-Ward, Ornstein, & Holden, 1984; Deloache & Brown, 1983; Deloache, Cassidy & Brown, 1985; Wellman, in press). The bulk of this research has involved recall of spatial location, essentially, hide-and-seek games, with older infants and toddlers. Deloache (1985) suggests that young children demonstrate higher level cognitive skills in tasks facilitated by the presence of external environmental cues than those requiring internal memory cues. Data from the studies on memory for spatial location, nevertheless, provide some support for

the notion that young children can be deliberate in their attempts to remember. The issue of whether similar competence can be demonstrated on primarily verbal tasks, still remains open.

Additionally, of direct interest to this research is the role that knowledge organization plays in young children's recall. The importance of real world knowledge in the construction of memory has been emphasized by Nelson and her colleagues (e.g., Nelson, Fivush, Hudson, & Lucariello, 1983; Nelson, 1986) as well as by Mandler (1979, 1983). The constructivist viewpoint assumes that memory is not an exact copy of experience but rather that information is interpreted in terms of the existing knowledge base. Therefore, it is necessary to understand the content and structure of the knowledge base that children bring to a memory task. Nelson points out that traditionally it has been assumed that the knowledge base of young children is disorganized and therefore children under the age of seven or eight are very poor, for example, at organizing lists of words into taxonomic categories. Nelson has taken the position that young children's knowledge is indeed organized but that the organization is a schematic rather than a taxonomic one.

Purpose of the Study

The development of strategies for remembering--including the issue of whether young children can be said to be strategic--and the role of knowledge in remembering, are central issues in contemporary developmental memory research. As noted above, while there has been a tendency to emphasize either strategies or knowledge as the major

factor in the development of memory, the interplay between the two has received relatively little attention, especially with very young children. It seems reasonable, for example, to assume that the use and effectiveness of mnemonic strategies will be facilitated when information to be remembered is presented in a manner consistent with the knowledge organization of the rememberer. Naus and Ornstein (1983) suggest that the "implementation of a deliberate organizational strategy is not content free, but rather depends upon the nature of the to-be-remembered materials to which the strategy is applied" (p. 23).

One purpose of this study was to address the issue of whether preschoolers can engage in behaviors that can be interpreted as strategic, that is, as deliberate attempts to remember. Additionally, adopting the perspective of Naus and Ornstein, the broader purpose was to look at the relationship between the ability of preschoolers to be "strategic" and their success in remembering as a function of the knowledge organization of the to-be-remembered materials. The general hypothesis to be tested was that compatibility between the organization of the stimulus materials and the knowledge structure of preschoolers would facilitate the use of deliberate and effective recall strategies (or precursors of strategies) when there is a need to remember. Additionally, although the typical memory experiment with young children involves a single recall trial or repeated trials within one session, of interest was the possible longer term effects on memory of variations in task goals and the nature of the items.

The Development of Mnemonic Strategies

In their major review, Brown et al. (1983) point out that during the 1960s and 1970s the picture that emerged of the development of strategies for learning and remembering, provided strong evidence that efficient performance in a wide variety of tasks was largely dependent on the mnemonic strategies the subject engages in, either spontaneously or with training. The mature learner uses a variety of both acquisition and retrieval strategies that are not part of the repertoire of the younger child. The primary memory strategies that have been identified include rehearsal, elaboration, and some form of grouping. Brown et al. note that the finding that increased strategy use leads to increased memory performance is extremely robust, being both a highly reliable and a very large effect. Similarly, a large body of literature summarized in Ornstein & Naus (1985) highlights the general finding that with age children become increasingly proficient at using mnemonic strategies and this increase in strategic skill corresponds with improved recall.

At the same time, Brown et al. (1983) acknowledge that the primary focus in the area of memory development has been on the school-age child and the emergence of the strategies of rehearsal, categorization, and elaboration during the years between five and eight. However, very little is known about the precursors of these strategies. Brown et al. conclude that this paucity of information about the precursors of these strategies represents a major gap in the understanding of memory development. If young children are not

using these traditional mnemonic devices, what is it they are doing when there is a need to remember?

As Wellman (in press) points out in his review article on the early development of memory strategies, the traditional view has been that preschool-age children do not engage in strategic approaches to memory demands, but rather that recall in young children is basically an incidental rather than a deliberate process. This is the perspective taken in a study by Appel, Cooper, McCarrell, Sims-Knight, Yussen & Flavell (1972). Preschoolers were presented with a set of nine pictures comprising three taxonomic groups displayed in random order and were told either to look at or to remember the names of the pictures. The children behaved no differently under the two conditions and there were no significant differences in recall (means of 4.30 and 4.15 for the look and remember conditions, respectively). Although the preschoolers named sequentially during the 1.5 minute study period--one of four behaviors considered to be a possible mnemonic strategy--they did so equally in both conditions, leading the authors to conclude that the behavior was an automatic verbal recognition response rather than a deliberate memory strategy. Appel et al. suggest that preschoolers do not realize that "the imminent presence of a recall test has implications for one's own present behavior with respect to the to-be-recalled items" (p. 1379).

A similar conclusion was reached by Perlmutter and Myers (1979). They carried out a series of studies in which three-and four-year olds had to remember nine objects that were either unrelated or were

derived from three taxonomic categories (animals, transportation, utensils). Children performed significantly better on the related items and under conditions of cued rather than free recall. However, the authors found that there was no evidence of deliberate strategy use, no overt rehearsal or primacy effects that might imply rehearsal, and little suggestion of possible organizational strategies. There was improvement in recall across the age ranges tested but no indication that this was due to increased strategy use by the older children. "In sum, these preschool children's performances could be described as nondeliberate" (p. 81).

Wellman, however, reviews other data to support his contention that, in fact, young children's memory activities are strategic and frequent, and that, as with older children, changes in memory performance in the preschool years are also dependent on strategy developments. According to Wellman, the strict definition of a strategy is that the "means must be employed deliberately, with some awareness, in order to produce or influence the goal" (p. 5). Paris, Newman, and Jacobs (1985) similarly emphasize deliberateness as an essential feature of strategic behavior, defining a cognitive strategy as a "selected action performed for the purpose of achieving a particular goal" (p. 85). On the other hand, others (e.g., Pressley, Elliot-Faust & Miller, 1985) take the position that strategic behaviors may be carried out automatically, almost reflexively. They emphasize that strategies are behaviors that <u>could</u> be applied deliberately.

In studying memory processes of very young children, the issue of deliberateness does seem important in evaluating whether the observed behaviors can be viewed as "strategic". The major procedure to determine whether the criterion of deliberateness has been met--the differentiation experiment--is outlined in Wellman (1977). The methodology involves providing contrasting conditions such that both instructions to remember and control instructions are given, and determining that potential strategic activities are observed only or primarily during the remember condition, and that the observed activities aid recall.

Several studies of spatial location with very young children have followed this general "differentiation" paradigm. DeLoache and Brown, for example, have carried out a series of studies with children ranging in age from 18 to 30 months. Typically, a stuffed animal is hidden either in a familiar setting at home or in a laboratory setting and the child's task is to find the toy after delay intervals ranging from one to four minutes (e.g., DeLoache & Brown, 1983; Deloache & Brown, 1984). During the delay interval children are usually playing with toys or talking to the experimenter. Across studies toddlers first search in the correct location over 80 per cent of the time. In one study of 18- to 24-month-olds (Deloache, Cassidy & Brown, 1985) children interrupted their play behavior to talk about the toy or its hiding place ("Big Bird hide", "Big Bird chair"), looked or pointed at the hiding place, or hovered near it. In control conditions in which Big Bird either took a nap in view of the child and the child was instructed

to wake him up when the bell rang, or when Big Bird was hidden but the child was told that the experimenter would find him when the bell rang, children were unlikely to exhibit any of the strategy-like behaviors evidenced in the standard experimental situation.

Deloache (1985) suggests that the toddler's interval behaviors appear very similar to the more mature mnemonic strategies of older children, such as rehearsal or self-monitoring. Interestingly, children were more likely to display these possible mnemonic strategies in the unfamiliar laboratory setting than at home. Deloache et al. (1985) hypothesize that uncertainty about the ability to find the toy is increased in an unfamiliar setting and causes the child to become more vigilant.

Deloache recognizes that these "mnemonic" behaviors could be interpreted as anticipatory goal responses that reflect the young child's inability to inhibit goal behaviors. However, she rejects this view since differential delay-interval behaviors were observed under experimental and control conditions and useful verbalizations, which were not part of the goal or retrieval response, did occur during delays. She further argues that the fact that an interval behavior resembles the retrieval response should not eliminate it from consideration as a strategy. If the latter were the case, verbal rehearsal would not meet the criterion of a mnemonic strategy.

In the summary of her review, Deloache (1985) concludes that the research on spatial location provides evidence of active mnemonic effort at a very early age. Toddlers are sensitive to memory demands and behave differently in response to them.

The issue of deliberateness was also explored by Somerville, Wellman, and Cultice (1983) in a study in which two-, three-, and four-year-olds had to remind their mothers to carry out a task at a later time. Children as young as two were able to do so when the reminder was related to something of personal interest to the child, such as buying candy. With short delays of one to four hours children were still able to remind their parents to do personally uninteresting chores such as get the wash out of the dryer. Children at ages two, three, or four, were more likely to remind their parents of any type of activity when delays were relatively short in contrast to delays of from 12 to 24 hours.

Other evidence of purposeful remembering was found by Wellman, Ritter, and Flavell (1975). They demonstrated that young children engage in deliberate activities when told to remember the location of a toy hidden in one of many containers in contrast to a condition in which they are told to wait with the same hidden toy. During the 40-second delay period, the three-year olds in the remember condition looked fixedly at the cup containing the hidden toy more, touched the hiding place, and on occasion did such things as pointing to the correct container and nodding yes and pointing to incorrect containers and nodding no. Children who engaged in these behaviors remembered better.

Although Wellman includes effectiveness as a criterion in his strict definition of a mnemonic strategy, he further argues that while an endeavor or activity must be deliberate to be considered strategic, the requirement that the attempt be effective is not

essential. Therefore, "faulty strategies"--strategies that don't lead to improved recall--also provide evidence of early development of strategy usage. Paris et al. (1985) also emphasize that effectiveness is not a defining characteristic of a strategy. They suggest, for example, that a child who puts a book under his pillow at night hoping to remember what's in it, is using a mnemonic strategy. The strategy is simply not constructive. Thus, while children under six may be intentionally strategic, their strategies often prove to be ineffective (e.g., Baker-Ward, Ornstein, & Holden, 1984). The Baker-Ward et al. study is of special interest as it is one of the few studies that supports the idea that preschoolers can be deliberate (demonstrating at least precursors of mnemonic strategies) on a verbal free recall task in contrast to the search tasks typically used with very young children.

The four-, five-, and six-year-old children in the Baker-Ward et al. study were presented with an array of 15 small toys with which they could play. At each age group, comparisons between children in the condition in which they were additionally instructed to remember the five target items (Target Remember), in contrast to conditions in which they were additionally instructed to play with the target items (Target Play) or where no further instruction was given (Free Play), revealed differences in behaviors during the two-minute activity period. Children in the groups designated Target Remember named the objects more and played with them less than children in the two other conditions, and also visually examined (scanned objects or visually focused on an object) more and had more "unfilled time". Unfilled

time was defined as behavior that was on-task, but did not involve either naming, visually examining, playing with, or manipulating the objects. The authors speculate that unfilled time may represent a period of covert cognitive activity.

These differences in behaviors among the groups appear to reflect the impact of the remember instructions and indicate that even the youngest children in the Target Remember group were engaged in deliberate attempts to do something that would help them to remember the target items. However, it was not until age six that the Target Remember group did recall more items than children in both the Target Play and Free Play groups. At age five the Target Play children recalled more items than the Free Play group but there were no differences between Target Remember and Target Play groups. At age four there were no significant differences in recall among the three groups.

Although the four-year-olds in the Target Remember group engaged in behavior patterns similar to those of the older children in the equivalent groups (naming, visually scanning, unfilled time, and minimum play), their efforts to remember were ineffectual. Interestingly, the best predictor of recall of the target objects for the four-year-olds was amount of unfilled time, raising the possibility that even at this age children may make attempts to use covert mnemonic mechanisms to aid recall. Baker-Ward et al. offer various possible explanations for their finding of a lack of correspondence between mnemonic behaviors and recall for the four-year-olds. They suggest, for example, that a particular behavior can

become more effective with age as it becomes increasingly automatic and consequently requires less effort.

An important question that emerges from the Baker-Ward et al. study is: Are there conditions under which the deliberate strategies or mnemonic behaviors that may be available to four-year-olds in a free-recall task can be functional, that is, lead to greater recall? Brown et al. (1983) maintain that there is research that suggests that preschoolers can be effectively strategic in situations where the goal of the activity is clear to the child, the setting familiar, and the index of strategic use is somewhat lenient. They cite Istomina's (1975) study which demonstrated that when the goal for remembering is made meaningful (i.e., to buy items at a play store) children can engage in deliberate "emergent" procedures for remembering. Interestingly, a recent study (Weisberg & Paris, 1986) failed to replicate Istomina. They found that three- and four-year-olds recalled more when the goal to remember a list of six food items was made explicit in a lesson format in contrast to the "shopping" scenario in which children were read the same list of items and sent to buy them at the "store". Differences in recall were attributed to the greater number of children in the lesson condition who rehearsed (nearly 50 percent) compared to the game condition (12 percent), and more distraction in the latter condition. Weissberg and Paris conclude that very young children can be deliberate in their attempts to remember if mnemonic goals are made explicit. Clearly, as Brown et al. further point out there is a need to understand more about the

conditions under which primitive precursors of memory strategies occur. This study seeks to explore this issue.

Knowledge Organization

One school of researchers has focused on the growth of children's memory strategies during the elementary school years as the basis for improved memory performance, whereas a second group has emphasized the expanding knowledge base of the elementary school child as the primary explanation for age-related changes in memory performance. Recent research, most notably by Chi (1978), has highlighted the important role of prior knowledge on memory performance. Chi's demonstration that 10-year-old chess experts were better rememberers of chess positions than were adult novices, although their general memory skills as measured by digit span were not as good as the adults, dramatically emphasized the role of knowledge on memory performance. This line of research explores how expertise influences recall. Another aspect of knowledge, the way in which it is organized, is of more direct interest here.

The importance of real world knowledge in the construction of memory has been emphasized by Nelson and her colleagues (e.g., Nelson, Fivush, Hudson, & Lucariello, 1983; Nelson, 1986). Their constructivist viewpoint assumes that memory is not an exact copy of experience but rather that information is interpreted in terms of the existing knowledge base. Therefore, it is necessary to understand the content and structure of the knowledge base that children bring to a memory task. Nelson disputes the traditional notion that young

children's knowledge base is disorganized. Instead she maintains that their knowledge of the world is schematically structured rather than organized around taxonomic categories. Mandler (1979, 1983) holds essentially the same view. Nelson, however, thinks that there is a subsequent shift to categorical organization whereas Mandler maintains that taxonomic knowledge is a secondary type of organization that is added on to a fundamental schematically organized memory system. She suggests that schematic organization continues to be the predominant form of knowledge organization throughout life. Schema theory, including the notion of scripts, provides the theoretical basis for item organization in this research and so will be elaborated upon.

History of Schema Theory. According to Anderson and Pearson (1984), Bartlett is generally credited with being the first psychologist to use the term schema in the way in which it is used today. In his classic text, Bartlett (1932) notes that the term schema was already widely in use but it was poorly defined and could refer to almost any vaguely outlined theory. In particular, common usage did not incorporate an essential aspect of Bartlett's schema notion--that the past is dynamic, constantly changing, and developing over time rather than merely registered as static traces of prior events. Nevertheless, Bartlett decided to use the word schema, defining it in his unique way as "an active organization of past reactions, or of past experiences, which must always be supposed to be operating in any well-adapted organic response" (p. 201). The word active was used to emphasize the constructivist nature of

remembering in contrast to the more common notion of memory as passive retrieval. In Bartlett's view, memory is never an exact duplication of a prior event but rather it is an imaginative reconstruction, involving condensation, elaboration, and invention. This perspective has a very contemporary ring and thus the acknowledgment by current schema theorists (e.g., Galambos, Abelson, & Black 1986), of their roots in Bartlett, although this Yale Cognitive Science group now prefers to use the term knowledge structure rather than schema.

Edwards and Middleton (1985) note that while contemporary psychologists may acknowledge a debt to Bartlett, they tend to ignore his focus on the role of affect in memory. In fact, Bartlett asserts that the reconstructive process of memory is only partially intellectual, and the end product of the process is primarily affective. Edwards and Middleton chastise contemporary schema theorists for their preoccupation with cognitive information processing and their consequent disregard of the role of emotion in memory. In so doing they distort Bartlett's legacy.

Another innovation of Bartlett's that is reflected in current memory research, was his rejection of the nonsense syllable paradigm of Ebbinghaus and his focus instead on the memory of meaningful material. Bartlett was interested in everyday memory function, as are most contemporary memory researchers.

When developmental psychologists think of historical precedents for the term schema, Piaget rather than Bartlett, is the name that comes to mind. Like Bartlett, Piaget emphasized the active nature of

schemata. As Nelson (1981) points out, however, Piaget's formulation is quite different from contemporary usage. Piaget's schema refers primarily to actions that are applied to a range of phenomena in the world. Most characteristic are the action schemas of the sensory-motor period such as sucking and grasping. These action schemas form the basis of subsequent representational thought. As Flavell (1963) notes, Piaget's concept of schema is not necessarily limited to the sensory-motor stage but it most elaborated for this period. Nelson emphasizes that the level of knowledge, especially about the social world, that current schema theories attempt to capture, is neglected by Piaget since he was interested in the child's construction of a logically consistent knowledge system. Such a system does not describe the social world of the child.

Contemporary Schema Theory. What is contemporary schema theory and what are its essential elements? Numerous researchers have described schema theory, emphasizing the particular aspects of the theory which seem most central to them and which are relevant to the type of research in which they are engaged. Among other things, Mandler has applied schema theory to her studies of memory for stories and complex pictures in both children and adults. She describes a schema as a cognitive structure, or organized representation of a body of knowledge (Mandler, 1979, 1983). Unlike other organized knowledge structures, however, schemata are based on connections that have been spatially and/or temporally linked. Categorical knowledge structures, for example, are determined by similarities shared by class members. Schemata are formed on the

basis of past experiences which then lead to a set of expectations about objects and events and the order in which they will occur. A schema represents relationships among its component parts and when the schema is activated the parts or variables are filled or instantiated with the appropriate information.

Nelson (1981, 1986) is interested in the knowledge very young children have about everyday routines and events. Like Mandler, she notes that traditional theories of cognition have used representation schemes that relate similar elements in a linear and hierarchical fashion. Although this paradigm describes some types of knowledge, such as taxonomic categories, it cannot account for many types of natural knowledge systems such as spatial layouts, story structure, games and everyday routines. According to Nelson, these types of knowledge structures are schematic rather than taxonomic. In schematic organization diverse elements are combined in a holistic way and it is this holistic nature of a schema that for Nelson is its most important characteristic.

Anderson has written extensively about schema theory in relation to reading comprehension (Anderson, 1984; Anderson & Pearson, 1984). Comprehension involves activating a schema that provides a reasonable explanation of a passage. Anderson emphasizes that schemata are abstract structures, created by drawing on a number of situations and summarizing information from them. Knowledge is not just an accumulation of facts but is organized. Schemata represent this structure of knowledge--this relationship among the elements of a schema.

Like Anderson, Rumelhart has an interest in the application of schema theory to reading comprehension. Schema theory has been described by Rumelhart (1980) as a theory about knowledge and the ways in which knowledge is represented and used. Schemata are the units that represent our knowledge about concepts, situations, events, sequences of events, actions and sequences of actions. Schemata stored in memory derive from normal circumstances or events. They are prototypical representations.

An important aspect of all schema theories is the idea that schemas consist of a set of variables or slots which can be filled with some degree of flexibility. Schemata are not rigid although they vary in their degree of generality. The more concrete the schema, the more predictable are the values that fill a given slot. Knowledge about the typical values of slots or variables in a schema is referred to by Rumelhart (1980) as the variable constraints. These constraints can serve as default values when we don't have specific information about a variable. Essentially, they allow us to make inferences and thus enable us to interpret or comprehend events or situations. Anderson and Pearson (1984) also emphasize the importance of inference in schema theory.

One can have a schema about anything at all with which one is familiar. As an example, Rumelhart discusses the schema for the concept BUY. The variables or slots that have to be filled for this schema would include things such as the purchaser, the seller, the medium of exchange, the merchandise, and negotiation. When a situation is understood to be one of buying, we determine to what

degree the present circumstance matches our prototypical BUY schema. Where information about one of the variables is missing, we supply the missing information based on our past experiences. Interpreting a situation to be an instance of some concept, involves the instantiation of the appropriate schema, say the BUY schema. The variables of the schema are matched with the variables in the situation and it is, according to Rumelhart, the traces of these instantiated schemata that are the basis of our memories.

Rumelhart reviews the four major characteristics of schemata originally outlined in Rumelhart and Orntony (1977) and adds two more:

1. Schemata have variables (e.g., the BUY schema has a seller, buyer, etc.)
2. Schemata can embed, one within another. A schema consists of a network of subschemata. Thus a face schema would include subschemata for eye and mouth, and so forth.
3. Schemata represent knowledge at all levels of abstraction. Thus the schema for room is more general than that for bedroom.
4. Schemata represent knowledge rather than definitions. They represent what we know about the world.
5. Schemata are active processes
6. Schemata are recognition devices whose processing is aimed at the evaluation of their goodness of fit to the data being processed.

As noted above, schemata can vary in their level of abstractness. Of particular interest here are the more simple and concrete schemata referred to by Schank and Abelson (1977) as scripts. Scripts describe the specific knowledge we have about ordinary events and activities. They are derived from our frequent experiences with such events and enable us to function efficiently in the world. Galambos (1986) defines scripts as "mental representations of the causally connected actions, props, and participants involved in common activities" (p. 19). Basically scripts entail temporal and/or causal sequences of events which form structured wholes, and which have variables that must be filled in particular contexts. Typical script examples include going to a birthday party, grocery shopping, washing your hair, changing a flat tire, and so forth. The most frequently cited script is probably the restaurant. The following examples from Schank & Abelson (1977) demonstrate how scripts help us comprehend standard situations:

1. John went to a restaurant. He asked the waitress for coq au vin. He paid the check and left.
2. John went to a restaurant. He saw a waitress. He went home.

The first scenario is readily understandable because it evokes a restaurant script. On the other hand the second "story" is confusing because although it seems to make reference to the restaurant script, the appropriate inferences don't follow. In the first example we can readily fill in any unspecified intermediate links. We assume that

John was seated, that he looked over the menu, ordered the meal, ate his dinner, received a check and paid for it. The connections between pieces of the story and the restaurant script fit the data in the first case but not the second.

Scripts such as the restaurant script may also have many tracks. Instead of this variation of the restaurant script, the data might have called forth the "fast food restaurant" script or the "cafeteria" script. The more concrete the script, the more predictable it is and the fewer the possible values for a variable. For example, in the McDonald's script the food variable could not be filled with much other than hamburgers.

Schank and Abelson's (1977) definition of a script includes the idea that it is a structured whole made up of interconnected slots (what is in one slot affects what can be in another), describing highly stylized or stereotypical everyday situations. Strong scripts specify the components and the sequence in which they occur, whereas weak scripts specify the component parts only.

Nelson (1981) suggests that the basic concrete nature of scripts makes them appropriate for describing children's representations of knowledge. She uses the term general event representation (GER) to refer to scripts applied to social contexts. Research by Nelson and her colleagues supports the notion that children's knowledge is schematically organized and that children construct scripts or GERs out of their repeated experiences with ordinary events. Nelson and associates (Nelson, 1981; Nelson & Gruendel 1980; 1981), have interviewed children about common events, asking them to describe

what happens in situations such as eating dinner at home, going to a restaurant, going grocery shopping, and so forth. They conclude that even at very young ages children's knowledge about these events is temporally organized, consistent over time, and socially accurate. Importantly, GERs are abstractions or generalizations from experienced reality, containing possible entries rather than specific values, in contrast to memory of a specific episode. When a child has established a GER for a situation, it provides an interpretive context for the persons, actions, objects, and relations to be found in that situation. Nelson believes that the difference between most situations in which children perform well in contrast to those in which they do poorly is that between those for which children have established a relevant GER or script and those for which they have not.

Young children understand the events they take part in within organized structures (e.g., "breakfast", "bedtime") that include appropriate actions (e.g., "eating", "hearing a story") and appropriate objects that are associated with these actions (e.g., "plates", "books"). The objects that have a shared function, that occur in the same position in a given script, are said to fill the slots that go with a particular action. Thus one can eat cereal or eggs for breakfast--these items are substitutable. Slot fillers are hypothesized as the basis of the child's first category structures (Nelson, 1986) and taxonomic categories emerge and develop out of this schematically organized knowledge base (Lucariello & Nelson, 1985). Mandler (1983), on the other hand, suggests that the

beginnings of taxonomic categorization are derived from the early repetitive episodes that also form the basis of scripts.

In a recent experiment, Lucariello and Nelson (1985) demonstrated that slot-filler categories provide a better match to the child's memory structure than do traditional taxonomic categories. They compared the memory performance of three- and four-year-old children presented with nine-word recall lists of either slot-filler categories (lunch foods, zoo animals, clothes you put on in the morning) or taxonomic categories (food, animals, clothes). Recall was significantly greater for children exposed to slot-filler lists, and although category cueing did not facilitate recall in either condition, script cueing (e.g., "tell me which things you could eat for lunch") increased the recall of children exposed to the slot-filler lists. Lucariello and Nelson suggest that these findings indicate that the scripts (e.g., eating lunch) provided the basis for the organization of the items on presentation and therefore the script cue was effective in increasing recall.

Schema, Scripts and Memory. Schema theories attempt to describe how knowledge is organized and how schemata affect comprehension of everyday situations and of reading material. Of special interest here is the role of schemata in remembering. The relationship between the availability of a schema and recall has been frequently demonstrated in reading comprehension with older children. Anderson and Pearson (1984) review the literature demonstrating that when a schema can be invoked (that is, when elements of a passage can be

meaningfully connected and linked) comprehension and consequently memory is greatly enhanced. They review some well known experiments (e.g., Bransford & Johnson, 1972) which demonstrate the effect on memory of giving titles to passages to be read. The title allows the reader to invoke a schema and vague, inexplicit terms can then be matched with appropriate slots in the schema. Text that was ambiguous becomes meaningful and thus better remembered.

For Rumelhart (1980), schemata are the "guiding forces behind remembering" (p. 49). Schemata influence memory in two ways. Initial interpretations of events are formed on the basis of schemata and thus they determine the form of memorial fragments. Additionally, schemata are used to reinterpret the stored data in order to reconstruct the original interpretation. What we remember is assumed by schema theorists to be our initial interpretations of the event, rather than the event itself. Rumelhart cites evidence for this, such as Bartlett's, (1932) findings on story recall, in which he found that people remember the gist of stories rather than specific details. Other evidence in Rumelhart comes from a series of studies by Bransford and colleagues (e.g., Bransford, Barclay & Franks, 1972) in which it was demonstrated that people cannot recognize which of two sentences has been previously presented to them when the meaning of both is the same, whereas similar sentences can be readily differentially recognized when the mere change of a preposition alters the meaning of the sentence. These findings suggest that people remember their interpretation of the sentence or event, rather than the exact event itself. Thus, they falsely

recognize a sentence which has the same meaning as the one they actually saw. On the other hand, they correctly discriminate between sentences in which, for example, the only change is the substitution of the word it for her, when such as change alters the meaning of the sentence. A series of studies by Paris and his associates (Paris, 1975; Paris & Mahoney, 1974; Paris & Lindauer, 1976) report similar findings with young children. They, too, falsely recognize sentences that are consistent with those actually presented.

Rumelhart also suggests that schemata are used to reinterpret stored information with the result that the longer the time between the initial presentation and recall, the more the person relies on his own schema in recalling an event. The more atypical the event was, the more room then there is for distortion. So the process of remembering is largely a process of selecting and verifying a schema or set of schemata that fits the stored data--our memorial fragments. Rumelhart makes the important point that this is not a passive process but rather a highly active one. We do not randomly search among our memories, whenever the issue of remembering is presented. Rather, we actively search, using schemata that guide our information seeking process. Rumelhart acknowledges that little work has been done in trying to understand the memory search process when recalling events after long delays.

Finally, Mandler (1979, 1983) also emphasizes the role of schemata in recall, especially with young children. Based on her own work as well as that of others (e.g., Nelson 1977, 1978; Schank & Abelson, 1977) she concludes that the earliest knowledge acquired by

the infant likely arises from daily, repetitive episodes during which infants learn to organize their world spatially, leading to perceptual categorization, and, temporally, leading to categories of events. The representation of these commonly experienced events appear to be script-like. Schematic organization provides a set of expectations that bring order and predictability to the young child's world. Just as importantly, schematic structures are activated when the child is remembering. Mandler suggests that young children can remember well if material is not arbitrary but can be fit into a familiar schema. "The schema is automatically activated at the time of comprehension and will be available at the time of retrieval" (p. 288).

Major Questions and Hypotheses

The major questions examined in this study were:

1. What types of behaviors characterize the preschooler's response to the need to remember? Can these behaviors be viewed as deliberate or strategic attempts to remember?

Following the differentiation procedure outlined by Wellman (1977) and applied in the Baker-Ward et al. (1984) study, children were instructed either to remember or to play with a set of small objects. Differences in behaviors between the two groups should be attributable to differences in the goals established (i.e., to remember or to play) and should provide further support for the tentative notion that young children do

make deliberate attempts to remember, not only on the typically studied search tasks, but on a free recall task.

2. Are the "mnemonic strategies" of the preschooler effective? That is, are the behaviors the young child engages in in response to the need to remember, related to recall? This was not the case for the four-and five-year olds in the Baker-Ward et al. (1984) study.

It is hypothesized that the failure to find a link between behavior and recall in the Baker-Ward et al. (1984) study was due to a lack of inherent item organization. Items were unrelated and were not capable of being organized in a manner compatible with the knowledge structures of the young child. To test the notion that this is an important element in recall effectiveness, children were exposed either to a set of items that were thematically tied and could evoke a familiar script (things you take on a beach picnic) or not related in an overall thematic way.

3. Do children who are given the goal of remembering recall more items than children who are asked to play with the items?

There is some evidence that making the goal explicit facilitates recall (Weissberg & Paris, 1986).

4. Do children who are presented with items that are organized in a way thought to be compatible with the knowledge structures of the young child (thematic slot-filler categories) remember more than children whose items are organized into more traditional taxonomic categories?

The research by Nelson and her colleagues suggests that this should be the case.

5. Do children who are instructed to remember the thematically organized set of items, recall more than the children who are: a) instructed to play with this same set of items, b) instructed to remember the set of items that are not thematically organized, c) instructed to play with the set of non-thematic items?

The major hypothesis of the study is that children in the Remember/Thematic (Beach) condition will recall a greater number of items than children in each of the other groups, since this condition invokes the need to remember for items organized in a manner consistent with the knowledge structures of the young child. The hypothesis is based on the premise that the explicit recall instruction will elicit "strategic" behavior and that recall is enhanced when the organization of the to-be-remembered material matches the knowledge organization of the rememberer, thus facilitating effective strategy use.

6. What are the longer term implications of the experimental conditions? Are there differential patterns of remembering over time as a function of the goal of the task (remember versus play) and item organization (thematic versus non-thematic)?

CHAPTER II

METHOD

Subjects

There were 43 part-Hawaiian subjects, including 39 children from the two preschool classes at the urban Kamehameha Schools campus site and four additional children from a rural Kamehameha preschool. One child from the initial sample of 40 refused to complete the immediate recall phase of the study and so was dropped. In order to replace this child and slightly increase the sample size, four children from the rural site where some of the pilot testing had been conducted were added to the sample. These children were among the few in the class who had not participated in any pilot testing.

Children attending the urban preschools were randomly selected from among all applicants living within a two mile radius of the school, with the restriction that 75 per cent of the families had to be on some form of public assistance. Additionally, there was an attempt to equalize the numbers of boys and girls in each class. Children at the rural site live in the geographic area designated by the Department of Education (DOE) for the public school in which the joint DOE-Kamehameha preschool class was conducted. Within each sex, children in the class were randomly selected from among all applicants.

The children ranged in age from three years-ten months to four years-ten months, with a mean age of four years-four months. There were a total of 25 boys and 18 girls in the sample.

Design

The overall design of the study was a repeated measures analysis of variance with two between-subject factors (Goal and Item Organization) and one within-subject variable (Immediate and Delayed Recall). An equal number of subjects from each class at the on-campus site were assigned to the four experimental conditions with the 21 boys and 18 girls from these classes evenly distributed across the conditions. Within each on-site class subjects were grouped by birth date into quartiles, with equal numbers from each quartile assigned to each experimental condition with some minor variations. The four children from the rural site were all boys and were randomly assigned to the four experimental conditions. Two boys from the urban preschools were not available for delayed recall. Table 1 diagrams the study.

Stimuli and Task

The items for the Beach and Non-Beach conditions were 12 miniature, colorful, attractive toy objects. The beach items were initially generated by interviewing 14 preschoolers about the kinds of things they take on beach picnics. There was considerable diversity in the types of responses obtained. An initial set of items was generated, including some frequently mentioned by children

Table 1

Experimental Design

Goal	Item Organization	Recall Period: Immediate (n)	Recall Period: Delayed (n)
Remember	Thematic Slot-filler (BEACH)	11	10
	Nonthematic Categories (NON-BEACH)	11	11
Play	Thematic Slot-filler (BEACH)	11	11
	Nonthematic Categories (NON-BEACH)	10	9

and some rarely or never mentioned. Following pilot work, a final set of thematically related beach items which could be grouped into slot-filler categories was selected. The slot-filler categories were: toys you play with at the beach, things you wear or put on at the beach, foods and food equipment you would use at the beach. The comparable non-beach, more traditional categories were: toys, clothing, and food or food related items. Items assumed to be familiar to preschoolers and fitting the non-beach categories were selected. Overall, a total of 16 children were pilot tested to finalize the number of items and to ensure that children were familiar with items from both sets, even if they did not necessarily have conventional labels for them. One pilot subject, for example, described swim fins as "bathing suit for your feet." Pilot testing also helped establish the optimum exposure time and final instructions.

The task was to remember the array of 12 small objects by asking for them at a pretend "store." Children were exposed either to the set of items you would take on a beach picnic or to the equally familiar but non-thematically connected group of items. The items were put in front of the child in a blocked presentation with the four items from each category laid out in a row. The specific toy items for the beach set were: dump truck, sailboat, ball, bucket; swimsuit, swim fins, sunglasses, towel; barbecue, soda, potato chips, and hamburger. The comparable non-beach items were: airplane, lego blocks, teddy bear, whistle; purse, pants, shoes, dress; refrigerator, eggs, pie, and milk.

Procedure

Exposure Period

The children were tested in a small room near the preschool classes which had been set up for the experiment with a pretend "store front" in one corner and a table for presentation of the items in the diagonally opposite corner. All sessions were videotaped with a Sony TCM-5000 EV or a JCV GSX-700 video camera which was connected to a Sony SLO-325 video cassette recorder. A clip-on microphone, which was either attached to the child's clothing or placed next to the child, was also connected to the cassette recorder. The instructions were given by the author and a second experimenter served as the "storekeeper" and elicited the recalled items from the children. Both experimenters had become familiar with the children by volunteering in the classrooms for several weeks prior to the start of the study.

As the children entered the experimental room they were given a general introduction to the task. In the Remember conditions they were told that they would be going on a shopping trip to a pretend store. The "store front" was a painted wooden structure with a shelf on which a toy cash register was placed. There were no other store accessories evident and no items on display. The "storekeeper" was seated behind the structure and greeted the children as they entered the room. The children were also shown a toy shopping cart which they were to use to get the things from the store. Children in the Remember Beach condition were additionally told that they would be

getting things needed for a beach picnic. The following instructions were given to children in the Remember conditions with the exception that no reference to the nature of the items was provided to the Non-Beach sample. Instructions were repeated as necessary when the child appeared too uncomfortable or too distracted to have understood them.

1) "I am going to show you some things we need for a beach picnic. You need to remember them so you can get them at the pretend store and bring them back to me. I am going to cover them up when you go to the store so you need to remember them."

2) "Do you know what remember means? Let's see if you know what remember means." The experimenter then showed the child a cup and a sink which the child was asked to label. After the child did so, the two items were covered and the child was asked to remember them. This training trial, which was easy for the children, was an attempt to ensure that they understood the meaning of the word remember in the context of the task.

3) The experimenter then revealed the array of items which had been covered by a box and the children were asked to label each object. Labels were provided if the child did not have a name for the item but all functional or unique labels that identified the object were accepted.

4) Following the labelling procedure the child was told, "Do anything you can to help you remember the things we need for our beach picnic. You won't be able to see, so you have to remember. You'll go to the store and bring the things back to me. I'll be busy for a few minutes, so you go ahead and try to remember the things we need for our beach picnic."

5) The child was then given two minutes with the objects. The intent was to remind the child of the need to remember midway during this period, however, the number of reminders varied as a function of the child's behavior. Instructions were repeated immediately if the child did not appear to understand the task demands. For example, a few children attempted to go to the store right away. Data on examiner comments during the exposure period are provided in the Results section.

6) At the end of the two-minute exposure period the "storekeeper" informed the child that the store was open and the child was sent there with the shopping cart to get the items.

The general introduction for children in the Play conditions as they entered the experimental room consisted of telling them that the examiner had some things to show them that they could play with. The children in the Play Beach condition additionally were told that the items were all things you could take on a beach picnic. The following instructions were then given with the exception, as in the Remember Non-Beach condition, that no reference was made to the nature of the items for the Play Non-Beach sample:

1) "I have some things to show you that you can play with. They are all things you can take on a beach picnic. You can play with them any way you like. I want to see if children like these things." The latter comment was an attempt to provide a purpose for the play, somewhat analogous to the need to remember the items in order to get them from the store.

2) As in the Remember conditions the items that had been covered by a box were revealed and the child was asked to label each one.

3) Following the labelling procedure the children were told to, "Play with the beach things any way you like. I want to see if children like them. I'll be busy for a couple of minutes so you play with them any way you like."

4) As in the Remember conditions, the children were exposed to the items for two minutes. At the end of this time the notion of the pretend store was directly invoked for the first time. The storekeeper indicated that the store was open and the children were presented with the shopping cart and told to go to the pretend store to get the things they had been playing with.

Immediate Recall

The child was welcomed to the store and asked to tell the storekeeper all the things the child remembered or had played with. The storekeeper used a variety of probes or prompts, praise and encouragement in an attempt to elicit the child's recall. A completedescription of the storekeeper's comments are provided in the Results section. When the child could not recall any more items the storekeeper placed the remembered and non-remembered items in two separate bags behind the counter out of view of the child. The two bags were then put into a brown paper shopping bag and handed to the child to be placed in the shopping cart and brought back to the experimenter. The experimenter praised the child for being a good shopper, took out the items the child had recalled one at a time and labelled each one saying, for example, "Oh, you remembered the ball." The non-recalled items were labelled with comments such as, "And you got a dress." Immediately after all the items had been presented, the child put them back into one bag and chose a sticker to place next to her/his name on a classroom chart that had been prepared for that purpose.

An attempt was made to get the children to verbalize how they remembered the items at the store, by probing with questions such as, "How did you know what to ask Auntie Michelle for?", "How did you remember all those things?", "You couldn't see, how did you know what to ask for?" Many children simply did not respond to these questions, others tended to say the equivalent of, "I just saw."

Delayed Recall

Delayed recall took place approximately one week after initial recall. For the four rural and two urban subjects there was a six-day interval. Twenty-nine of the urban children were re-tested after seven days, but due to holidays or absences, the delay period for five children was extended to eight days, and for two children, to nine days. Two children, who were absent for longer periods of time, were not included in the delay testing.

For delayed recall the children returned to the same setting and went directly to the "store" where they were instructed to tell the storekeeper all the things they remembered or had played with last time. Children who had seen the beach items were reminded that they had seen things you could take on a beach picnic. The procedure for delayed recall was the same as for immediate recall with the exception that when children brought items back from the store they were encouraged to play with them if they wished. At the end of the delay session the child placed another sticker next to her/his name.

Behavioral Coding Schemes

Child Exposure Codes

The child's behavior during the exposure period was coded according to the system developed for this study and described in detail in APPENDIX A. Five pilot tapes were transcribed by the author and based on these data a preliminary set of behavioral categories were established. The pilot tapes were subsequently coded by a second person who was unfamiliar with the purpose of the study.

After consultation and further practice coding, a final coding scheme was established. The two digit coding system captures the primary approach to the task at a given time (State) and the nature of any accompanying talk (Verbalization). The State codes consist of Play, Link, Contact, Visual Examination, Pause, and Off-Task, and are similar to the behavioral categories described in Baker-Ward et al. (1984). The Pause category is broad and consists of on-task behaviors not included in any other category. An attempt was made to code separately facial expression which seemed to reflect thoughtfulness or contemplation from those that seemed to indicate such things as a need for task clarification, reassurance, or approval from the experimenter, but these attempts were unreliable. The Verbalization codes specify various types of child comments and/or naming of items, and are coded along with the appropriate State. Complete definitions of the codes with examples are provided in APPENDIX A.

For the State codes the duration of the behavior rather than frequency was the primary data since this seemed to be a better index of the style of the child's approach to the task and to patterns of responses. A child had to be engaged in one of the specified States for a minimum of three seconds in order for that behavior to be coded. Shorter durations included too many brief glances or momentary diversions and longer durations missed too much behavior. Since verbalizations in general, and naming in particular, can be very brief, these were coded whenever they occurred and did not have to meet the three-second State criterion.

The behavioral data were entered directly from the videotapes onto an IBM-PC using the 8410 Behavioral Coding System developed by PLK Instruments for the Frank Porter Graham Child Development Center in Chapel Hill, North Carolina (Pollock, 1985). The system allows the IBM PC to function as an event recorder. A two-minute "timebase" was laid on the audio channel of the video cassette recorder. Subsequently, when the behavioral codes were entered as the video tape was played, the time of occurrence for each behavior was automatically recorded. Data were then processed with a series of software programs (Crocker, unpublished manuscript) which provided information on the duration and frequency of all codes. These data were then subjected to various analyses described in the Results section.

Adult Exposure Codes

The system for coding the adult's behavior during the two-minute exposure period is described in detail in APPENDIX B. The same tapes used to develop the categories for the child exposure codes were used to establish the adult codes and the same person coded the child and then the adult behaviors. The adult codes also have two components. The State codes reflect the experimenter's attempts to evoke the need to remember or play, to make the task purposeful or functional, to encourage the child's involvement in the task, and to avoid the child's attempts to engage the adult. The accompanying codes capture any references to Remember, Play, or Beach. As with the child data, the codes were entered directly from the video tapes onto the IBM-PC. The coding of the adult was much simpler than

coding the child since typically adult behavior was either minimal or absent and interest was primarily in the frequency of the codes rather than their duration.

CHAPTER III

RESULTS

The major results of this study as well as findings on some secondary issues are reported in this chapter. One purpose of the study was to assess the impact of an explicit goal to remember on the recall performance of preschoolers. A second factor investigated was the effect on memory when the material to be remembered is organized thematically, in a manner consistent with the hypothesized scripted knowledge structures of young children. It was expected that the need to remember and the thematic organization would independently enhance recall performance, but that the combination of these factors would produce the highest levels of recall. These variables were explored with respect to both immediate and delayed recall. Another focus of this study was to evaluate whether children could demonstrate deliberate and "strategic" behaviors in response to the need to remember on a verbal recall task. Following Wellman's differentiation model (1977) it was assumed that behavioral differences between children instructed to remember the objects presented rather than to play with them, would provide some evidence of early "strategic" behavior. Of additional interest was the question of whether their behaviors would be linked to recall scores. The effectiveness of a behavior tends to provide further support for the notion that it was employed deliberately and represents at least the semblance of a mnemonic strategy.

The first section of the Results presents data on recall scores as a function of (1) the Goal of the task (Remember versus Play), (2) the Organization of the items (Beach Theme versus Non-Beach theme), and the interaction of these variables. Subsequent sections cover (3) the behaviors of children during the exposure period and (4) the relationship between these behaviors and recall scores. Data on the experimenter's behavior during all phases of the study are also included. Additionally, information on the children's recall organization and item labels are presented.

Variables Affecting Recall Scores

Goal (Remember vs. Play)

The recall scores were analyzed by a repeated measures analysis of variance as described in the SPSSX Advanced Statistics Guide (Norusis, 1985) with two between group factors, Goal (Remember and Play), and Item Organization or Theme (Beach and Non-Beach), and one within subject factor, Recall Trial (Immediate and Delayed). The means and standard deviations of the immediate and delayed recall scores for each experimental condition are presented in Table 2. Collapsing across Theme and Recall Trial, it is evident that overall there was greater recall in the Remember condition ($M = 5.9$) than in the Play condition ($M = 4.8$). This was true for both immediate and delayed recall. The results of the analysis of variance provided in Table 3 indicate that the main effect of Goal approaches significance ($p < .086$). There is no interaction of Goal by Recall Trial since

Table 2

Means and Standard Deviations
for Immediate and Delayed Recall Scores

		Recall Period			
		Immediate		Delayed	
Condition	n	M	SD	M	SD
Remember					
Beach	10	6.4	2.5	6.2	2.1
Non-beach	11	5.9	1.2	5.1	1.2
Play					
Beach	11	4.8	2.0	4.9	2.3
Non-beach	9	5.4	3.0	4.0	2.0

Table 3

Repeated Measures Analysis of Variance

Source of Variation	ss	df	ms	F	p
BETWEEN-SUBJECTS EFFECTS					
Within Cells	297.40	37	8.04		
Constant	2327.92	1	2327.92	289.62	.000
Goal	24.95	1	24.95	3.10	.086
Theme	4.51	1	4.51	.56	.459
Goal x Theme	2.21	1	2.21	.27	.603
WITHIN-SUBJECT EFFECTS					
Within Cells	35.18	37	.95		
Recall Trial	7.16	1	7.16	7.53	.009
Goal x Recall Trial	.14	1	.14	.15	.700
Theme x Recall Trial	5.90	1	5.90	6.21	.017
Goal x Theme x Recall Trial	1.07	1	1.07	1.13	.296

there was a consistent drop in scores from immediate to delayed recall for children in both the Remember and Play groups. Although results for the Goal variable were in the expected direction, they were only marginally significant. The relatively small number of subjects and the large variances undoubtedly reduced the Goal effect.

Theme (Beach vs. Non-Beach)

Collapsing across Goal and Recall Trial, it can be seen that while there was a tendency for children in the Beach condition to recall more items (M = 5.6) than those in the Non-Beach condition (M = 5.1), the main effect of Theme was clearly not statistically significant. Interestingly, organization of the items did make a difference on delayed recall. Inspection of Figure 1 clearly shows that there was no difference between the recall of beach or non-beach items immediately, but that in the delay session more items were recalled by children in the Beach condition than by children in the Non-Beach condition. From the ANOVA reported in Table 3 it indeed can be seen that there was a significant Theme by Recall Trial interaction ($p < .017$). The effects of the one-week delay period were different for the Beach and Non-Beach conditions. Figure 2 presents another way of looking at these data. Individual immediate and delayed recall scores are plotted. Children in the Beach condition tended to maintain or increase their recall scores from immediate to delayed recall. Specifically, 14 of the 21 children in the Beach condition remembered as many or more items at the delay trial as they

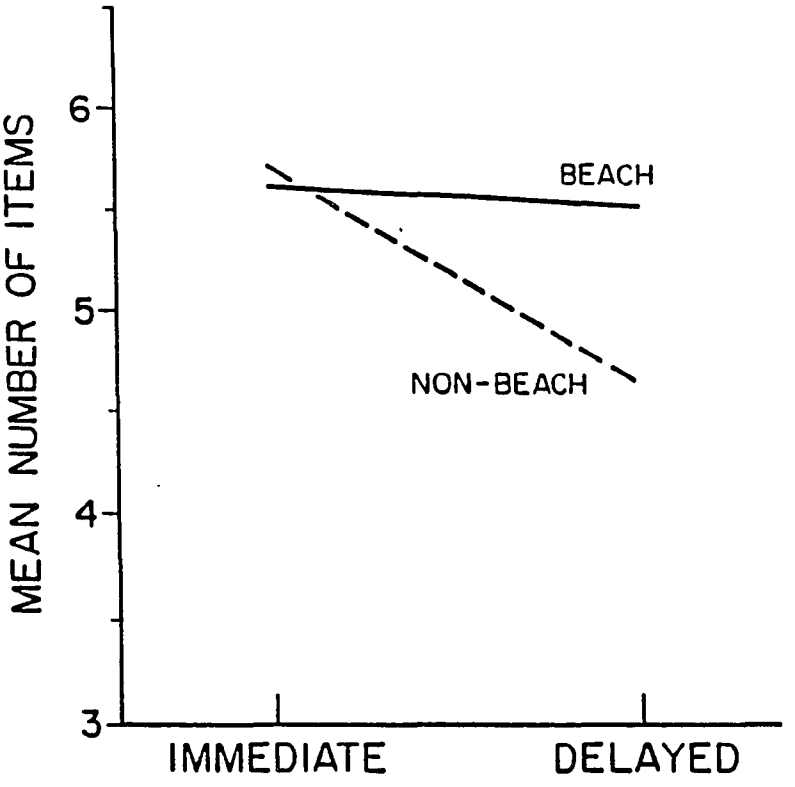

Figure 1. Mean number of items recalled during immediate and delayed tests as a function of item organization for remember and play groups combined.

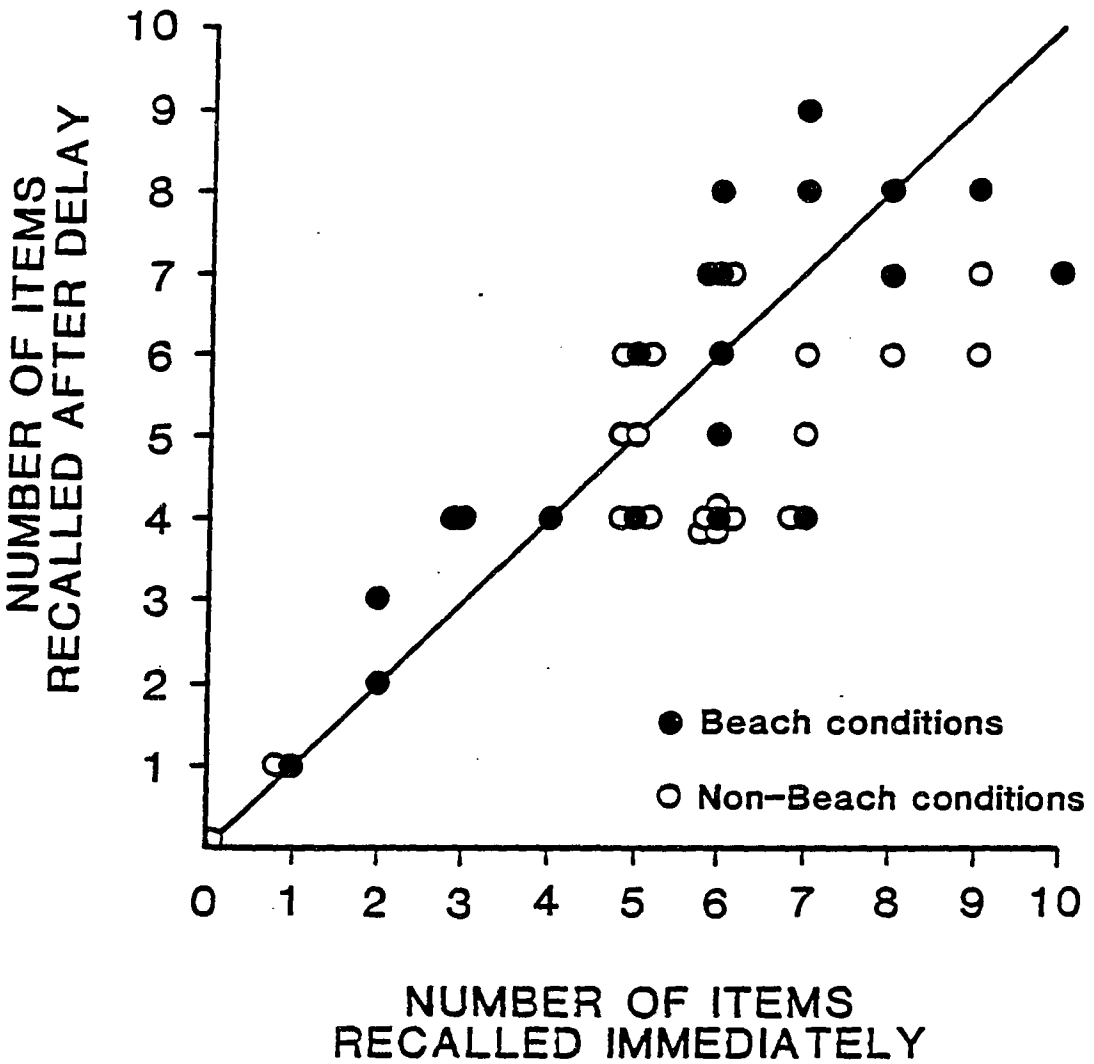

Figure 2. Scatter plot of immediate by delayed recall scores for beach versus non-beach conditions.

had immediately, whereas only seven of the Non-Beach group did so. This difference was statistically significant [X (1) = 4.17, $p < .05$].

Goal and Theme

Figure 3 graphically presents recall scores of the individual experimental groups averaged over immediate and delayed recall. Children in the Remember Beach group earned the highest recall scores (M = 6.3) and those in the Play Non-Beach remembered the fewest items (M = 4.7) There was not a significant Goal by Theme interaction, but since it had been hypothesized that children in the Remember Beach condition would recall more than children in any other condition, planned comparisons between the Remember Beach and all other groups were carried out. Using a directional test, comparisons with the Play Beach, $t(19) = 1.55$, $p < .068$, and the Play Non-Beach groups, $t(17) = 1.44$, $p < .084$) were marginally significant. The comparison with the Remember Non-Beach group was not significant. Figure 4 presents these same data separately for immediate and delayed recall. It can be seen that the pattern of results for immediate recall were not completely as expected. Although the Remember Beach children scored higher than the Remember Non-Beach, the pattern was reversed within the Play condition, with the Non-beach group recalling more items than the Beach. On delayed recall, the pattern of results was in the expected direction. The highest recall scores were earned by children exposed to both the remember instructions and the thematic set of items (Remember Beach), intermediate scores were

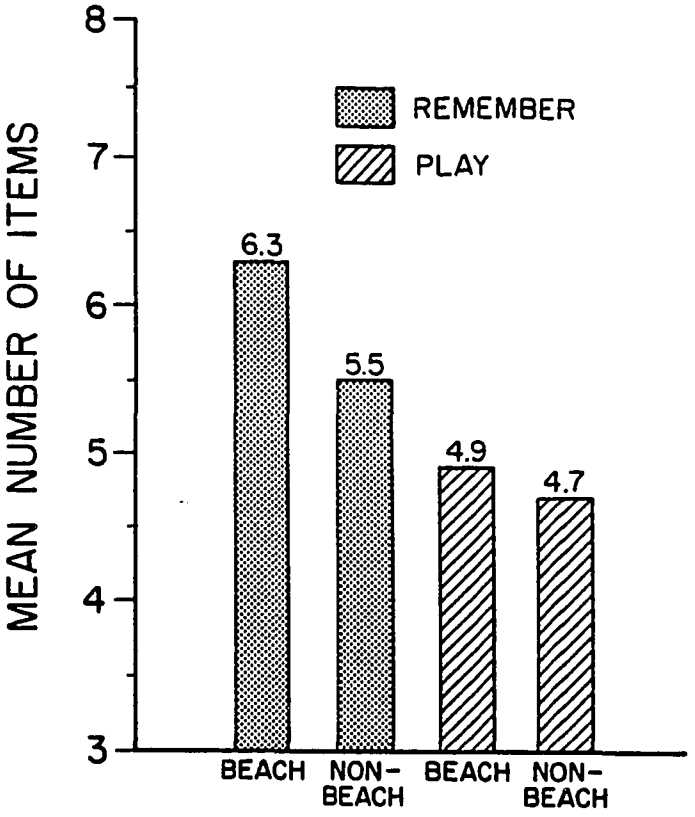

Figure 3. Mean number of items recalled as a function of goal (remember vs. play) and theme (beach vs. non-beach). Data are for both recall trials combined.

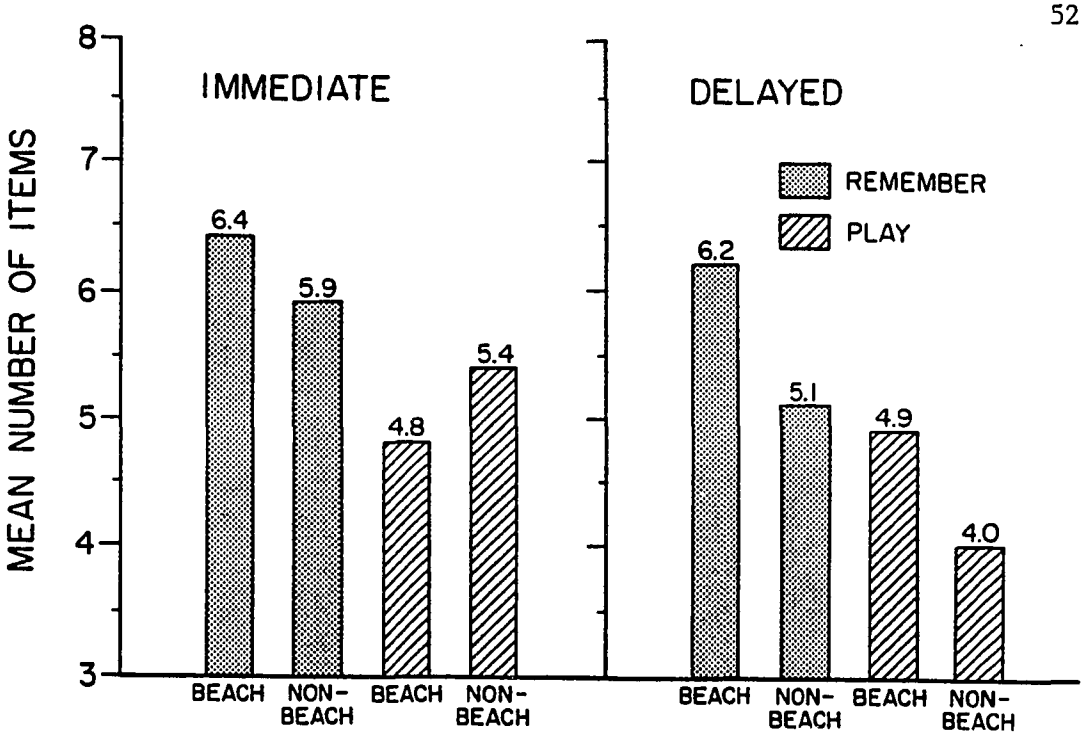

Figure 4. Mean number of items recalled as a function of goal and theme. Data are shown separately for immediate and delayed recall.

achieved by children experiencing either one of those variables (Remember Non-Beach and Play Beach), and children told to play with the non-thematic set (Play Non-Beach) had the lowest delayed recall scores.

Finally it should be noted that the triple interaction of Goal by Theme by Recall Trial was not significant but that the overall drop in scores from immediate to delayed recall was significant ($p < .009$).

Summary of Effects of Goal and Theme

Although only marginally significant, there was an overall tendency for children instructed to remember to earn higher recall scores than those directed to play. This finding was consistent for both immediate and delayed recall. In contrast, the importance of item organization was reflected in a significant Theme by Trial interaction. Children in the Beach conditions maintained their level of recall between immediate ($M = 5.6$) and delayed recall ($M = 5.5$), while children in the Non-Beach conditions showed a clear drop in performance between immediate ($M = 5.7$) and delayed recall trials ($M = 4.6$). Children in the Remember Beach group recalled the most items, but comparisons with the other conditions indicate only marginally significant differences with the two Play groups, and a nonsignificant difference with the Remember Non-Beach group. When immediate and delayed recall scores are looked at separately, the expected pattern of results for each of the four experimental groups is evident in delayed recall scores. Finally, across conditions

there was a significant drop in recall following the one-week delay interval.

Effect of Remember and Play Instructions on Behavior

Children's Exposure Period Behaviors

The system developed for characterizing the children's behaviors during the two-minute exposure period was described in both the Method section and in APPENDIX A.

Reliability of child exposure codes was determined both for time of entry of each code onto the computer (when a behavioral state was judged to begin) and for agreement on the nature of the code. Times were considered comparable if the difference between the two coders was no more than one second and time reliability consisted of the number of times meeting that criterion over the total number of times recorded. Behavioral code reliability was established by dividing the number of agreements over the total number of codes recorded. Final training reliability between two coders based on tapes of three pilot children was .82 for time of entry and .85 for behavior codes. The coding of the actual data was completed by the one coder who was unaware of the purpose of the study. Reliability of these data, based on seven children randomly chosen from the Remember and Play groups, was .92 for time and .95 for behavior.

The first question of interest with respect to the exposure period was whether children behaved differently when told to remember a set of items in contrast to being told to play with the items.

Figure 5 compares the behaviors of the Remember and Play groups. Each circle depicts the 120-second exposure period divided into segments representing the average number of seconds the children in the Remember and Play conditions, respectively, spent engaged in each of the coded State behaviors (with Play and Link combined) when they were not verbalizing. The Verbal category represents all verbal behaviors, naming and/or commenting, occurring during any State. Since the categories are mutually exclusive, the totals for all behaviors combined add up to 120 seconds.

Figure 5 makes it immediately apparent that there were very large differences in behaviors as a function of the goal of the task. Most dramatically, the two groups varied greatly in the amount of physical contact with the items. Children in the Play conditions spent an average of 97.7 seconds in direct physical contact with objects (69.7 sec. in Play and 28.0 in Contact) whereas the comparable figures for the Remember conditions are 4.5 sec. in Play and 2.2 sec. in Contact. The children in the Remember conditions spent most of their time in the behavioral states of Pause (51.4 sec.), Visual Examination (25.7 sec.) or Off-Task (19.3 sec.). Play children, on the other hand, spent only an average of 11.2 sec and 5.0 sec. in the Pause and Visually Examine states, respectively, and were virtually never Off-Task (.3 sec.). In general, there was not much verbal behavior, but children in the Remember conditions spent an average of 15.1 seconds verbalizing in contrast to an average of 5.2 sec. for children in the Play conditions.

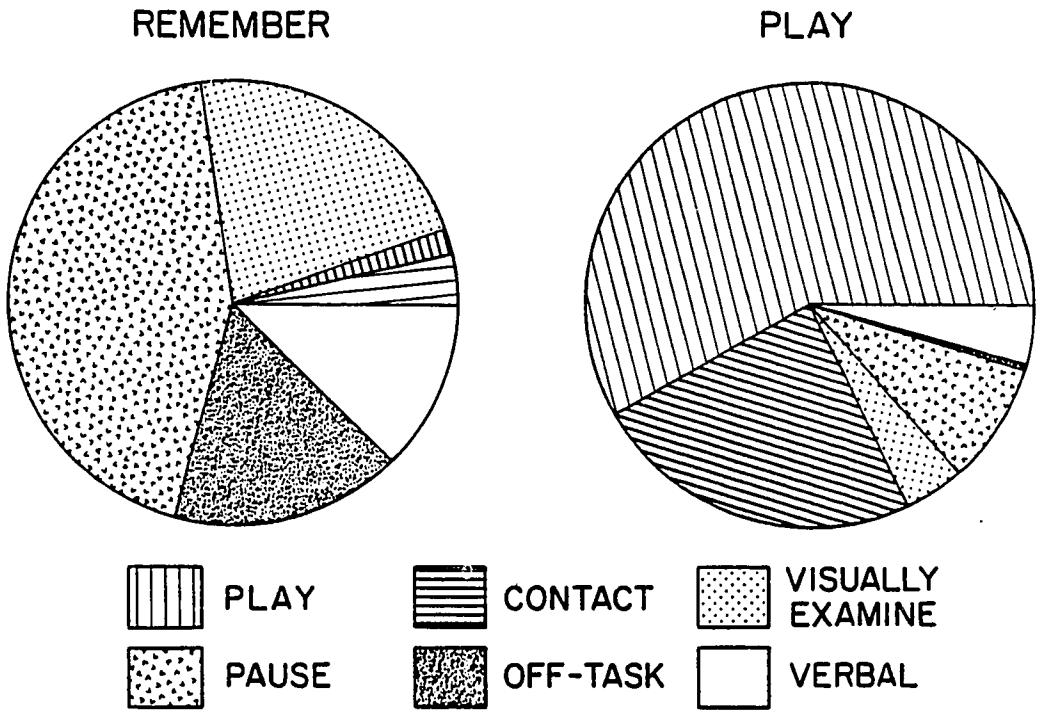

Figure 5. Mean duration spent in each of the indicated behaviors during the two-minute exposure period by the remember and play groups.

The differences between the Play and Remember groups for each of six State variables and for Verbal behavior were calculated with t-tests. However, due to the large number of comparisons, the modified Bonferroni Test recommended by Keppel (1982) for establishing a familywise error rate rather than a pairwise error rate was applied. With two groups and seven comparisons (Play was separated into Play with individual objects and Linking items together) and using the standard significance level of .05, the significance level for evaluating each comparison becomes .05 divided by 7, or .007. It should also be noted that these comparisons are not completely orthogonal in the sense that spending considerable time engaged in one behavior precludes the opportunity to engage in other behaviors. The differences between the Play and Remember groups on the duration of Play, Contact, and Pause with t values of 7.80, 5.59, and 4.57, respectively, with df = 40, were significant at $p < .001$. The values for duration of Link were $t = 3.43$, $p < .003$, and for Visual Examination, $t = 2.94$, $p < .007$. Differences in Verbal and Off-Task behaviors were not significant.

Another way of looking at differences between the Remember and Play groups is to consider the number of children in each group who engaged in a particular type of behavior at least once. Figure 6 provides these data for nonverbal behavior (State codes) and Figure 7 provides the same information for verbal behavior broken down into the various verbalization categories. The frequency data were subjected to chi square analyses, but since many of the expected frequencies were under 10 and thus the chi square is likely to be an

overestimate, Yates' correction for continuity was applied (Downie & Heath, 1965). Where the overall frequencies were very small (Off-Task and Comments), the data were not analyzed statistically.

Not only did the Play children on the average spend a great deal of time playing, but virtually all of them played (20 out of 21 children) in contrast to only three of the Remember children. Additionally, 12 of the Play children linked items together in their play and 18 of them Contacted the items whereas only one child in the Remember condition Linked items and only six Contacted them. With chi square values of 24.6, 11.14, and 11.76, for Play, Link, and Contact, respectively, all differences are significant ($p < .001$). Differences for the Pause variable were also significant [X^2 (1) = 6.64, $p < .01$)], but differences for Visual Examination were not significant. Apparently, many of the Play children engaged in Visual Examination but for brief periods of time in comparison with the Remember children.

Figure 7 separates the Verbal category into naming and commenting and differentiates naming alone from naming embedded in a comment, and comments directly tied to play from the more general comments. The most important finding here is that ten of the children in the Remember conditions named an item at least once during the two-minute exposure period in contrast to only three children in the Play conditions. This difference was significant [X^2 (1) = 4.01, $p < .05$).

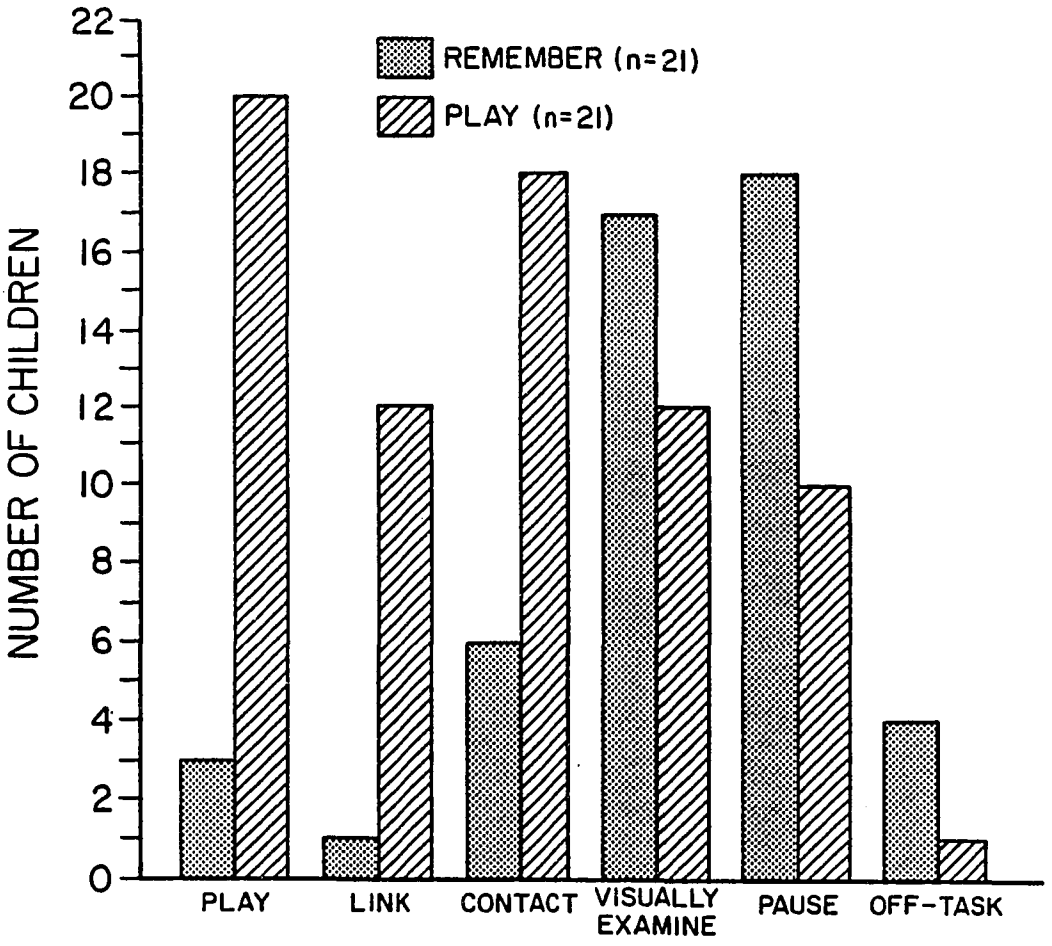

Figure 6. Number of children in remember and play groups displaying indicated types of nonverbal behavior during the exposure period.

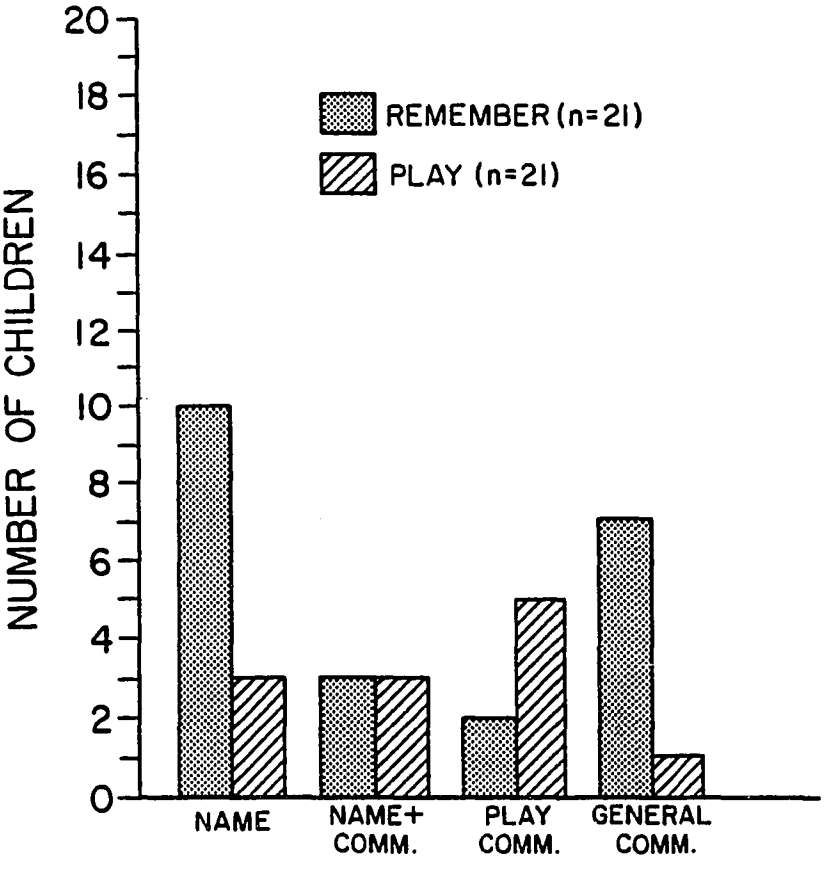

Figure 7. Number of children in remember and play groups displaying indicated types of verbal behavior during the exposure period.

Summary of Children's Exposure Period Behaviors

The findings from both the amount of time spent in the various coded activities and the number of children engaged in these activities clearly demonstrates marked differences in behaviors as a function of the goal of the task. The pattern for half the Remember children was to name items, and for the group in general to spend some time looking at the items, and a great deal of time in the Pause State. Children in the Remember condition rarely physically contacted the items. The Play children, on the other hand, generally heeded the instruction to play. They spent their time manipulating the objects either by using the properties of the objects or simply touching them.

Adult Exposure Period Behaviors

The system devised for coding the adult's behavior during the two-minute exposure period was described in the Method section and in APPENDIX B. The frequency and duration of different types of adult behaviors during the two-minute period were coded, but for data analysis the duration data were collapsed to generate a total duration of adult talk variable. The mean number of seconds of adult talk to children in the Remember conditions was 8.5 seconds; the comparable figure for the Play conditions was 2.7 seconds. This difference in duration of adult talk was signficant [$t(40)$, $p < .005$]. Table 4 presents the number of children in each of the four experimental conditions to whom the adult spoke in the various ways coded. An examination of this table reveals that the variability in

Table 4

Number of Children Receiving Different Types of Adult Comments During Exposure Period

Condition	n	Avoid Engage.	Encourage	Focus on Remember or Play	Focus on Remember/ Beach	Focus on Remember Functional
Remember	21	7	8	14	4	8
Beach	10	3	5	6	4	2
Non-Beach	11	4	3	8	-	6
Play	21	6	4	7	-	-
Beach	11	2	2	3	-	-
Non-Beach	10	4	2	4	-	-

total amount of adult talk directed to the two groups was due to differences in the number of children in the Play and Remember groups whom the adult reminded about the goal of the task (Need to Remember versus Need to Play), attempted to provide a purpose for the task (Remember Functional), and encouraged to stick with the task (Encourage). Approximately the same number of children in the two goal conditions elicited comments by the examiner which were attempts to distance herself from the task and not get involved with the child (Avoid Engagement).

Differences in the adult's response to the children in the two goal conditions primarily reflect the differences in the children's response to the instructions. Children in the remember conditions were more likely to engage in behaviors that prompted an examiner reaction. Referring back to Figure 7, it can be seen that more children in the Remember conditions made general comments which were directed to the experimenter and which, in turn, elicited a response. Additionally, children in the Play conditions were judged to be somewhat more comfortable in the situation than those in the Remember condition, and thus less likely to appear to need encouragement. Based on the pilot tapes, a four-point comfort scale was created in which children were characterized as either (1) very comfortable and actively engaged in the task, (2) moderately at ease and willingly participates in the task, (3) somewhat uncomfortable and marginally engaged in the task, or (4) very uncomfortable and minimally engaged in the task. Three other raters, unaware of the purpose of the study or of the performance of the children rated the

pilot tapes, and after consultation and discussion over any disagreements, rated the comfort level of the children. One rater evaluated behavior during the two minute exposure period, and the second and third raters, coded comfort during immediate and delayed recall, respectively. The mean comfort score for the Play children was 1.8 (1.6 for Beach children and 1.9 for Non-Beach children); the mean score for the Remember children was 2.3 (2.1 and 2.5, for the respective Beach and Non-Beach conditions). Interestingly, during the recall period the children in the Play conditions were judged to be somewhat more uncomfortable than the Remember children and clearly more uncomfortable than they had been during the exposure period. The mean comfort score during recall for the Play children was 2.4 and for the Remember children it was 2.1. The unexpected task demand created when the Play children had to recall the items at the "store", undoubtedly created discomfort. The Remember children, on the other hand, knew what to expect and so did not become more uncomfortable when asked to recall the items. All the children were judged to be more comfortable during delayed recall, undoubtedly due to familiarity with the total situation as well as the specific task demands. Mean comfort ratings on delayed recall were 1.3 for the Remember groups and 1.5 for the children in the Play conditions.

Summary of Adult Exposure Period Behaviors

During the two-minute exposure period the examiner spent more time interacting with the children in the Remember groups than in the Play groups and made more varied types of comments to them. Since

children in the Remember group were more likely to address the examiner, and were judged to be somewhat more uncomfortable during the exposure session, this variability in the examiner's behavior appears to have been a reaction to the children's behavior. The relationship between child behavior and examiner responses is analyzed further in the next section.

Relationship between Exposure Period Behaviors and Recall

To explore the question of whether children's behaviors during the exposure period, especially in response to the need to remember, were linked to recall, regression analyses were carried out using a stepwise selection procedure. The procedure as described in the SPSSX Advanced Statistics Guide (Norusis, 1985) involves initially entering the variable with the largest correlation with the dependent variable (recall scores), followed by the variable with the largest partial correlation, and so forth. Variables are entered if they meet the criterion set. Default values of .05 for entry and .10 for removal were applied. After the first variable is entered, the second variable entered is based on the highest partial correlation as long as it too meets the entry requirements. At this point the first variable is reexamined to determine whether it should be removed. When none of the remaining variables meets the entry requirements, the procedure is terminated.

In addition to the overall analysis for the total sample, separate regression analyses were carried out for the Remember and Play groups since the behaviors of the two groups were so different. The child behavior variables included in the regression analyses were duration of (1) Play, (2) Link, (3) Contact, (4) Visual Examination, (5) Pause, (6) Off-Task, (7) Naming during any State, (8) Naming while commenting, (9) Making a general comment, and (10) Making a comment connected to the play. Additionally, a (11) Diversity score was entered into the analysis for the Play condition. The diversity variable was created to provide information about the number of different items contacted since the basic behavioral coding scheme documented the duration of activities but not the variety of objects which engaged the child. Only actual physical contact was coded since it was not possible to determine reliably the specific item a child was visually examining. The child who played for most of the exposure period could theoretically have focused on one item or all 12. In order to assess this factor, the two-minute exposure period was divided into 24 5-sec. blocks, and the number of blocks in which a particular item was physically contacted was noted. The diversity variable was simply the total number of different items contacted during at least one 5-sec. block. Since children in the Remember conditions infrequently touched an item, the data were added to the regression analysis for the Play condition only. Table 18 in APPENDIX C provides data on the mean frequency of contact for each item and the number of children remembering that item on immediate and delayed recall.

The adult variables included in the regression analysis for the combined group were the frequency variables of Encourage, and Avoid Engagement, since these were the two adult variables that occurred under both goal conditions. In addition, for the Remember analysis, frequency of focus on the Need to Remember, the Need to Remember Beach items, and the purpose of the task (Remember Functional) were added to the analysis. For the Play analysis, the added variable was the Focus on the Need to Play. Also included in all the regression analyses were the demographic variables of age and sex.

Predictors for the Remember Condition

The results of the regression analyses for immediate and delayed recall are presented in Table 5. For children in the Remember group the only variable that was predictive of immediate recall was Naming, and none of the variables predicted delayed recall. Table 6 presents correlations between all the variables entered in the regression equation and immediate and delayed recall scores for the Remember group. As expected from the regression analyses, Naming is significantly correlated with immediate recall ($r = .47$, $df = 19$, $p < .025$), but also with delayed recall ($r = .37$, $df = 19$, $p < .05$). Duration of naming behavior, rather than naming per se appears to have been the important feature of the naming behavior. The immediate recall means for the ten children in the Remember conditions who named was 6.3 compared with 6.0 for the 11 non-namers. For delayed recall the differences were larger with a mean of 6.0 for those who named compared with 5.3 for the non-namers.

Table 5

Predictors of Immediate and Delayed Recall

Goal	Recall Period	Predictors	R^2	F	p
Remember (n=21)	Immediate	1. Naming	.22	5.28	<.033
	Delayed	None			
Play (n=20)	Immediate	1. Age	.26	4.13	<.021
	Delayed	1. Age	.33	8.88	<.008
Combined (n=41)	Immediate	1. Avoid Engagement	.15	6.74	<.013
	Delayed	1. Naming	.11	5.05	<.030

Table 6

Correlations between Remember Condition Behaviors and Immediate and Delayed Recall

	Recall Period	
	Immediate (n=21)	Delayed (n=21)
Child Variables		
Demographic		
Age	-.19	-.14
Sex	.37	.26
Nonverbal		
Play	-.14	.15
Link	-.14	.05
Contact	-.12	-.09
Visually Examine	.04	-.10
Pause	.20	.13
Off-Task	-.30	-.27
Verbal		
Name	.47**	.37*
Name & Comment	-.20	.05
General Comment	.23	.36
Adult Variables		
Total Duration of Talk	.25	.24
Need to Remember	.24	.18
Need to Remember Beach	-.03	.26
Remember Functional	.15	.06
Encourage	.22	.14
Avoid Engagement	.40*	.42*

*p <.05; **p <.025.

The adult's attempts to avoid getting involved with the child (Avoid Engagement) also correlate significantly with both immediate ($r = .40$) and delayed recall ($r = .42$), respectively ($df = 19$, $p < .05$). The fact that only Naming shows up in the regression analysis can be explained by the very high correlation between Naming and Avoid Engagement ($r = .69$, $df = 19$, $p < .005$). The significant correlation between sex and immediate recall, reflects the high recall scores of boys in the Remember Beach condition coupled with the low scores of two girls in that group.

Table 19 in the APPENDIX C provides the intercorrelation matrix for all the variables entered into the regression analysis for the Remember group. Some interesting relationships are the high correlations between children's general comments and the adult's attempts to avoid engagement ($r = .58$, $df = 19$, $p < .005$) and to remind the children of their need to remember ($r = .64$, $df = 19$, $p < .005$). Thus, the adult talk to children in the Remember conditions noted in the previous section was likely a response to these children's comments.

Predictors for the Play Condition

As can be seen from Table 5, Age was the one predictor for both immediate and delayed recall for the Play group. Correlations of the individual variables with recall scores are presented in Table 7. It appears that no one particular way of directly interacting with the objects (Playing, Linking, Contacting) was related to recall. On the other hand, children who spent considerable time in Visual

Table 7

Correlations between Play Condition Behaviors and Immediate and Delayed Recall

	Recall Period	
	Immediate (n=20)	Delayed (n=20)
Child Variables		
Demographic		
Age	.51*	.58**
Sex	-.00	-.07
Nonverbal		
Diversity	.21	.33
Play	.07	.04
Link	.04	.11
Contact	-.07	.06
Visually Examine	-.32	-.42*
Pause	-.02	-.21
Off-Task	-.08	-.05
Verbal		
Name	.29	.26
Name & Comment	.20	.32
Play Comment	-.02	.04
Adult Variables		
Total Duration of Talk	.30	-.02
Need to Play	.20	-.16
Encourage	.13	-.17
Avoid Engagement	.39*	.05

*$p < .05$; **$p < .01$.

Examination, tended to have low recall scores immediately and there was a significant negative correlation with delayed recall scores ($r = -.42$, $df = 19$, $p < .05$). Although the correlation was nonsignificant, contact with a variety of objects (Diversity) did seem to facilitate delayed recall. With respect to the adult variables, as was true for the Remember condition, Avoid Engagement is significantly correlated with immediate recall ($r=.39$, $p<.05$). Unlike the findings for the Remember condition, however, it is not correlated with delayed recall. In fact, although none of the correlations are significant, the adult behaviors which were positively correlated with immediate recall tended to be negatively related to delayed recall. It appears that whatever Play children did in response to the examiner's verbalizations facilitated immediate but not delayed recall.

For the children in the Play groups, there was no particular behavior that was significantly correlated with recall scores. Apparently, different approaches to the task facilitated recall for different children. Without the presence of a consistent pattern of response linked to recall, as was the case for the Remember group, the best predictor of both immediate and delayed recall becomes Age. There was no comparable effect for the Remember group, suggesting perhaps that the Remember manipulation was effective in overriding the power of the age variable.

Table 20 in APPENDIX C provides the intercorrelation matrix for all the variables entered into the regression analysis for the Play group. Here it is interesting to note the very high correlations

between the Pause variable and the adult variables, especially Encourage ($r = .82$, $df = 18$, $p < .005$) and the reminder of the need to play ($r = .63$, $df = 18$, $p < .005$). Additionally, parallel to the finding of a significant link between General Comments and Avoid Engagement in the Remember condition, for the Play condition the comparable relationship is between Play Comments and Avoid Engagement ($r = .46$, $df=18$, $p < .025$).

Combined Regression Analysis

In the combined regression analysis the best predictor of immediate recall is the adult's attempts to avoid engagement with the child, and Naming emerges as the one predictor of delayed recall. These two variables are highly correlated ($r = .49$, $df = 39$, $p < .005$). The correlations for the total sample with the various child and adult variables are presented in Table 8. These data reaffirm the consistent thread of Naming, Age and the adult's attempts to Avoid Engagement as central correlates of the recall scores. Additionally, general comments were significantly correlated with delayed recall.

The intercorrelation matrix off all the variables entered into the regression analysis for the combined Play and Remember groups is provided in Table 21 of APPENDIX C.

Table 8

Correlations between Exposure Behaviors and Immediate and Delayed Recall for All Children

	Recall Period	
	Immediate (N = 41)	Delayed (N = 41)
Child Variables		
Demographic		
Age	.21	.27*
Sex	.16	.08
Nonverbal		
Play	-.17	-.18
Link	-.10	-.06
Contact	-.20	-.16
Visually Examine	.06	-.01
Pause	.21	.17
Off-Task	-.10	-.07
Verbal		
Name	.38***	.34**
Name & Comment	.02	.19
Play Comment	-.10	.04
General Comment	.20	.29*
Adult Variables		
Total Duration of Talk	.31**	.23
Encourage	.22	.12
Avoid Engagement	.38***	.21

*p <.05; **p <.025; ***p <.01

Summary of the Regression Analyses

Naming emerged as the one behavioral variable predictive of recall. For children in the Remember condition it predicted immediate recall, and for the combined sample it was the best predictor of delayed recall. None of the behavioral variables was predictive of recall for children in the Play group, but Age was a significant predictor of both their immediate and delayed recall scores. Overall, the adult's attempts to avoid getting involved with the child (Avoid Engagement) were predictive of immediate recall. Avoid Engagement was highly correlated with both immediate and delayed recall for children in the Remember group and for immediate recall for the Play group. Additionally, it was significantly correlated with both Naming and General Comments for the Remember group and with Play Comments for the Play group.

Recall Prompts

As noted in the Method section, no specified time limit was set and there were no predetermined number of examiner questions for eliciting recall. Table 9 summarizes the mean number of times the "storekeeper" used any one of seven categories of verbalization during immediate and delayed recall for all experimental conditions. Not surprisingly, the most frequent comments across all conditions during immediate recall were attempts to get the child to remember by asking the child directly what else was recalled (Probes). Overall,

Table 9

Mean Frequencies of Adult Verbalizations During Immediate (I) and Delayed (D) Recall

Type of Verbalization	Experimental Condition: Remember, Beach I	Remember, Beach (D)	Remember, Non-Beach I	Remember, Non-Beach (D)	Play, Beach I	Play, Beach (D)	Play, Non-Beach I	Play, Non-Beach (D)
Probe	9.1	(5.5)	7.5	(4.9)	9.3	(7.1)	11.1	(5.6)
Praise	7.2	(6.8)	5.5	(6.3)	5.2	(5.9)	4.6	(5.2)
Encourage	2.8	(2.5)	3.4	(1.8)	3.0	(2.8)	3.7	(3.4)
Review items recalled	1.1	(1.3)	.9	(1.0)	1.4	(1.6)	1.3	(1.3)
Repeat last item	3.5	(2.3)	2.7	(1.8)	2.5	(2.2)	4.0	(3.4)
Ask child to clarify	1.9	(1.2)	1.5	(.1)	1.3	(.6)	3.3	(1.1)
Other	.5	(.4)	1.2	(.6)	1.0	(1.6)	.7	(.8)

there were considerably fewer probes during delayed recall. Likely, since the children had been through the procedure already, there was less need to cue them as much. It is also possible that the decrease in probes contributed to the overall drop in delayed recall scores. In fact the delayed recall phase was shorter. The mean time forimmediate recall was 4.3 minutes and for delayed recall it was 3.1 minutes. The data on adult cueing are presented primarily for descriptive purposes to provide documentation of the storekeeper's behaviors and to look for marked differences in approaches to the four groups. No clear pattern emerges differentiating cueing to the various groups. Table 10 provides information on the number of references to remember and/or beach made by the storekeeper in her attempts to elicit recall. The "storekeeper" was just as likely to ask children in the play groups what they remembered as she was the children in the remember conditions. Comments during recall probing that referred specifically to beach items were very infrequent.

Recall Organization

In addition to the major analyses reported, other aspects of the data were analyzed. Recall organization, both objective and subjective, although not a primary focus of the study, potentially provides some information about underlying processes facilitating recall. The measure of objective organization typically is a clustering score or measure of category repetitions--the number of times items from the same category are recalled adjacently.

Table 10

Mean Frequencies of Adult References to Remember and/or Beach during Immediate (I) and Delayed (D) Recall

Condition	Adult References					
	Remember		Remember + Beach		Beach	
	I	D	I	D	I	D
Remember						
Beach	5.1	5.3	.6	1.0	.8	.6
Non-Beach	7.5	5.5	--	--	--	--
Play						
Beach	5.6	5.1	.9	1.2	.8	1.3
Non-Beach	6.7	5.2	--	--	--	--

Subjective organization generally refers to consistency across trials in the sequence of items recalled. In this study, interest was in the consistency or overlap between the specific items recalled in the immediate and the delayed trials.

Clustering

The objects to be recalled were laid out in blocked form--toys, clothes and foods for the Non-Beach groups and the comparable slot-filler categories for the Beach groups. Thus a measure of clustering could reflect either categorical recall or recollection of the visual presentation. In other words, children could recall items sequentially from the same category because they were visually grouped rather than categorically organized. In any case, a measure of recall clustering provides information on organization of item recall.

Since the observed number of category repetitions is necessarily correlated with number of items recalled, several solutions for dealing with this problem have been suggested. Murphy and Puff (1982) reviewed this issue and concluded that for low levels of recall the Ratio of Repetition (RR) is the most appropriate measure. The RR formula is simply r/(n-1), where r equals the number of category repetitions and n equals the number of items recalled. Clustering scores based on RR are presented in Table 11. The slightly reduced sample size was due to the loss of three cases where recall was less than two and, therefore, no clustering is possible. Additionally, as with all other analyses, no delay data were obtained

Table 11

Means and Standard Deviations for Ratio of Repetition Clustering Scores

		Recall Period				
		Immediate			Delayed	
Condition	n	M	SD	n	M	SD
Remember	22	.36	.23	21	.43	.27
Beach	11	.39	.27	10	.47	.29
Non-Beach	11	.33	.20	11	.38	.27
Play	18	.36	.22	17	.40	.21
Beach	10	.33	.28	10	.36	.18
Non-Beach	8	.41	.12	7	.45	.26

Table 12

Means and Standard Deviations for Consistency Scores between Immediate and Delayed Recall

Condition	n	M	SD
Remember	21	.81	.12
Beach	10	.82	.12
Non-Beach	11	.80	.13
Play	19	.78	.16
Beach	11	.79	.15
Non-Beach	8	.76	.19

for two children. There were no significant differences in clustering scores among experimental groups for either immediate or delayed recall. However, across all conditions there were significant correlations between individual clustering scores and recall both immediately ($r = .32$, $df = 38$, $p < .02$) and at delayedrecall ($r = .33$, $df = 36$, $p < .02$) It appears that no experimental condition particularly facilitated clustering, but children who did cluster had higher recall scores.

Consistency

In addition to the clustering measures, a consistency score was calculated to determine the degree of overlap between items remembered on immediate and delayed recall. Here the interest was not in consistency in the sequencing of the responses--a traditional subjective organization measure--but in seeing whether there was variability among experimental groups in the number of overlapping items. The measure of consistency (Hudson & Fivush, 1983) is defined as the number of overlapping items recalled on the two trials divided by the mean number of items recalled on the two trials. Table 12 presents the means and standard deviations of the consistency scores for the four experimental conditions. There were no significant differences in consistency scores, with all groups remembering about 75 to 80 per cent of the same items on immediate and delayed recall. Thus, group differences in delayed recall were not due to variability in the percentage of item overlap but rather to differences in the number of items added and forgotten. Table 13 provides specific

Table 13

Mean Number of Items Added, Forgotten, and Overlapping between Immediate and Delayed Recall

Condition	n	Added M	Added SD	Forgotten M	Forgotten SD	Overlapping M	Overlapping SD
Remember	21	.76	.70	1.24	.89	4.86	1.77
Beach	10	.90	.74	1.10	.88	5.30	2.11
Non-Beach	11	.64	.67	1.36	.92	4.45	1.37
Play	20	.85	.93	1.45	1.50	3.65	1.90
Beach	11	1.09	.94	1.00	1.26	3.82	1.89
Non-Beach	9	.56	.88	2.00	1.66	3.44	2.01

information on the number of items added and forgotten by each group and the number of overlapping items. Children in the Beach conditions generally forgot one item and added one new item on delayed recall to maintain their overall recall performance. The Non-Beach sample, on the other hand, forgot one to two items and on the average added less than one to produce the overall decline in their delayed recall scores.

Categories and Items Recalled

Table 14 provides information on the average number of items recalled by categories for each experimental condition and Table 15 indicates the number of children recalling each item collapsing across Remember and Play groups. The data from Table 14 indicate that children in the Remember Beach condition were least likely to remember things you wear at the beach, whereas the Play Beach children were least likely to remember the food related items. Both groups of Non-Beach children remembered the clothes category the best initially, but there was a sharp drop in recall of these items for the children in the Play Non-Beach group. The comparable drop for the Remember Non-Beach children was in the toys category. Irrespective of category, some items were remembered by most children and some by few. The Beach children remembered the truck and boat during both immediate and delayed recall; the correspondingly high recall items for the Non-Beach group were pants, dress, and ice box. The items that showed a large drop in the number of children remembering them between immediate and delayed recall were hamburger

Table 14

Mean Category Scores for Immediate (I) and Delayed (D) Recall

Category	Recall Period	Experimental Condition: Beach, Remember M	Beach, Remember SD	Beach, Play M	Beach, Play SD	Non-Beach, Remember M	Non-Beach, Remember SD	Non-Beach, Play M	Non-Beach, Play SD
TOYS	I	2.27	(1.27)	1.82	(1.08)	1.82	(1.08)	1.40	(1.26)
	D	2.50	(1.27)	1.91	(1.14)	1.00	(1.09)	1.11	(1.17)
CLOTHES	I	1.64	(1.21)	1.91	(.94)	2.36	(.81)	2.20	(1.23)
	D	1.60	(1.07)	1.64	(.92)	2.55	(.82)	1.44	(1.01)
FOOD	I	2.37	(1.49)	1.09	(1.14)	1.64	(1.12)	1.60	(1.35)
	D	2.10	(1.52)	1.36	(1.12)	1.55	(1.04)	1.44	(1.13)

Note.--The comparable slot-filler categories were toys taken to the beach, things worn at the beach, food items associated with the beach.

Table 15

Number of Children Recalling Each Item

	Item	Recall Period Immediate	Delayed
	Truck	15	16
	Boat	15	15
	Ball	9	8
	Bucket	5	7
BEACH	Bathing suit	11	11
	Swim fins	12	9
(n=21)	Sunglasses	6	7
	Towel	9	7
	Barbecue	8	9
	Soda	10	12
	Chips	9	11
	Hamburger	8	4
	Plane	12	4
	Lego	6	3
	Teddy bear	11	9
	Whistle	5	5
NON-BEACH	Purse	4	3
	Pants	16	12
(n=20)	Shoes	11	12
	Dress	16	14
	Ice box	15	16
	Eggs	5	3
	Pie	5	4
	Milk	7	6

for the Beach children and very dramatically plane for the Non-Beach groups.

Summary of Recall Organization

There were no significant differences in either clustering or consistency scores among the experimental groups. Clustering was not facilitated by any experimental condition, but overall children's clustering scores were significantly correlated with recall. There was a 75 to 80 per cent overlap between the specific items recalled in the immediate and delayed trials across conditions. However, during delayed recall, children in the Beach conditions, on the average, forget fewer items and recalled more new items than children in the Non-Beach groups.

Item Labels

One final area explored was the nature of the labels children used to identify the objects. Any child labels consistent with the category to which they belonged and when appropriate, the Beach theme, were accepted during item identification and during recall. Labels such as rag (towel) or rubbish can (bucket) were corrected during the initial labelling of items, although they were plausible answers. On the other hand, functional labels such as "for make meat" (barbecue), "for put on" (pants), were accepted. Table 16 provides a simple breakdown of the types of labels children used. In general, children supplied conventional labels, but for two of the

Table 16

Labels Used by Children During Item Identification

	Type of Label			
	Conventional	Functional	Incorrect	None
Beach Item				
1. Truck	19	0	0	2
2. Boat	21	0	0	0
3. Ball	20	0	1	0
4. Bucket	13	1	6	1
5. Bathing suit	10	0	6	5
6. Swim fins	3	7	2	9
7. Sunglasses/glasses	21	0	0	0
8. Towel	16	0	5	0
9. Barbecue	2	10	4	5
10. Soda	19	0	1	1
11. Chips	17	0	3	1
12. Hamburger	20	0	1	0
Non-Beach Item				
1. Plane	21	0	0	0
2. Lego	14	0	4	3
3. Teddy bear	20	0	1	0
4. Whistle	21	0	0	0
5. Purse	18	0	0	3
6. Pants	20	0	1	0
7. Shoes	21	0	0	0
8. Dress	17	0	4	0
9. Ice box	11	0	4	6
10. Eggs	15	0	5	1
11. Pie	15	0	4	2
12. Milk	20	0	0	1

beach items (fins and barbecue) they tended to give either a functional description or no label. Because of these two items, 21 per cent of the total number of 252 potential labels (12 items x 21 children) were either not labeled or incorrectly identified by the children in the Beach conditions. The comparable figure for the Non-Beach group is 15 per cent. Comparing this table with Table 15, it appears that not labelling an item initially or providing a functional label did not interfere with recall. Fins and barbecue, which tended to be functionally labelled or not labelled by the child were remembered as well as many other items for which virtually all children had conventional labels. The pattern for correct versus incorrect labels is highly inconsistent. Hamburger, correctly identified by 20 children was recalled by only eight children initially and by four children on delay. Similarly for the Non-beach items, milk was labelled correctly by 20 children but was remembered by only seven children at immediate recall and six at delayed recall. On the other hand, some items which were frequently mislabeled (e.g., bathing suit) had relatively high rates of recall. Overall, it seems that using expected and/or conventional item labels did not facilitate recall, and lacking a label or providing a functional one, did not interfere with recall. Children apparently were familiar with the items they did not label and were able to adopt or modify the labels provided by the examiner and remember them during recall.

Some interesting examples of children's label modifications are provided in Table 17. What is noteworthy is the child's alteration of the adult's response to a label or description meaningful to the

Table 17

Changes in Item Labels from Initial Identification to Delayed Recall

Child's Initial Label	Adult's Response	Immediate Recall Label	Delayed Recall Label
Barbeque			
Bowl	(accept)	Stove	For make charcoal, the thing, cooking stuff
(no label)	Barbeque, for cooking	The stuff for you cook the meat	Stuff for cook the meat
For make meat	(accept)	Fire for make the meat	For make meat
Oven	Barbeque type oven	Oven	Barbeque
Swim Fins			
For swim	(accept)	For paddle, for when you dive	The kind for dive
(no label)	Swim fins you put on your feet	The thing that you put on your feet	The fins
(no label)	Swim fins for your feet	The swimming stuff for your feet	The stuff for the feet--swimming
(no label)	Flippers, you put on your feet for swimming	Fins	Fins
(no label)	Flippers for the water	For swim, put the stuff on top your feet	Stuff for put on your feet, for swim
Swimsuit			
(no label)	Swimsuit	For swim, for put on your own body	Bathing suit
Refrigerator			
(no label)	Refrigerator	Icebox	Icebox
Freezer	(accept)	Freezer	Icebox

child, and the active cognitive processing that this implies. Children did not just incorporate the adult's labels but rather transformed them. Thus, refrigerator is converted to "ice box", swimsuit to "for swim, for put on your own body", flipper to "fins", or to "for swim, put the stuff on top your feet". Additionally, the child's own response does not remain static, but moves, for example, from "bowl" to "stove" to "for make charcoal";, from "freezer" to "ice box"; or with reference to the swim fins, from "for swim", to "for paddle, for when you dive", to "the kind for dive". The vast majority of labels were children's initial responses to the task demand to identify the items. When for various reasons it was necessary for the adult to provide the label, children incorporated the adult concept but clearly not necessarily the adult label.

Summary of Item Labels

Children in the Beach groups correctly identified the objects during the initial labeling process 79 percent of the time; the comparable figure for the Non-Beach group was 85 percent. Additionally, two of the beach items frequently elicited functional descriptions, but there were no functional labels offered for the non-beach items. Interestingly, the type of label, or the lack of a label did not appear to bear any consistent relationship to item recall. It is also interesting to note how flexible children were in adapting the examiner's labels and in the use of their own labels between immediate and delayed recall.

CHAPTER IV

DISCUSSION

Two issues in the development of memory have been central during recent years. One area of interest has been the role that mnemonic strategies play in memory performance. Specifically relevant to this study, is the issue of whether young children can be strategic and, if so, whether the early expressions of strategic behavior can be effective in enhancing memory. To assess this, children were asked to remember a set of items or alternatively, to play with the items. Their behavior during a two-minute study period was videotaped. From these data it was possible to evaluate the effects of the remember instruction to see whether a memory goal did evoke strategic behavior which, in turn, affected the level of recall.

The second issue of importance in the development of memory concerns the way in which knowledge is organized, and how this knowledge organization affects what children will remember. Specifically, it has been argued that young children's knowledge is structured schematically (e.g., Nelson, 1986; Mandler, 1979, 1983) and that memory performance will be enhanced when material to be remembered is compatible with a schematic organization of events. Thus, children who were asked to remember a set of items thematically linked around a beach picnic theme, were expected to recall more

items than children exposed to familiar items grouped into taxonomic categories.

Since both the explicit instruction to remember and the thematically-linked items were expected to enhance recall, it was hypothesized that children who were instructed to remember the beach items would earn the highest recall scores. Finally, in order to explore the impact of these variables over time, recall was measured immediately after the two-minute exposure to the objects and again one week later.

The Effect of the Memory Goal on Recall Performance and Strategic Behavior

It was expected that children instructed to remember would recall a greater number of items than children who were asked to play, although some previous research (e.g. Baker-Ward et al., 1984) had not found differences in recall between two comparable groups. However, the items in that study were random, in contrast to the thematic and categorical sets of items used in this research. Additionally, Weissberg and Paris (1986) found significantly greater recall for three- and four-year-olds told to remember a short list of foods or names than for children for whom the task was embedded in a shopping or party scenario.

In fact, children asked to remember the items did recall more than the children asked to play with them; the differences, however, were only marginally significant. From a statistical perspective,

the magnitude of the differences with the small sample size and rather large variances were insufficient to induce a clearly significant effect. From a theoretical perspective, it may be that the remember instruction did not lead to sufficiently effective strategic behavior which, in turn, would have led to better recall.

Based on the regression analysis it was established that the one behavior that was linked to recall for children in the Remember conditions was duration of naming the items. Consequently, it appears that the Remember instruction was effective in promoting recall to the extent to which it prompted the children to spend time naming the items during the two-minute exposure period. Ten of the 21 children did, in fact, name the items. The children engaged in other behaviors (e.g. visually examining and "pausing") that seemed to be an appropriate response to the need to remember, but only naming the items actually contributed to recall performance. Ornstein, Baker-Ward, and Naus (in press) make the relevant point that "mnemonic mediators that appear to be similar in form may be employed with varying degrees of effectiveness at different points in development (p. 21)." That these children engaged in behaviors that overtly resembled mature mnemonic strategies, but that were not necessarily effective, suggests that we may be capturing that point in development when mnemonic strategies are emerging but may require the assistance of another person to be more effectively expressed. In Vygotskian (1978) terms, children appear to be operating at the zone of proximal development in their use of mnemonic strategies for verbal recall.

Evidence for this point is provided in a study by Sodian, Schneider, and Perlmutter, (1986) in which one group of German four-year-olds were given instructions to play and remember. Their task was to remember 16 objects, each belonging to both a taxonomic and a color category (e.g.,yellow cow, red horse, yellow table, red chair). Half the children spontaneously sorted the objects categorically and half did not sort at all. Children who sorted remembered more items. In another condition, children were specifically told to "put those things together that go together" for the purpose of remembering. With this specific directive to apply a memory strategy, 15 children sorted (14 of them by category) and produced correspondingly very high rates of recall. Thus, when specifically told to employ an appropriate strategy, essentially all the four-year-olds in the Sodian, et al. study, did so effectively. It would be interesting to attempt to replicate that finding (using a naming strategy) with this population and these materials.

However, not all efforts to guide young children to use mnemonic strategies have been successful. In earlier research reported by Howe and Ceci (1979), children were instructed to say aloud the names of objects represented in pictures. For children between the ages of six and eight, this practice facilitated recall. However, there was no effect on the performance of the ten-or four-year-olds. Howe and Ceci conclude that the older children named spontaneously silently and that the younger children were too young to benefit from a naming strategy. Their conclusion is a description rather than an explanation, and inconsistent with the results of this study. Thus,

their specific instruction to name the items was less effective than the spontaneous naming exhibited by children in this study. The issue of the effectiveness of directing very young children in strategic behaviors warrants further study as it has important theoretical and practical implications. The nature of the materials to be remembered and corresponding variations in the the types of strategies suggested or spontaneously employed are the basic variables that should be investigated.

It is interesting to note that about half the three- to four-year-olds in the research reported here, in the Sodian et al. (1986) study, and in Weissberg and Paris (1986), spontaneously employed an effective strategy (i.e., naming and categorical sorting) when a memory goal was invoked. Whether the use of mnemonic strategies at this early age is related to more developed strategic behaviors later on or to subsequent cognitive functioning generally has not been explored. Ornstein et al. (in press) have recently urged that longitudinal assessments of strategy development be pursued in contrast to the typical cross-sectional study of the development of memory strategies. Continuity within individual children between these early expressions of strategy-like behaviors and more mature mnemonic activity would strengthen the notion that we are indeed observing the precursors of later strategic behavior. Although the goal effect in this study was only marginally signficant, combined with data from these other recent studies, there seems to be a need for a shift in the prevailing view that children in this age group cannot be deliberate and effective in their attempts to remember.

The Effect of the Thematic Array on Recall Performance

In contrast to expectations, there were no differences in performance at immediate recall between children exposed to objects tied to a beach theme and children exposed to the objects for which there was no overall connecting theme. However, children in the Beach condition were able to maintain their level of performance over the one-week delay interval while the children in the Non-Beach condition exhibited a reduction in recall. In fact, 14 of the 21 children in the beach group either maintained or increased their level of recall from the immediate to the delayed recall trial. Only seven of the Non-Beach group did so.

The unanticipated pronounced delay effect coupled with the lack of immediate effect on recall of the thematic array requires some interpretation. The saliency of both sets of items coupled with the specific task demands apparently engaged the interest and attention of the children sufficiently to produce comparable levels of recall between Beach and Non-Beach groups just after the children had seen all the objects. At immediate recall children undoubtedly were remembering the particular toy items they had just played with, looked at, named, and so forth, and not relying on either the thematic element or a personal beach script to retrieve items. The fact that all the items were toys rather than actual objects may have limited the saliency of the beach theme. Following the one-week interval, however, without the support of the immediacy of the

experience supporting recall of the items, the thematic organization served to facilitate recall. Consistent with the theoretical views of schema theorists, it can be argued that the nature of the thematic items permitted young children to be receptive to their verbally identified and inherent scripted organization--things you could take on a beach picnic. After the delay interval children presumably could rely on the beach theme to trigger recall of the specific items presented a week earlier. With recency of item exposure no longer aiding recall, children exposed to the non-beach array, had to rely on memory for individual items or possibly to the relevant taxonomic categories to aid their recall. While there is evidence that even for preschoolers taxonomic categories facilitate recall when compared with random items (Perlmutter & Myers, 1979), they appear to be less effective than scripted slot-filler categories (Lucariello & Nelson, 1985).

An additional point with respect to item categories, however, should be made. There were no differences in category clustering across conditions, suggesting that the nature of the categories was not the important element affecting recall performance. Rather it appears that the presence or absence of an overall theme or script accounts for differences in delayed recall. These findings are in contrast to those of Lucariello and Nelson (1985) who found that memory and organization were significantly higher for slot-filler categories than for taxonomic categories on an immediate recall task. However, neither the taxonomic categories or the slot-filler categories generated for this study were pure or prototypical

representatives of the respective category types. The food category, for example, rather than being limited to food also included a refrigerator. This was deliberately done in at attempt to make the items in the two sets, equally familiar and functionally similar. Thus the refrigerator was intended as the equivalent of the barbecue in the thematic array. Additionally, the slot-filler categories (e.g. toys you take to the beach), undoubtedly did not contain strong associates for children comparable to slot-filler categories used by Lucariello & Nelson (1985). In fact, their items consisted of the most frequent responses given by preschoolers when asked to name zoo animals, lunch food, and clothes put on in the morning. In contrast, the items in this study included some that were frequently and some rarely mentioned when during pilot testing children were asked about things they would take on a beach picnic.

A relevant point of theoretical interest with respect to the differential delay performance of the Beach and Non-Beach groups is Alba and Hasher's (1983) contention that schemas influence retrieval rather than encoding. Their view that schemas operate at the retrieval end rather than the selection end of the memory process appears compatible with the results of this study. What children encoded or stored during the exposure period may not have been primarily determined by the beach script per se. Encoding evidently was influenced more by the instruction to remember or to play and the general exposure to the objects. However, what apparently influenced delayed recall in addition to these factors, was the ability of children exposed to the thematic array to access stored items. Thus,

while children in the Beach condition tended to forget one or two items at the delay trial, they were able to retrieve additional items from memory that they had not recalled earlier. Clear support for the notion that the beach script influenced retrieval rather than encoding would require a recognition test at delayed recall with the prediction that then there would be no differences in recall between the Beach and Non-Beach groups. In a recognition test, ability to retrieve items would not be an issue, and only differences in original encoding would be reflected in the recognition scores. If, in fact, scripts operate primarily to facilitate retrieval, allowing children adequate time to search for the items during the recall phase, may have been a benefit to children searching within a framework in contrast to more general searching.

A recent study by Smith, Ratner, and Hobart (1987) also emphasized the importance of schemas on retrieval processes. Kindergartners made clay along with an adult and then immediately afterwards and again two weeks later described the clay making process to another adult. Children, who after the initial free recall procedure had the opporturnity either to demonstrate the event as they recalled it or for whom the objects used in making the clay were present during immediate recall, remembered significantly more actions two weeks later than they did immediately after the event. Children who verbally described the activity without any aides still were able to recall the same number of specific actions immediately and two weeks later. The authors conclude that information originally encoded did not decay and that the second experience of

the event allowed for increased accessibility of the information originally encoded. Generally speaking, the authors suggest that, "Assuming that there is little or no decay of information, script development more likely involves changes in accessibility rather than changes in the amount of information available in memory " (p.21). Their conclusions are compatible with the notions of Alba and Hasher and with the results of this study that suggest that scripted remembering leads to increased accessibility of encoded information.

An additional theoretical notion of relevance to the findings on delayed recall is the concept of reminiscence. This concept was investigated by Kraeplin at the turn of the century and refers to improvement in performance after a delay interval, usually with the idea that a rest period has allowed for consolidation of material. Eventually, the concept was dropped from the literature but in recent times Eysenck and Frith (1977) devoted an entire text to the subject. However, the data presented by them are limited to studies of motor tasks, where rest may be an important factor contributing to improved performance. Eysenck and Frith note that demonstrating reminiscence in verbal tasks is much more difficult because forgetting is so rapid that consolidation cannot be so effective in producing reminiscence effects. Glass and Holyoak, (1986) have suggested that the best explanation of reminiscence is that for some reason immediate recall is suppressed. This contemporary view of memory processes supports the focus on differences in accessibility of material to account for recall differences rather than emphasizing forgetting.

One final possible explanation for the improved recall performance of many children in the Beach condition should be considered. During pilot work, young children had been interviewed to establish the kinds of items preschoolers associate with beach picnics. The final array included items mentioned by many children as well as some rarely or never referred to. The notion was that the beach items would evoke a beach script and that some of the items would be compatible with the child's prior beach script and some would not. One could argue that the reason for the high level of delayed recall was that children were not remembering the experimental array, but merely naming items that they associate with the beach. The evidence suggests otherwise. If children were activating their prior beach schemas and thus naming common beach items rather than remembering the ones presented, then one would predict that some of the children's responses would include beach items that were not in the experimental set. In fact, with one minor exception no child ever "remembered" a beach item which was not in the original array. It seems quite clear, therefore, that children were remembering the items that had been presented during the experiment.

The Effect of Goal and Theme on Recall Performance

It had been expected that children instructed to remember the thematic set of items would exhibit the highest level of recall. The interaction of goal and theme was not significant but comparisons

between the Remember Beach group and the two Play groups was marginally significant. The difference between the two Remember groups was not significant. Since the remember condition elicited effective strategic behavior from only half the children and since the impact of the thematic organization was minimal during immediate recall, the findings for the combination of these variables was not robust. Sharper contrasts between the goal conditions and between the organization of the items might have enhanced the effect. Weissberg and Paris (1986) suggest that the children in their study who were invited to play remembered less well than children in a more formal lesson setting because their attention was diverted by their interest in the people and objects involved in the game setting. In this study the conditions were much more comparable, with the same objects available to children in both the Play and Remember groups and minimal adult interaction in both conditions. Similarly, had the non-thematic array consisted of random items rather than categorical groups, differences between the groups might have emerged during immediate recall.

Although the beach script enabled children, on the average, to maintain their level of performance, in contrast to the drop in performance demonstrated by the children in the Non-Beach groups, it should be noted that both at immediate and delayed recall, the absolute scores of children in the Remember groups were higher than for children in the Play groups. Thus, overall, the task goal was more important in determining immediate recall scores but the

organization of items determined how much would be retained a week later.

Evidence of Strategic Behavior

Children asked to remember behaved dramatically differently during the exposure period from those requested to play. Their behaviors were characterized by a lack of contact with the objects, in contrast to children in the play conditions who spent virtually all of their time physically engaged with the items. Children given the instruction to play, were sensitive to the task demands and essentially did what they were asked to do. When told to remember, children also engaged in behaviors appropriate to the instruction. They named the objects more frequently and visually inspected them for considerably longer periods of time than did children in the play groups. Additionally, much of their time was spent not directly focused on the objects, but seemingly still engaged in the task. This behavior was similar to that defined by Baker-Ward et al. (1984) as "unfilled time", and which they assume have may provided an opportunity for covert cognitive activities.

In addition to the overall differential response to the task demands, the nature of the particular set of behaviors exhibited by children when there was a memory goal supports the contention that these children were making deliberate attempts to remember, a first step at least in the development of mnemonic strategies. They spent their time engaging in the behaviors that most closely resemble

mature mnemonic strategies: Naming, Visual Examination, and Pausing. Naming is a precursor of rehearsal or could be actual rehearsal, visually examining the items provides the opportunity to encode a strong visual image to aid recall, and "pausing" potentially allows for covert cognitive activity . As noted earlier, however, only Naming was applied effectively. In other words, although the behaviors engaged in appear to have been an appropriate response to the need to remember, only Naming actually contributed to recall performance.

Additionally, when children from the two goal conditions engaged in the same behavior, such as Naming, the behavior appeared to serve a different function. The three Play children who named did so in the context of playing. Their naming appeared to be an incidental part of the play scenario. On the other hand, children asked to remember, named while looking at the items or touching them. The combination of looking and naming simultaneously is particularly suggestive of strategic behavior. For example, in the Baker-Ward et al. study (1984), there was a significant increase between the ages of four and six in the co-occurrence of naming and visual examination.

Finally, it is possible that children who named were just mimicking the procedure carried out during the instruction phase when they had to label each item. However, it is not clear why children in the Remember condition were so much more likely to do so than children in the Play conditions unless they recognized that naming behavior was appropriate when attempting to remember a group of

objects, and not particularly relevant to playing. Thus, while children may have been provided a model for behavior that facilitates recall, they had to apply that behavior in the appropriate context.

Another possible basis for determining that behavior is deliberate or strategic is its effectiveness in promoting recall. For children instructed to remember, Naming was the best predictor of recall, lending further support to the thesis that their naming behavior was "strategic". No other child behavior was linked to recall for either the Remember or Play groups. Looking at patterns of behavioral variables or sequences of responses rather than individual variables would provide additional insight into the cognitive processing that was linked to recall. Thus some children who did not name also remembered very effectively. In the absence of a behavioral variable that was powerful enough to contribute to recall, age emerged as the best predictor of recall scores for children instructed to play.

Interestingly, the adult variable that consistently was related to children's recall scores was the attempt to avoid getting involved with the child. For the Remember group, this variable was significantly related to immediate and delayed recall and was also highly correlated with naming and with children's general comments. This pattern of correlations suggests that when children directed general comments to the examiner, she attempted to disengage herself from the child. In turn, when children's attempts to engage the examiner were rebuffed, they apparently saw this as a directive to return to the task. For many children in the Remember conditions,

task behavior involved Naming, which in turn was linked to recall performance. This scenario was partly confirmed by a review of some relevant tapes. Children in the Play condition apparently also were prone to return to the task when the experimenter attempted to avoid involvement with them. This in turn facilitated immediate but not delayed recall. Perhaps because the Play children's task behaviors were not goal directed the effects of activity triggered by the adult's comments were limited to the immediate situation.

Following Wellman's (in press) three part formulation of the differentiation experiment to evaluate whether a behavior is strategic, it seems reasonable to conclude that behaviors exhibited by the children given the goal of remembering, were indeed deliberate and represent precursors of more mature strategic behavior. Specifically, this experiment involved: 1) contrasting conditions in which one group was instructed to remember and a second group essentially served as a control (Remember versus Play); 2) potentially strategic activities occurred primarily within the memory condition,(e.g. Naming, Visual Examination, Pause; 3) the activities of children instructed to remember enhanced recall (e.g. Naming).

Summary and Conclusions

The results support the position that even very young children can demonstrate "strategic" behaviors in the presence of a memory goal. Thus, when asked to remember, children engaged in behaviors which appeared to be attempts to remember the items, and which were

very different from the behaviors generated by children requested to play. Only naming the items, however, was effective in enhancing recall scores. The development of mnemonic strategies is an emergent process and these data as well as that from other recent studies (e.g. Sodian, Schneider, & Perlmutter, 1976; Weissberg & Paris, 1986) suggest that during the preschool years, some children spontaneously employ effective "strategies". Taking a Vygotskian perspective, it may also be a time when adult assistance can be very effective in helping to promote the development of strategic behaviors since guidance may be most useful when a behavior is in its embryonic form.

With respect to the thematic variable, somewhat surprisingly, there were no effects of the organization of the items on immediate recall. However, item organization determined how much was retained a week later. The robustness of the delayed effect of the thematic condition was reflected in the large number of children in the Beach group who either maintained or increased their immediate recall scores. One possible explanation for this differential effect of item organization as a function of delay trial is the contention that schemas affect retrieval rather than encoding (Alba & Hasher, 1983). Thus, at immediate recall the thematic array was not particularly beneficial. However, during delay, children in the Beach groups were able to use the beach organizer to access the items encoded earlier. The Non-Beach children had to rely on the recollection of individual items.

The development of young children's memory with respect to both the emergence of mnemonic strategies and their ability to encode and retain material as a function of the organization of the stimulus materials has been explored in this study. Understanding the interplay between these variables has important theoretical and educational implications. While it has long been recognized that young children remember incidentally as a consequence of their everyday experiences, their ability to remember deliberately has been assumed to be negligible. However, it is becoming increasingly clear that mnemonic deliberateness is an evolving process and precursors of mature strategic behavior can be demonstrated in the early years as a function of the context of the task, the specific task demands, and the nature of the information that is to be remembered . Studying this process during its evolving stages can provide insights into the factors that contribute to mature strategic behavior and to better understanding of how the adult, both parent and teacher, can facilitate its development.

APPENDIX A

CHILD CODES FOR EXPOSURE PERIOD

STATES			VERBALIZATIONS
1	PLAY	(explore properties of item)	1 NONVERBAL
2	PLAY	(link items)	2 NAMING
3	CONTACT	(point to, touch, pick up or move item)	3 COMMENT (Related to Play)
4	VISUAL EXAMINATION	(look at, scan items)	4 COMMENT (Related to Remembering)
5	PAUSE	(none of the above, but not OFF-TASK	5 COMMENT (General)
6	OFF-TASK		6 COMMENT (Irrelevant)
			7 NAMING + COMMENT (Related to Play)
			8 NAMING + COMMENT (Related to Remembering)

GENERAL CONVENTIONS FOR CHILD EXPOSURE PERIOD CODES

1. All child exposure period codes consist of two digits. The first digit represents the STATE of the child (Play, Play in which items are linked, Contact, Visual Examination, Pause, and Off-Task). The second digit is the VERBALIZATION code, reflecting the type of verbaliztion, if any, that the child has uttered.

2. All STATE codes are mutually exclusive. If more than one state occurs at the same time (e.g. the child is touching an item but looking around the room), the predominant state is coded. Contact generally will be subordinate to other STATES.

3. A STATE behavior must last three seconds in order to get coded. States of shorter duration are ignored.

4. VERBALIZATIONS are coded whenever they occur, unless a repetition of the same type of verbalization occurs wihin three seconds of the previous verbalization. For example, if a child is naming items one after the other and the gap between labels is less than three seconds, Naming is coded at the start of the sequence and a new code appears only when the type of verbalization changes (e.g. the child makes a comment), or there is a shift in STATE (e.g. the child shifts from Visual Examination and Naming to Contact and Naming).

Description of Child Exposure Period Behavior Codes

STATES

PLAY

1 --Using or attempting to use the properties of the item; exploring, examining the item; engaging in playful behavior.

EXAMPLES: opening the snaps or velcro on pants or dress
"flying" the airplane
rolling, bouncing the ball
blowing the whistle
moving the dumptruck
putting on the sunglasses
shaking the ice box
smelling the bear

2 --Linking items together in a deliberate manner in contrast to just moving items to the same general location. The linkage may or may not be obviously meaninfgul, but the connection between items must not seem accidental or random.

EXAMPLES: hamburger put on the grill
ball put in the bucket
shoes put on the bear
attempt to put food in the ice box
milk placed on the dress
hamburger put on the towel
flippers placed under the swimsuit

CODING CONVENTIONS

a) Play behavior gets coded when the play is first initiated--when the child touches the item that is subsequently played with. Linking gets coded when the first of the two items to be linked is initially contacted.
b) In order to code linking, two items have to be linked together for a minimum of three seconds, although the child does not have to be directly involved with the items for the entire three-second period. During the three-second link interval, no other STATE can be coded. For example, if the child places the hamburger on the grill and leaves it there as she picks up another item, linking is coded. When the three second interval is over, the appropriate code is applied to the next behavior. However, if the child places the hamburger on the grill and removes it before three seconds have passed, linking is not coded.
c) After the initial coding of linking, linking continues to be coded in subsequent intervals only if the play appears to involve the

properties of both items. A ball placed in a truck gets a linking code, but subsequently if the truck is being wheeled around and the ball now seems inconsequential, PLAY (1) is the appropriate code. However, if a hamburger is placed on the grill, and then turned over to be "cooked", linking or PLAY (2) continues to be coded, as both the hamburger and the grill are still essential to the play.

d) Linking does not necessarily have to involve direct contact between items. If the child appears to be making a deliberate association between items, linking is coded. Placing the swim fins directly under the swim suit is an example of conceptual rather than physical linking and would receive a PLAY (2) code.

CONTACT

3 --Pointing to, touching, picking up an item; turning over an item; placing an item in its initial position or in the correct orientation; moving one or more items or gathering items without any apparent interest in associating particular items.

Examples: picks up pie, turns it over, puts it down
moves boat near a group of apparently random items

CODING CONVENTIONS

a) A distinction needs to be made between contacting an item and examining or using the properties of an item. PLAY is coded if the child acts upon the item in some way other than just touching, picking it up, turning it over or changing its location.

b) Contact is coded when a item falls or is inadvertently dropped and the child proceeds to retrieve it.

VISUAL EXAMINATION

4 --Glancing at, scanning, surveying, or looking intently at one or more objects.

PAUSE

5 --Engaging in behavior that cannot be included under either PLAY, CONTACT or VISUAL EXAMINATION, but which is not obviously OFF-TASK. These behaviors generally are breaks in the routines or patterns the child has been following, during which the child may be deciding what to do next, may be thinking about the items or the task, may be waiting for further instructions or guidance, feels she/he has completed the task and is unsure about what to do, or where the child apparently has not understood the instructions.

EXAMPLES: Child glances around room.
Child looks toward examiner, perhaps seeking further direction or approval.
Child looks toward store, perhaps waiting to be told store is open, or just to make eye contact with "store keeper".
Child looks up at the ceiling, or down at the floor.

CODING CONVENTIONS

a) Pause does not get coded with an Irrelevant Verbalization code (Code 6). If the child makes an irrelevant comment and is not at the same time playing, contacting or looking at the items, the behavior is considered OFF-TASK.

OFF-TASK

6 --**Behaving in a manner that suggests that the child is clearly not engaged in any aspect of the task. This may be reflected by deliberately avoiding looking at or contacting the items; by ignoring examiner's prompts or directives; by making irrelevant comments; by involvement with non-task items. The child's behavior may be viewed as a response to distress in an unfamiliar situation, or to an unwillingness to engage in the task for some other reason.**

EXAMPLES: Child plays with his/her clothing, such as zippering a jacket up and down.
Child plays with the microphone.
Child says, "See my finger nails."

VERBALIZATIONS

1 NONVERBAL

2 NAMING--Child labels the item, using either a conventional label or a more individualized functional label (e.g. "charcoal stuff" for the barbecue).

3 COMMENT RELATED TO PLAY--Child makes a comment or asks a question that accompanies, or is appropriate to play, or is about any of the items.
EXAMPLES: "What has in here?" (as child shakes ice box)
"Take this for cook." (as child picks up hamburger)

4 COMMENT RELATED TO REMEMBERING--Child makes a comment that reflects a focus on remembering.
EXAMPLES: "I remembered everything."

5 GENERAL COMMENT--Child makes a comment or asks a question about the task, the procedure, the items, the equipment, what the examiner is doing, as well as indications from the child that the task is completed or that instructions were not understood.
EXAMPLES: "Auntie, I did it all."
Auntie, the store is open?"
"Where's this from?" (pointing to the microcrophone)
"Where you buy these?" (referring to all the items)
"Do what?" (following instructions)

6 IRRELEVANT COMMENT--Child makes a comment or asks a questions that seems unrelated to the task, procedure, or relevant examiner behavior.
EXAMPLES: "What's that noise?" (referring to sounds outside the room)
"Look what I have." (showing the examiner her nail polish)
"Hello, how you doing?" (talking into microphone)

7 NAMING + PLAY COMMENT--(Combines codes 2 and 3)
EXAMPLES: "The eggs are in the icebox."
"Oh, the milk doesn't fit."
"That was me blowing the whistle."
"The purse, can it open?"

8 NAMING + REMEMBER COMMENT--(Combines codes 2 and 4)
EXAMPLES: "I remember whistle."

APPENDIX B

ADULT CODES FOR EXPOSURE PERIOD

	STATES		CONTENT OF VERBALIZATION
1	EVOKE NEED TO REMEMBER OR PLAY	1	REFERENCE TO REMEMBER
2	MAKE TASK FUNCTIONAL	2	REFERENCE TO REMEMBER + BEACH
3	ENCOURAGE INVOLVEMENT IN TASK	3	REFERENCE TO PLAY
4	AVOID ENGAGEMENT WITH CHILD	4	REFERENCE TO PLAY + BEACH
		5	NO REFERENCE TO REMEMBER, PLAY, OR BEACH

CODING CONVENTIONS

1. An Adult code is terminated by another Adult code, or by the termination code (90). A single statement receives a termination code at the end of the statement. The termination code follows the last statement in a sequence of statements.

2. Any adult statement separated by three seconds or more from a subsequent statment receives a termination code.

3. The appropirate Adult code is recorded as soon as the adult starts speaking. A subsequent code is recorded when either the adult stops talking (termination code) or there is a change in the nature of the adult's comments.

DESCRIPTION OF ADULT EXPOSURE PERIOD CODES

1. **Evoke the need to Remember or Play**

Statements by the adult which essentially repeat those aspects of the instructions that focus on the need a) to remember, or b) to play.

EXAMPLES

1-1 focus on remember--"Do anything you can to help you remember."

1-2 focus on remember plus beach--"Try to remember the things we need for our beach picnic."

1-3 focus on play--"Play with the toys."
"Play any way you like."

1-4 focus on play plus beach--"Play with the beach things."

2. **Make the need to Remember or to Play functional**

Statements by the adult which a) make the need to remember functional, by providing a purpose for the need to remember, usually by linking the need to remember to getting items from the store; b) make play functional, by indicating to the child that the adult need the child's help to find out if children like the "toys".

EXAMPLES

2-1 "You try to remember all these things for when you go shopping."
"Remember these things here so you can get them at the store."

2-2 "Remember these things for our beach picnic so you can get them from the store."

2-3 "Play with these things, because I want to know if children like them."

2-4 "Play with these things, so I can see if children like these beach toys."

3. **Encourage involvement in the task**

Attempts to get the child involved without specific reference to the need to remember or to play. Encourage child to stick with the task.

3-5 "Work on it some more, work real hard."
"The store will be open soon."
"You'll get to pick your sticker."
"Why don't you see if you like these things?"
"I'll tell you when it's time to go to the store."
"Auntie Michelle will call you when the store is open."

4. **Avoid engagement with the child**

Attempts to avoid engagement with the child usually by referring to what the adult has to do while the child is engaged in the task; responses to the child's tangential questions.

4-5 "I have to write things down now."
"I'll tell you later."
"I'm busy now."

APPENDIX C

Table 18

Mean Number of 5-Second Blocks Items Were Contacted and Number of Children Recalling Each Item

Beach	M	Recall Period: Immed. (n=11)	Recall Period: Delay (n=11)	Non-Beach	M	Recall Period: Immed. (n=10)	Recall Period: Delay (n=9)
Truck	3.8	7	8	Airplane	1.8	4	2
Boat	2.5	7	6	Lego	.8	3	1
Ball	3.4	4	3	Bear	1.0	5	4
Bucket	3.1	2	4	Whistle	2.6	2	3
Swimsuit	1.0	2	4	Purse	3.1	2	1
Swim fins	2.4	8	7	Pants	1.7	6	2
Sunglasses	4.2	4	4	Shoes	.1	6	5
Towel	2.7	5	3	Dress	.9	8	5
Barbeque	5.1	3	3	Icebox	12.5	8	7
Soda	3.7	4	6	Eggs	2.6	1	1
Chips	5.6	3	5	Pie	2.6	3	2
Hamburger	3.9	2	1	Milk	2.8	4	3

Table 19

Intercorrelation Matrix for the Remember Group

	AGE	SEX	PL.NVD	L.NVD	C.NVD	V.NVD	PA.NVD	O.NVD	NAMED	COMNAMED	PA.COMGD	COMPL.O	ENCOUR
AGE	1.000	-.043	.050	-.090	-.070	.130	-.104	.028	-.159	.010	.126	.017	-.256
SEX	-.043	1.000	.053	-.258	-.076	.249	-.151	-.155	.155	-.034	.071	.096	.165
PL.NVD	.050	.053	1.000	.539	.648	-.275	-.356	-.176	-.033	.963	.320	.931	-.004
L.NVD	-.090	-.258	.539	1.000	.631	-.189	-.151	-.106	-.079	.589	.334	.297	.032
C.NVD	-.070	-.076	.648	.631	1.000	-.193	-.269	-.145	-.033	.727	.194	.557	.223
V.NVD	.130	.249	-.275	-.189	-.193	1.000	-.051	-.389	-.294	-.269	-.183	-.265	-.005
PA.NVD	-.104	-.151	-.356	-.151	-.269	-.051	1.000	-.597	.075	-.352	-.036	-.354	.196
O.NVD	.028	-.155	-.176	-.106	-.145	-.389	-.597	1.000	-.188	-.164	-.211	-.138	-.289
NAMED	-.159	.155	-.033	-.079	-.033	-.294	.075	-.188	1.000	-.044	.409	-.052	.287
COMNAMED	.010	-.034	.963	.589	.727	-.269	-.352	-.164	-.044	1.000	.133	.940	-.104
PA.COMGD	.126	.071	.320	.334	.194	-.183	-.036	-.211	.409	.133	1.000	.021	.497
COMPL.O	.017	.096	.931	.297	.557	-.245	-.354	-.138	-.052	.940	.021	1.000	-.119
ENCOUR	-.256	.165	-.004	.032	.223	-.005	.196	-.289	.287	-.104	.497	-.119	1.000
AVOID	-.016	.035	-.086	-.134	-.295	-.249	.026	.003	.691	-.207	.577	-.174	.446
NREM	-.118	.213	.207	.041	.063	-.008	.041	-.231	.234	.034	.638	.056	.621
NREMB	.215	-.340	-.065	-.101	-.222	-.138	.201	.051	-.121	-.157	.182	-.132	.201
REMFUNC	-.132	.283	-.017	.285	.233	.229	-.129	.028	-.342	.021	-.134	-.069	.039
RECALL1	-.189	.372	-.139	-.136	-.116	.038	.203	-.295	.466	-.197	.231	-.176	.220
RECALL2	-.137	.258	.146	.050	-.092	-.104	.131	-.273	.369	.050	.361	.065	.136

	AVOID	NREM	NREMB	REMFUNC	RECALL1	RECALL2
AGE	-.016	-.118	.215	-.132	-.189	-.137
SEX	.035	.213	-.340	.283	.372	.258
PL.NVD	-.086	.207	-.065	-.017	-.139	.146
L.NVD	-.134	.041	-.101	.285	-.136	.050
C.NVD	-.295	.063	-.222	.233	-.116	-.092
V.NVD	-.249	-.008	-.138	.229	.038	-.104
PA.NVD	.026	.041	.201	-.129	.203	.131
O.NVD	.003	-.231	.051	.028	-.295	-.273
NAMED	.691	.234	-.121	-.342	.466	.369
COMNAMED	-.207	.034	-.157	.021	-.197	.050
PA.COMGD	.577	.638	.182	-.134	.231	.361
COMPL.O	-.174	.054	-.132	-.069	-.176	.065
ENCOUR	.446	.621	.201	.039	.220	.136
AVOID	1.000	.493	.071	-.223	.400	.416
NREM	.498	1.000	-.033	-.109	.243	.175
NREMB	.071	-.033	1.000	-.355	-.034	.261
REMFUNC	-.223	-.109	-.355	1.000	.149	.060
RECALL1	.400	.243	-.034	.149	1.000	.759
RECALL2	.416	.175	.261	.060	.759	1.000

Table 20

Intercorrelation Matrix for the Play Group

	AGE	SEX	PL.NVD	L.NVD	C.NVD	V.NVD	PA.NVD	O.NVD	NAMED	CONNAMED	PA.CONGD	COMPL.O	ENCOUR
AGE	1.000	.210	.011	.204	.026	-.379	-.207	-.185	.222	.182	.	.115	-.040
SEX	.210	1.000	.300	-.271	.287	-.328	-.497	-.254	.097	-.144	.	.168	-.302
PL.NVD	.011	.300	1.000	-.398	-.605	-.419	-.521	-.047	.138	.077	.	.076	-.356
L.NVD	.204	-.271	-.398	1.000	.121	-.151	-.117	-.075	-.164	-.202	.	-.185	-.197
C.NVD	.026	.287	-.605	.121	1.000	-.015	-.070	-.165	-.322	-.279	.	-.125	-.063
V.NVD	-.379	-.328	-.419	-.151	-.015	1.000	.577	-.139	-.160	-.108	.	-.217	.372
PA.NVD	-.207	-.497	-.521	-.117	-.070	.577	1.000	.418	-.201	-.166	.	-.248	.815
O.NVD	-.185	-.254	-.047	-.075	-.165	-.139	.418	1.000	-.075	-.072	.	-.092	.459
NAMED	.222	.097	.138	-.164	-.322	-.160	-.201	-.075	1.000	.740	.	.404	-.163
CONNAMED	.182	-.144	.077	-.202	-.279	-.108	-.166	-.072	.740	1.000	.	.330	-.156
PA.CONGD	.	.	.	.	.	.	.	.	.	.	1.000	.	.
COMPL.O	.115	.168	.076	-.185	-.125	-.217	-.248	-.092	.404	.330	.	1.000	-.171
ENCOUR	-.040	-.302	-.356	-.197	-.063	.372	.815	.459	-.163	-.156	.	-.171	1.000
AVOID	.033	-.129	.011	-.214	-.274	-.125	.377	.481	.129	-.054	.	.458	.541
NEEDPLAY	-.130	-.256	-.109	-.296	-.134	.076	.634	.699	-.205	-.212	.	.022	.746
DIVERSE	.350	.453	-.268	.051	.516	-.015	-.358	-.321	.157	.146	.	.211	-.155
RECALL1	.511	-.004	.073	.035	-.069	-.322	-.051	.085	.284	.197	.	-.015	.134
RECALL2	.575	-.070	.038	.109	.062	-.418	-.211	-.053	.259	.315	.	.038	-.174

	AVOID	NEEDPLAY	DIVERSE	RECALL1	RECALL2
AGE	.033	-.130	.350	.511	.575
SEX	-.129	-.256	.453	-.004	-.070
PL.NVD	.011	-.109	-.268	.073	.038
L.NVD	-.214	-.296	.051	.035	.109
C.NVD	-.274	-.134	.516	-.069	.062
V.NVD	-.125	.076	-.015	-.322	-.418
PA.NVD	.377	.634	-.358	-.051	-.211
O.NVD	.481	.699	-.321	.085	-.053
NAMED	.129	-.205	.157	.284	.259
CONNAMED	-.054	-.212	.146	.197	.315
PA.CONGD	.	.	.	.	.
COMPL.O	.458	.022	.211	-.015	.038
ENCOUR	.541	.746	-.155	.134	-.174
AVOID	1.000	.676	-.305	.393	.047
NEEDPLAY	.676	1.000	-.299	.177	-.158
DIVERSE	-.305	-.299	1.000	.211	.332
RECALL1	.393	.177	.211	1.000	.764
RECALL2	.047	-.158	.332	.764	1.000

Table 21

Intercorrelation Matrix for All Children

	AGE	SEX	PL.NVD	L.NVD	C.NVD	V.NVD	PA.NVD	O.NVD	NAMED	COMNAMED	PA.COMGD	COMPL.D	ENCOUR
AGE	1.000	.081	-.083	.056	-.075	.073	-.031	.054	-.033	.093	.123	.056	-.140
SEX	.081	1.000	.117	-.197	.126	.111	-.183	-.104	.121	-.085	.055	.129	.058
PL.NVD	-.083	.117	1.000	.170	.260	-.434	-.608	-.278	-.264	.169	-.160	.221	-.284
L.NVD	.056	-.197	.170	1.000	.397	-.245	-.318	-.159	-.201	-.084	-.104	-.063	-.181
C.NVD	-.075	.126	.260	.397	1.000	-.300	-.425	-.228	-.279	-.074	-.164	.031	-.172
V.NVD	.073	.111	-.434	-.245	-.300	1.000	.251	-.197	-.097	-.180	-.031	-.212	.141
PA.NVD	-.031	-.183	-.608	-.318	-.425	.251	1.000	-.241	.243	-.215	.145	-.277	.376
O.NVD	.054	-.104	-.278	-.159	-.228	-.197	-.241	1.000	-.055	-.108	-.099	-.113	-.157
NAMED	-.033	.121	-.264	-.201	-.279	-.097	.243	-.055	1.000	.073	.463	-.001	.337
COMNAMED	.093	-.085	.169	-.084	-.074	-.180	-.215	-.108	.073	1.000	.103	.659	-.090
PA.COMGD	.123	.055	-.160	-.104	-.164	-.031	.145	-.099	.463	.103	1.000	.001	.522
COMPL.D	.056	.129	.221	-.063	.031	-.212	-.277	-.113	-.001	.659	.001	1.000	-.125
ENCOUR	-.140	.058	-.284	-.181	-.172	.141	.376	-.157	.337	-.090	.522	-.125	1.000
AVOID	.009	-.042	-.023	-.145	-.182	-.174	.108	.017	.491	-.137	.413	.113	.406
GOAL	-.124	-.022	.772	.471	.652	-.416	-.576	-.310	-.353	-.029	-.296	.047	-.293
RECALL1	.212	.164	-.167	-.096	-.202	.060	.214	-.095	.382	.019	.203	-.097	.218
RECALL2	.268	.081	-.178	-.056	-.155	-.013	.167	-.072	.339	.188	.290	.035	.122

	AVOID	GOAL	RECALL1	RECALL2
AGE	.009	-.124	.212	.268
SEX	-.042	-.022	.164	.081
PL.NVD	-.023	.772	-.167	-.178
L.NVD	-.145	.471	-.096	-.056
C.NVD	-.182	.652	-.202	-.155
V.NVD	-.174	-.416	.060	-.013
PA.NVD	.108	-.576	.214	.167
O.NVD	.017	-.310	-.095	-.072
NAMED	.491	-.353	.382	.339
COMNAMED	-.137	-.029	.019	.188
PA.COMGD	.413	-.296	.203	.290
COMPL.D	.113	.047	-.097	.035
ENCOUR	.406	-.293	.218	.122
AVOID	1.000	-.017	.384	.214
GOAL	-.017	1.000	-.234	-.277
RECALL1	.384	-.234	1.000	.777
RECALL2	.214	-.277	.777	1.000

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