Children's awareness of the interaction of person, task and strategy variables in memory and communication

Gordana Miletić
Iowa State University

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CHILDREN'S AWARENESS OF THE INTERACTION OF PERSON, TASK AND STRATEGY VARIABLES IN MEMORY AND COMMUNICATION

Iowa State University
Ph.D. 1985

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106
Children's awareness of the interaction of person, task and strategy variables in memory and communication

by

Gordana Miletic

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

Major: Child Development

Approved:

In Charge of Major Work

For the Major Department

For the Graduate College

Iowa State University
Ames, Iowa
1985
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INTRODUCTION

Flavell (1976) has defined metacognition as thinking that takes any sort of cognitive process or product as its object. If the object in question is memory, such metacognition is referred to as metamemory. Similarly, if the object in question is communication, such metacognition is referred to as metacommunication.

Most studies dealing with metamemory in children have attempted to answer what appears to be a central question concerning metamemory: "What might a person conceivably come to know, or know how to find out, concerning memory as a function of cognitive growth and learning, experience?" (Flavell and Wellman, 1977, p. 6). Flavell and Wellman (1977), in an attempt to answer such a question, have proposed two basic types of knowledge the child has to acquire. A child should learn which situations do and which situations do not call for intentional memory-related behaviors. This type of learning constitutes what Flavell and Wellman call the 'sensitivity' category. A child should also learn about the major variables that influence memory performance, such as who is doing the memorizing (Person), what is to be remembered (Task), and how to memorize (Strategy). This type of learning forms the 'variable' category.

Flavell (1976) has attempted to apply these basic ideas relevant to the development of metamemory to the area of communication, suggesting deep commonalities among the two cognitive phenomena. He has suggested that the observed difficulties children have in the area of communication (research in general shows that children
have problems when communicating, Glucksberg, Krauss and Higgins, 1975), result from children's lack of understanding of the knowledge which constitutes the sensitivity and variable categories.

Many researchers have investigated the effects of person, task and strategy variables on memory behaviors. The main concern, however, has been on studying the effects of these variables separately. Only recently Wellman (1978) and Wellman, Collins and Glieberman (1981) attempted to look more directly at children's knowledge of the interactions among these variables. However, these studies only investigated the combined effect of either person and task variables, person and strategy variables or task and strategy variables. To date, three-way interactions of these variables have not been examined. Research related to children's understanding of the combined effects of person, task and strategy variables on communicative behaviors has not been done as well. Furthermore, research attempting to look at the possible commonalities among cognitive phenomena in general and memory and communication in particular, in relation to the variable category, is limited to a study by Yussen and Bird (1979).

The purpose of this study was: (1) to look at children's understanding of the combined effects of person, task and strategy variables on memory and communicative behaviors (both two-way and three-way interactions were considered), and (2) to assess whether or not children's understanding follows the same pattern of development across the two cognitive domains: memory and communication.
REVIEW OF THE LITERATURE

Metamemory

Flavell and Wellman (1977) in an attempt to answer a developmentally very important question—What are the different types of knowledge that a child needs to acquire about memory?—have proposed two such categories of knowledge. A child should learn which situations do and which situations do not call for intentional memory-related behaviors. This constitutes the sensitivity category. A child should also learn about the major variables that influence memory performance: person, task and strategy. The person, task and strategy variables form the variables category. Since the purpose of this study was to look at the variable category and not the sensitivity category, only the former will be discussed.

Many researchers have investigated the effects of person, task and strategy variables on memory behavior, however, the main concern has been on studying separately the effects of these variables.

The person variable refers to knowledge of oneself and others as memorizers. Two related types of knowledge in the person category are (1) general previously-acquired knowledge about the properties of self and others (an individual, through experience, may realize that he is good in remembering faces of the people but not their names), and (2) ability to interpret concrete experiences in the here-and-now (an individual can learn to read his own memory states).

In the case of general properties, it was found that older children are more aware of their own memory abilities and limitations than the younger ones (Brown, 1978; Flavell, Friedrichs and Hoyt,
Flavell et al. (1970) asked children to predict how many objects they would be able to recall in correct serial order, and immediately tested them to do so. Younger children, 4 to 6-year-olds, predicted 'unrealistically' the number of pictures they could recall, while older children, 7 and 8-year-olds were able to predict more accurately their capabilities.

Brown (1978) also found that young children's estimates are often unstable and inconsistent, e.g. estimating that they can recall 6 items, cannot recall 7, but can recall 8 or 9, etc.

Markman (1977) tested 5-year-olds on a task similar to Flavell et al. (1970) and found that children of this age: (1) are very unrealistic in predicting their own recall, (2) can predict their ability to perform a certain task (distance they can jump) more accurately than their ability to recall, (3) can predict other's ability to recall with the same accuracy as their own and (4) understand that older subjects can recall more than younger ones.

The major contribution to understanding many aspects of the development of metamemory, including person variables, was done by Kreutzer et al. (1975). In the study, twenty children at each of the grades K, 1, 3 and 5 were tested on 14 different tasks dealing with the problems of retrieval or preparation for future retrieval. Data relevant to person variables show that older children were better in understanding that memory abilities vary from one situation to another within the same individual, that older children can recall better than younger ones, that older children will study
differently in preparation for future recall than younger ones, and that briefly presented information is subject to rapid memory loss.

In the case of here-and-now memory, studies show that older children are again more aware of their memory states.

Children in the study by Flavell et al. (1970) were asked to carefully study a set of items. After they had signaled their readiness to recall them, they were immediately tested. It was found that 4- to 6-year-olds were less proficient at estimating their readiness for recall than 9 and 10-year-olds. Younger children signaled to be ready before time.

Yussen and Levy (1975) exposed preschoolers to practice trials before asking them to predict their ability to recall and found no improvements. The authors "were amazed by the several preschoolers who actually predicted that they could recall 9 or 10 items after just being shown they could not recall this many in the...practice sequence" (p. 507). However, there is some evidence that shows that younger subjects (5-year-olds) have at least some awareness of how well they have done on a retrieval test (Moynahan, 1973). In this study, for example, 5-year-olds realized easily which items they recalled and which ones they missed, when shown the entire set afterwards. On the other hand, when asked to assess their readiness to recall, younger subjects were very poor in comparison to older ones.

Knowledge of task demands understanding of things, such as knowing that tasks that are familiar to the subject, or have some
meaning to him, will be easier to store and retrieve; tasks that are related in some logical or causal way will be easier to recall since one item may cause the recall of another; longer tasks are harder to recall than shorter.

Research shows that 9- and 11-year-olds are better than 5- and 7-year-olds in realizing the above variables, however, even the younger subjects, the 6- and 7-year-olds were aware of some of the above variables (Kreutzer et al., 1975; Moynahan, 1973).

Kreutzer et al. (1975) tested 6-, 7-, 9-, and 11-year-olds on various tasks. On one task children were presented with a list of words (bed, tie, shoes) and then they were told a story which contained those words (A man gets up out of bed, and gets dressed putting on his best tie and shoes). The children were then asked if the story presentation would make it easier or harder for a child of their age to remember the pictures and why. Older children agreed more often than younger that the story presentation would help a child remember the words easier. The reasoning they gave was "intelligible" and "appropriate."

In another task, Kreutzer et al. (1975) presented children with sets of words and told them "These words are opposites, boy goes with girl, hard goes with easy, cry goes with laugh, and black goes with white. These other words are people and things they might do, so Mary goes with walk, Charley goes with jump, Joe goes with climb and Anne goes with sit." The children were asked which sets of words would be easier to remember and why. Most 6- and 7-year-olds did
not see that the "pairs of opposites" will be easier to learn; the 9- and 11-year-olds realized this and could also explain why.

In still another task, however, Kreutzer et al. (1975) presented 6- and 7-year-olds with twenty pictures and asked them who can remember the pictures better—a child that studies them for one minute or a child that studies them for five minutes. Almost half of the 6-year-olds and almost all the 7-year-olds realized that studying for five minutes has to be more effective. Thus, younger children are aware of at least some of the variables that can help in remembering a certain task.

Under the strategy variable a child should learn about different memory strategies that can help recall. A child can mentally elaborate upon the material to be retrieved, e.g., using rehearsal (keep repeating the items that need to be remembered) and/or grouping (try to organize the items that have something in common into the smaller categories: apple, banana, and pear belong to the fruit category). A child can also help recall by making notes, using photographs or using other external cues. Research shows that younger as well as older children tend to use external over internal resources (Kreutzer et al., 1975).

Flavell, Beach and Chimsky (1966) tested rehearsal strategies of 5-, 7- and 10-year-olds and found that 5-year-olds do not rehearse, that 7-year-olds rehearse irregularly and that only 10-year-olds used rehearsal more regularly. Moely, Olson, Halwes and Flavell (1969) obtained similar results when looking at children's grouping abilities.

Kreutzer et al. (1975) used different tasks to test preparation strategies of children. In one of the preparation tasks, a child had
to imagine that he is going ice skating, and was asked to tell what he would do to make sure he would not forget his skates. Data show that children of all grade levels tried to help themselves by using external sources, e.g. asking mother to remind them, writing a note, leaving the skates by the door. The children would speak less of internal sources such as thinking about the skates the night before, or rehearsing things that have to be done that morning.

Kreutzer et al. (1975) also tested children's knowledge on retrieval strategies. Children were asked to imagine that they lost a jacket at school and now had to think of all the possible ways that would help to find it. As expected, the older children could think of a greater number of different retrieval strategies than the younger ones. While younger children did think of some good strategies (e.g. asking others for help, try the school's Lost and Found), older children thought of more elaborate strategies such as: 'First I'd do X, and if I didn't find it there, then I'd look in Y.'

On another Kreutzer et al. (1975) retrieval strategy task, a child was told: 'Suppose your friend has a dog and you ask him how old his dog is. He tells you he got his dog as a puppy one Christmas but can't remember which Christmas. What things could he do to help him remember which Christmas he got his dog? Anything else he could do? (p. 36). According to the authors, 6-year-olds probably did not understand the problem thus could not solve it; 7-year-olds often mentioned asking adults for help (relying on external sources),
while 11-year-olds were able to think of internal strategies as: 'try to remember things associated with dog's arrival, try to remember some of the toys he got the same Christmas.'

While the above studies all focus on a single variable category (person or task or strategy), only a few researchers have attempted to investigate children's knowledge of the combined effects of various person, task and strategy variables. The questions to be asked are: (1) To what extent is a child aware that, depending on who is storing, something is easily retrievable and something is not (Person X Task); (2) that use of strategy variables should depend on the nature of the task (Strategy X Task); (3) that some individuals prefer one strategy to another (Person X Strategy); and (4) that strategic behavior needs to be related to both person and task (Strategy X Person X Task).

Kreutzer et al. (1975) have some indirect evidence supporting children's understanding of this interaction of variables. Twenty children at each of grades k, 1, 3 and 5 were tested with 20 stimuli. Drawings of common objects such as stove, chair, fish etc. were used. The testing procedure consisted of presenting a child with the following paragraph: 'The other day I asked two children to look at and learn some pictures (gestures at the pictures) because I wanted to see how well they could remember. I asked them how much time they would like to learn the pictures before I would take them away and ask them how many they could remember. One child said 1 minute. The other child said a longer time, 5 minutes. (1) Why do you think he wanted as long as 5 minutes? (2) Which child remembered the most, the one who studied
1 minute, or the one who studied 5 minutes? (3) Why? (4) And what would you do, study 5 minutes or 1 minute? (5) Why?' (p. 18). Results show that the majority of subjects at each grade level thought that the child who studied for 5 minutes would remember more than a child who studied for 1 minute. Furthermore, they stated that they themselves would study 5 minutes rather than 1 minute. When asked why, one half of the kindergarteners and all the 1, 3 and 5 graders were able to give 'intelligible' and 'appropriate' explanations. Such findings indicate an understanding that the two variables, number of pictures to be remembered (task), and amount of studying time (strategy) taken jointly determine success.

Flavell et al. (1970) failed to find any indications of such understanding with their young subjects. Subjects consisted of 4-, 6-, 9- and 10-year-old children. Children were asked to study carefully different-length series of pictures. The series consisted of 3 to 10 familiar objects such as houses, blocks, scissors etc. After children had signaled their readiness to recall the list, they were tested immediately. Results show that 4- and 6-year-olds were less proficient at estimating their readiness to recall than 9- and 10-year-old children. In other words, younger children signaled to be ready before time, not understanding that number of items on the list does affect studying time.

There are two possible reasons for this discrepancy in the results. A first reason may be an inability to understand the instructions. Children in the Flavell et al. (1970) study were
instructed to memorize. It might be that 4- and 6-year-olds simply did not understand the instruction - memorize! Appel, Cooper, McCarrell, Sims-Knight, Yussen and Flavell, (1972) suggested that younger children usually do not understand such instructions. A second reason may be difficulty of the task. In the Flavell et al. (1970) study children were asked to memorize a list of items. In order to remember a series of object names, a child has to rely on internal cues, a task too difficult for a 4-year-old, since research shows (Kreutzer et al., 1975) that both younger and older children tend to rely on external rather than internal memory cues. In the Kreutzer et al. (1975) study, children were asked to respond to a story, a task much easier even for the 4-year-olds. However, since the initial intention of both of the studies was not to test the child's understanding of the interaction of variables, the authors suggest that the results should be interpreted with caution.

Wellman (1978) and Wellman et al. (1981) have attempted to look more directly at children's knowledge of the interaction of memory variables. Subjects for the 1978 study were 5- and 10-year old children; subjects for the 1981 study were 5-, 8-, 10- and 19-year olds. Stimuli, that consisted of drawings of familiar objects, tested children's understanding of simple variables as well as their understanding of the interaction among variables. Results of the 1978 study indicated that both 5- and 10-year-olds performed well on a simple variable situation (understanding that the number of
items make a task easier or harder and/or understanding that writing down a list of items is a better strategy than simply looking at the items); only 10-year-olds performed well on complex variable situations e.g., understanding that both variables, the number of items to be remembered and the strategy used, need to be considered. However, the younger subjects in the 1981 study were able to evaluate the difficulty of the task by looking at both variables involved, thus performing significantly better than the 5-year-olds in the 1978 study. The reason for such a discrepancy in the results, according to the authors, is due to the difficulty of the task used in the 1978 study. What seems to be indicated is that young children are not aware of their own memory abilities. The lack of this awareness can be partially attributed to the lack of knowledge that is contained under the person, task and strategy variables. For example, young children do not understand how one's memory abilities differ relative to who is doing the memorizing (person), what is to be remembered (task), and how one goes about memorizing (strategy). Furthermore, young children do not understand how these variables taken together can affect one's memory performance.

Metacommunication

Most studies dealing with communication in children focus on referential communication. Referential communication studies investigate how a child uses the language he/she possesses in order to inform another person. In the simplest referential communication situation, there are two people, namely a speaker and a listener. The role of
the speaker is to put together the message in such a way that a listener can understand what the message refers to. Most commonly, knowing what the message refers to means being able to select the intended referent (a target stimulus) from a set of nonreferents (set of nontarget, alternative stimuli). The research in general shows that children have problems when communicating, both in the role of speaker and listener (Glucksberg et al., 1975).

Flavell (1976), stating that there are deep commonalities among cognitive phenomena in general, and memory and communication in particular, attempted to explain observed children's difficulties by drawing some parallels between the two cognitive areas. Flavell (1976) proposed that the lack of knowledge contained under the two major categories, sensitivity and variable category, which weakens children's performances on memory tasks, affects children's performances on communication tasks as well. Lack of knowledge related to person, task and strategy variables affects children's performances both in the roles of speakers and listeners. Whenever engaging in conversation, an experienced speaker knows that he/she needs to take into consideration who the listener is (person variable), what it is that he/she as a speaker has to communicate to the listener (task variable) and carefully choose the best possible way to convey the message to the listener (strategy variable). An experienced listener will in return listen to the message (task variable), critically evaluate it demanding for more information when necessary (strategy variable) and always take into consideration who the speaker is
(person variable). Research, however, shows that young children when communicating engage in such activities neither as speakers nor as listeners and consequently have problems communicating (Glucksberg et al., 1975). Flavell (1976) outlined some of the knowledge a young child needs to acquire under the person, task and strategy variables in order to improve his/her communicative abilities.

In relation to the person variable, both the general previously-acquired knowledge about the properties of self and others and the ability to interpret concrete experiences in the here-and-now, relate to the area of communication.

In the case of general properties, a young child needs to learn about general abilities of both speakers and listeners. For example, he/she needs to know that all speakers and listeners have information processing biases and limitations that need to be taken into account when communicating. Thus, the same message should be presented differently to listeners of different ages and interests since this same message will be processed differently by different listeners. Conversely, a child needs to learn that the same message will be presented differently by different speakers according to their general abilities. In other words, a growing child needs to gradually develop some understanding about his abilities both as a speaker and a listener, and at the same time develop some understanding about the communicative abilities of others. Inevitably, such knowledge will influence children's communicative behaviors. Research shows that older children are more aware of the above
variables, however, there is some evidence showing that even 4-year-olds have some of the needed knowledge.

Shatz and Gelman (1973) found that 4-year-old children adjust their conversation to suit the needs of their different listeners. Four-year-old children were asked to talk to listeners who were 2-year-olds, 4-year-olds and adults. Results indicated that the speech to the 2-year-olds contained more short and simple utterances than the speech to the adults. Four-year-olds choose to talk to their peers (4-year-olds) in the same way they talked to the adults. The same findings were obtained for both structured (where a child was asked to talk about a particular toy) and spontaneous conversations (where a child was asked to talk freely about anything).

Cazden (1970) and Jakobson (1968) similarly suggested that preschoolers tend to 'talk down' to children younger than themselves.

Sonnenschein and Whitehurst (1980) found that 6-year-old children become better communicators to adults after listening to competent peers, competent adults, incompetent peers but not incompetent adults. In other words, children exposed to good adult and/or peer models tended to imitate the models. When exposed to poor peer models, children attempted to modify and improve the conversation themselves. However, when exposed to poor adult models, children failed to engage in any modifications, but simply imitated inadequate conversations. The question that arose was - Why did the children not improve their conversation after listening to incompetent adults? The obtained results could not be explained by the fact that children had forgotten
the inadequate messages of the adults, as predicted. Children recalled the uninformative adult performances as well as they recalled the uninformative peer performances. The results could also not be explained by the fact that children tend to obey adults since children were explicitly told that an adult did a poor job and shouldn't be imitated. Rather, the results were apparently due to the fact that children have different expectations of how well the different aged speakers communicate. Children expecting adults to send good messages, failed to see inadequacies in their messages, which prevented children from modifying the adults poor messages. On the other hand, children expected their peers to be capable of sending poor messages, saw them as poor, and modified them accordingly.

In the case of here-and-now, a child needs to learn to actively evaluate and monitor ongoing messages. The task of the speaker is to be sensitive to: (1) the characteristics of listeners—the message should ideally take into account who the listener is, what the listener already knows and what he/she wants to know, (2) the referent-nonreferent array—a speaker needs to provide information to a listener that discriminates between the referent and potentially confusing nonreferents, and (3) listener's feedback—if a listener indicates that he or she does not understand the message the speaker needs to modify the original message to suit the listener's needs. The task of the listener is to evaluate messages critically and ask for more information when and if necessary. Again, research shows that older children are better than younger ones in realizing
the above relationships.

Flavell, Beach and Chimsky (1966) found that young children, in the role of speakers, are not able to take into consideration who the listener is and thus fail to decode the message to suit the needs of that particular listener. What they tend to do is to confuse their own perspective with that of the listener in communication situations.

Besides not being able to take into consideration who the listener is, young children in the roles of speakers, fail to critically evaluate the message itself. Asher and Oden (1976) implied that younger children failed to engage in the comparison activity necessary for selecting messages that discriminate between referents and nonreferents. The task used consisted of presenting both the speaker and the listener with a pair of words (e.g., ocean-river). The speaker knew which word was underlined but the listener did not. The speaker's task was to provide a clue word, such as waves, so the listener could decide which was the underlined word. Young children failed to provide clues that pertained more to the referent word than to the nonreferent word. With respect to speaker's sensitivity to listener's feedback, Peterson, Danner and Flavell (1972) found that 4- and 7-year-olds reformulated their initial messages when the feedback was of an explicit, verbal nature (can you tell me anything else), but not when confronted with nonverbal expressions of noncomprehension or with implicit verbal requests. Only the 7-year-olds changed their messages in
response to an implicit verbal request (I don't understand), but even they did not react when feedback was of a nonverbal nature.

Beal and Flavell (1982) stated that poor performances of children, in the role of listener, are not due to their lack of awareness of the ambiguity of messages, but are due to "fundamental metacognitive deficits in their knowledge about the communicative process." In other words, even when being aware of the inadequacy of a message, computed response latencies were longer to ambiguous than to unambiguous messages, younger children still failed to see how such ambiguous messages can affect the success or failure of communication.

In the relation to the task variable, a young child needs to learn what makes one task easier or harder to understand when listening and explain when speaking. Research shows, however, that children have problems identifying a message as difficult both in the roles of speakers and listeners (Glucksberg et al., 1975).

Glucksberg et al. (1966) have developed a game to study communicative abilities of children which they called 'Stack the Blocks.' The purpose of the game is to build two matching stacks of blocks with the speaker providing the listener all the instructions. The major finding, obtained from a series of studies, was that pairs of nursery school children were unable to come up with the same matching stacks of blocks. The children's difficulty seemed to stem from their use of reference phrases which were idiosyncratic and not descriptive of the forms. They tended to use
private imagery rather than conventional or socially shared forms. In other words, children failed to identify who the listener is. Children did not take into consideration, for example, that terms which are so familiar to them as speakers might not be as familiar to their listeners. Furthermore, children did not take into consideration the difficulty of the task. They did not realize that since the listener cannot see the speaker's block structure the speaker needs to provide as much detailed information as possible to assure the listener will complete the task successfully.

Under the strategy variable a young child needs to learn certain strategies that will help his/her communicative behaviors both in the role of speaker and listener. As speaker, a good communicator should know how to organize and present information in order to facilitate comprehension and retention in the listener. As listener, a good communicator should know how to get the speaker to improve his/her message. Some of good speaker's strategies are: talk slowly and clearly, check with the audience whether or not a certain especially difficult concept has been understood, use visual aids such as pictures and slides, etc. Some good listener's strategies are: evaluate messages critically, ask for more information when necessary, etc.

Research shows not only that young children do not engage in any of the above activities, but in what appears to be an even more serious problem, they are not even aware that such activities
Several attempts have been made to train children to improve their communicative abilities. In the role of speakers, children were trained to organize and present information by taking into consideration both the nature of the message itself and the various needs of listeners. In the role of listeners, children were trained to evaluate messages critically and were encouraged to ask for more information if and when necessary. A typical experimental procedure used in many training studies was to expose a child to 'appropriate means of communication' through various training and/or modeling techniques. The hypotheses tested explored whether or not children would respond to such training.

Shantz and Wilson (1972) trained 24 7-year-old boys and girls on tasks which required a speaker to send a complete message so the listener could replicate a design and to send a limited but useful message so the listener could recognize the design. Each child took the roles of both speaker and listener and was trained on both tasks. When compared to subjects in the control group, trained subjects at posttesting gave significantly more useful information and had better overall evaluation of messages.

Lempers and Miletic (1983) have used various training strategies involving modeling to train children's performances as listeners. The results indicated that the listener skills of the 5-year-olds were not changed by such training. The training, however, proved to be both successful and long-lasting for 7-year-
olds (children were retested one month after originally trained). Similar findings have been obtained by others (Patterson, Massad and Cosgrove, 1978).

With respect to metacommunication, research indicates that young children are not aware of their own communicative abilities. This is partially due to their lack of knowledge that is contained under the person (who is communicating), task (what is to be communicated), and strategy (how one goes about communicating) variables. It seem obvious that the above variables considered separately and in combination affect one’s ability to communicate. However, research related to the combined effects of person, task and strategy variables on communicative behaviors of children has not been done.

Metamemory and Metacommunication

Research attempting to look at the possible relationships between metamemory and metacommunication, in relation to the variables category, is limited to a study by Yussen and Bird (1979). Yussen and Bird (1979) tested performances of 4- and 6-year-old children across three cognitive areas: memory, communication and attention. Under each cognitive area children's knowledge of four variables was assessed: (1) length—understanding that a longer list of items is more difficult to work with than a shorter list, (2) noise—understanding that noise interferes with performance, (3) time—understanding that shorter time vs. longer time available to finish a task will affect performance and (4) age—understanding
that older children tend to perform better on tasks than younger ones. The purpose was to see whether or not the same pattern of reasoning would be evident across all three cognitive areas. The results obtained suggested notable parallels in the performances across the 3 cognitive areas on all the four variables tested. Questions related to the variables of length and noise were easier than the questions related to the variables of age and time for both 4- and 6-year-olds. Performances of 6-year-olds were better than the performances of 4-year-olds on all of the tasks.

The study, however, looked only at the performances of the children in relation to the separate effects of person, task and strategy variables. The interesting question remains as to whether or not the same results would be obtained when understanding of combined effects of person, task and strategy variables would be assessed.

One of the purposes of the present study was to look at children's knowledge of the interaction of person, task and strategy variables in relation to memory and communicative behaviors of children. Both two-way and three-way interactions were considered. The questions that were asked were: (1) when is a child aware of such interactions; (2) to what extent is understanding of the independent effects of person, task and strategy variables necessary for understanding of the interactions among those variables and (3) do children first learn that more than one variable needs to be taken into consideration to solve the problem and only later
understand how those variables interact and affect one's cognitive ability or are those concepts acquired at the same time.

The second purpose of the present study was to assess whether or not children's understanding of the variable category follows the same pattern of development across the two cognitive domains of memory and communication.
METHODOLOGY

Subjects

Subjects for the study were 18 nursery school children ranging in age from 4 years and 1 month to 4 years and 7 months with a mean age of 4.4 years; 18 kindergarteners ranging in age from 5 years and 1 month to 5 years and 10 months with a mean age of 5.6 years; and 18 first graders ranging in age from 7 years and 1 month to 7 years and 9 months with a mean age of 7.4 years.

There were 10 boys and 8 girls in the nursery school group, 9 boys and 9 girls in the kindergartener group and 9 boys and 9 girls in the first grader group.

The nursery school was run by the YWCA (Young Women's Christian Association) while kindergarteners and first graders attended Airlawn Public School. The schools are located in Chevy Chase and Bethesda, Maryland which are both predominantly white upper middle-class suburbs of Washington, D.C.

Criteria for the selection of children to be included in the study were: (1) each subject had to be between the ages of 4 years, 1 month and 7 years, 11 months; (2) each subject had to demonstrate complete understanding of the 'Recall task' and the 'Practice task.'

Stimuli

Two sets of three different picture cards each served as stimuli for the Recall task. The picture cards for the first Recall set had the drawings of a candle, a lamp and a cup. The picture cards for the second Recall set had the drawings of a flower, an apple and
an ice-cream.

Two sets of three different picture cards each served as stimuli for the Practice task. The two Practice sets used depicted the following situation: Set 1 - One card of a girl with a fence taller than herself to jump over, one card of a girl with an ankle-high fence to jump over and one card of a girl with a medium size fence to jump over. Set 2 - One card of a boy lifting a large a large box, one card of a boy lifting a small box and one card of a boy lifting a medium size box.

The testing stimuli consisted of two groups: the first group contained 12 sets of three different picture cards and the second group contained 2 sets of 4 different picture cards. Pictures were hand drawings of people (woman, man, girl, boy) doings things such as reading, looking, writing, etc. Six sets of the first group were used to test condition 1 (judging the separate effect of person, task and strategy variables). The six remaining testing sets were used to test condition 2 (judging the interaction effect between two variables e.g., person X task, person X strategy and strategy X task). The second part contained 2 sets of four different picture cards and was used to test condition 3 (judging the three way interaction of the variables e.g., person X task X strategy). One example of each condition is given: Condition 1 - set related to person variable: One card of a woman with a story to remember/communicate, one card of a girl with a story to remember/communicate and one card of a baby girl with a story to remember/communicate. Condition 2 - set related to person X strategy interaction: One
card of a woman with 18 items to remember/communicate who writes the items down, one card with a woman with 18 items to remember/communicate who looks at the items and one card of a girl with 18 items to remember/communicate who writes the items down.

3 - set related to person X task X strategy interaction: One card of a woman with 9 items to remember/communicate who writes the items down, one card of a woman with 18 items to remember/communicate who writes the items down, one card of woman with 9 items to remember/communicate who only looks at the items and one card of a girl with 9 items to remember/communicate who writes the items down (Appendix A).

Procedure

Testing was done in a room furnished with a table, two chairs and a tape recorder. Children were brought individually to the room from their classrooms and were told that they would be playing a game. In the room, a child and the experimenter were seated at the table next to each other. On the table in front of the experimenter were 2 sets of picture cards needed for the Recall task, 2 sets of picture cards needed for practice trials and 14 sets of picture cards need for testing, all stacked on top of each other in rows. Also in front of the experimenter was a notebook for recording the answers, and the cards with the questions to be asked.

First a child was asked to do the Recall task. The two Recall sets of three different picture cards were used. When set one was shown, a child was told: 'look at these pictures carefully so later
you can tell me the names of these pictures from memory." Then, the set was described for a child as: "This is a picture of a candle, this of a lamp and this of a cup" (point to the pictures). After the pictures were described, the pictures were removed and the child was asked: "Tell me the names of those pictures from memory?" When the second set was shown, a child was told: "Look at these pictures carefully so later you can tell me what you have seen." Then, the second set was described for a child as: "This is a picture of a flower, this of an apple and this of an ice cream." Each time the picture card was described the experimenter pointed to it. After the pictures were removed, the child was asked: "Tell me what you have seen?" The procedure was repeated once more when and if necessary. Only children that were able to understand and perform well on both sets of the Recall task were tested further. The specific purpose of the Recall task was to see whether or not children understood the instructions "to tell from memory" and "to tell to someone."

For the practice trials, the two Practice sets of three different picture cards were used. A child was told: "Each of these cards have a boy or a girl (point to them) on them. They have to do something, just like you had to remember and tell what was on the pictures before." Then each set was described for a child. For example, when set 1 was shown a child was told: "This is about a girl who had to jump a fence. Once she had to fence a wall which was bigger than herself, once she had to jump a fence which was coming to her ankles and once she had to jump a fence which was
coming to her waist. Which fence was the easiest to jump and why?" When set 2 was shown, a child was told: "This is about a boy who had to lift a box. Once he had to lift a small box, once he had to lift medium size box and once he had to lift a large box. Which box do you think it was easiest to lift and why?" Each time the picture card was described the experimenter pointed to it. The procedure was repeated once more if and when necessary and only children that performed well (responded correctly to both of the sets) were tested further. The purpose of the practice stimuli was to introduce children to the test tasks and to prepare them to make judgments in terms of difficulty.

Following the practice trial, a child was introduced to the testing phase as follows: "Each of these cards (point to the testing stimuli) also have people on them that have to remember/tell something, just like you had to remember/tell those pictures before. Let's see for whom of those people it is the easiest to remember/tell what they have seen on the pictures?" The same stimuli were used for metamemory and metacommunication tasks in order to assure constancy among variables in terms of difficulty. The child, however, was asked to respond to the stimuli differently. In relation to metamemory, a child was asked to respond to such questions as: Which things are easier to remember? Who has more problems remembering baby boy/baby girl, boy/girl, man/woman? Who has more problems remembering, a man who looks at 18 things or a boy who writes them down? Who has more problems remembering, a woman who has to remember 9 things and writes them down, a woman
who has to remember 18 things and writes them down, a woman who has to remember 9 things and only looks at them or a girl who has to remember 9 things and she writes them down?, etc. In relation to metacommunication, a child was asked to respond to the same questions. The only difference, however, was in substituting the verb 'to remember' with the verb 'to tell' e.g., Who has more problems telling 18 things to a friend, a man who looks at them or a boy who writes them down?

Fourteen sets were presented to a child and each set was described. For example, description for set 1 condition 1 was: 'This is about a man who had 9 things to remember/tell to a friend, a baby-boy who also had 9 things to remember/tell to a friend and a boy who also had 9 things to remember/tell to a friend. For whom do you think it was easier to remember/tell those things, for a man, a baby-boy or a boy and why?' Description for set 1 condition 2 was: 'This is about a girl who had 18 things to remember/tell to her friend and who wrote the things down, a girl who had 9 things to remember/tell to her friend and who looked at the things and a girl who had 9 things to remember/tell to a friend and wrote the things down. For which of these girls do you think it was easier to remember/tell to a friend things and why?' Description for set 1 condition 3 was: 'This is about a woman who had 9 things to remember/tell to a friend and who wrote the things down, a woman who had 18 things to remember/tell to a friend and who also wrote the things down, a woman who had 9 things to remember/tell to a friend and who looked at the things and a girl who had 9 things to
remember/tell to a friend and who wrote the things down. For whom to you think was the easiest to remember/tell to a friend things and why?*

The order of the presentation of type of task (Memory vs. Communication), and of type of variable within condition (person, task, strategy and task X strategy, person X task, person X strategy) were counterbalanced by using the method of incomplete counterbalancing. The location of the correct picture card was also randomized. The order of presentation of type of condition (condition 1, condition 2, condition 3) was kept constant.

Responses recorded by the experimenter were both the chosen picture card and the explanation given by a child as to why that particular card had been chosen. Therefore, both the chosen picture card and the explanation given by a child constituted the dependent measures.

Children's responses were scored by two judges and an agreement of 100% was obtained for both the number of correct choices and the number of correct explanations. The correct score was defined relative to adult judgements: more items were judged to increase the difficulty of a task, writing the items down was considered a better strategy than just looking, two difficult attributes (more items and looking) made a task harder than a difficult and an easy attribute (looking and fewer items), three difficult attributes (more items, looking and younger person) made a task harder than two difficult and one easy attribute (more items, looking and older person), etc.

In relation to the person variable all answers given by children
that described a woman on the pictures as a mother, teacher, grown-up, etc., and a man as a father, teacher, grown-up, etc., were taken as correct. The explanation for these answers was that young children in general tend to see parents, teachers and grown-ups as more knowledgeable than themselves.

For each of the dependent measures, a child was assigned a score ranging from zero to two; zero signifying no correct responses, one signifying one correct response and two signifying two correct responses were given by a child. Thus, the total score a child could get on each of the dependent measures ranged from 0 to 14 for both cognitive domains.

Data analysis was not done with individual person, task, strategy and/or person x task, task x strategy, person x strategy variables. Rather, summary variables were derived by summing the individual variables together. For example, a summary variable for Condition 1 was the sum of person + strategy + task variables, similarly, summary variables for Condition 2 was the sum of person x task + task x strategy + person x strategy variables. Since Condition 3 consisted of only one combination of variables person x task x strategy, summary variable was derived by multiplying the combination three times. This way, all three conditions were given equal weights.
RESULTS

A 3 (Age) X 2 (Sex) X 2 (Cognitive Domain) X 3 (Condition) analysis of variance with repeated measures on the cognitive domain and condition variables was performed.

No significant main effect for sex was found. This was true for both dependent measures: (1) number of correct choices, $F(1,48) = .14, p<.71$ and (2) number of correct explanations, $F(1,48) = .01, p<.92$.

No significant main effect involving domain was found. This was true for both dependent measures: (1) number of correct choices, $F(1,48) = .27, p<.61$ and (2) number of correct explanations, $F(1,48) = 3.78, p<.10$. Performances of children seemed to be the same across both memory and communication tasks. The means and standard deviations are presented in Table 1, Appendix C.

The main effect of age reached significance for both dependent measures: (1) number of correct choices, $F(2,48) = 7.77, p<.001$ and (2) number of correct explanations, $F(2,48) = 13.35, p<.0001$. Follow-up comparisons were performed on the significant effects of age using Tukey's two-tailed procedure. In relation to the number of correct choices, it was found that the 7-year-olds had higher scores than the 4-year-olds ($p<.01$), and that the 5-year-olds had higher scores than the 4-year-olds ($p<.05$). The performances of the 7-year-olds were not significantly different from the performances of the 5-year-olds. In relation to the number of correct explanations, it was found that the 7-year-olds had higher scores than the 4-year-olds ($p<.001$), and that
the 5-year-olds had higher scores than the 4-year-olds (p < .001). Performances of the 5- and 7-year-olds did not differ significantly.

The main effect of condition was significant for both dependent measures: (1) number of correct choices, $F(2, 96) = 9.54$, p < .001, and (2) number of correct explanations, $F(2, 96) = 24.58$, p < .0001. Followup comparisons were performed on the significant effect of condition using Tukey's procedure. In relation to the number of correct choices it was indicated that condition 3 was significantly more difficult than condition 1 (p < .01). However, condition 3 was not more difficult than condition 2, and condition 2 was not more difficult than condition 1. In relation to the number of correct explanations, it was found that condition 2 was more difficult than condition 1 (p < .01) and that condition 3 was more difficult than condition 1 (p < .001). Condition 3 was not significantly more difficult than condition 2.

The only interaction effects that reached significance were between condition and age, and between condition, age and sex. The condition and age interaction effect reached significance for both dependent measures: (1) number of correct choices, $F(4, 96) = 2.85$, p < .03 and (2) number of correct explanations, $F(4, 96) = 8.09$, p < .001.

Relative to this finding two questions were asked: (1) Did children's performances differ at each condition? and (2) Did conditions differ at each age? Tests for simple effects were used for data analysis. Furthermore, significant simple effects were analyzed by Tukey's procedure.
Looking at age differences within each condition separately, it was found that the performances of the children were different across some conditions. Performances of the 4-, 5- and 7-year-old children did not differ across condition 1. This was true for both the number of correct choices and the number of correct explanations. Performances of the children did differ across condition 2, however. This was true for both the number of correct choices ($p<.001$) and the number of correct explanations ($p<.0001$). In relation to the number of correct choices, 5-year-olds had higher scores than 4-year-olds ($p<.01$), 7-year-olds had higher scores than 4-year-olds ($p<.01$) and 5 and 7-year-olds did not differ significantly. In relation to the number of correct explanations, it was found that 5-year-olds performed better than 4-year-olds ($p<.01$), that 7-year-olds performed better than 4-year-olds ($p<.001$) and that the performances of the 7 and 5-year-olds did not differ significantly.

Children’s performances differed across condition 3 as well. This was true for both the number of correct choices ($p<.001$) and the number of correct explanations ($p<.0001$). In relation to the number of correct choices, it was found that 5-year-olds performed better than 4-year-olds ($p<.05$), that 7-year-olds performed better than 4-year-olds ($p<.01$) and that the performances of the 7-year-olds were not significantly different from the performances of the 5-year-olds. In relation to the number of correct explanations, it was found that 5-year-olds performed better than 4-year-olds ($p<.01$), that 7-year-olds performed better than 4-year-olds and that 7-year-olds performed better than 5-year-olds ($p<.05$).
Looking at condition differences within each age separately, it was indicated that conditions did differ at age 4. This was true for both the number of correction choices (p<.0001) and the number of correct explanations (p<.0001). In relation to the number of correct choices, condition 2 was more difficult than condition 1 (p<.01), condition 3 was more difficult than condition 1 (p<.001); however, conditions 2 and 3 did not differ significantly. In relation to the number of correct explanations, condition 2 was more difficult than condition 1 (p<.001), condition 3 was more difficult than condition 1 (p<.001) and conditions 2 and 3 did not differ significantly. At age 5, conditions did not differ for the number of correct choices. However, in relation to the number of correct explanations, conditions did differ (p<.001). Condition 2 was more difficult than condition 1 (p<.05) and condition 3 was more difficult than condition 1 (p<.01). Conditions 2 and 3 did not differ significantly. At age 7, conditions did not differ either in relation to the number of correct choices nor in relation to the number of correct explanations. The interaction effects are shown in Figures 1 and 2, Appendix B.

The age, condition and sex interaction effect was significant only for the number of correct choices, $F(4,96) = 3.91$, $p<.01$. The interaction effects are shown in Figure 1, Appendix D. The relatively small $F$ value might suggest that the effects of such interaction were not as strong. The means and standard deviations taken separately for boys and girls are presented in Table 2, Appendix E.
DISCUSSION

It has been suggested that young children are not aware of their own memory and communicative abilities (Flavell and Wellman, 1977). The lack of this awareness can be partially attributed to the lack of knowledge that is contained under the person, task and strategy variables. Young children do not understand how one's memory/communicative abilities differ relative to who is doing the memorizing/communicating (person variable), relative to what is to be remembered/communicated (task variable), and relative to how one goes about memorizing/communicating (strategy variable). Furthermore, young children might not be aware of how these variables taken together can affect one's cognitive performance. They might not understand how some individuals prefer one strategy to another (person and strategy), that the use of strategy variables should depend on the nature of the task (task and strategy), that the difficulty of the task changes depending who is involved with the task (person and task), and that strategic behavior needs to be related to both the person and the task (strategy and person and task).

While many researchers have investigated the individual effects of such variables on cognitive performances of children, only a few researchers have attempted to investigate children's knowledge of the combined effects of various person, task and strategy variables. Wellman (1978), and Wellman et al. (1981) looked at the children's understanding of the two-way interactions of these variables on memory behaviors. The findings of the two studies were different for the performances of the 5-year-olds. In the 1978 study, 5-year-olds did
not understand the two-way interactions, while in the 1981 study 5-year-olds understood such interactions. Thus, in order to understand better the reasoning of 5-year-olds, more research seemed necessary. Furthermore, the above studies did not look at children's understanding of the three-way interactions of the variables. Research related to children's understanding of the combined effects of person, task and strategy variables on communicative behaviors has not been done. Research attempting to look at the possible commonalities among memory and communication in relation to the variable category is limited to a study by Yussen and Bird (1979). The study, which pointed to the notable parallels in the performances of 4 and 6-year-olds across memory, communication and perception, looked only at the separate effects of the person, task and strategy variables. It seemed interesting to find out whether or not the same pattern of understanding would be obtained when understanding of the combined effects of person, task and strategy variables would be assessed.

The first purpose of the present study was to look at children's understanding of the combined effects of the person, task and strategy variables on memory and communicative behaviors. The following questions were asked: (1) When do children become aware of such interaction? (2) Is understanding of the independent effects of the person, task and strategy variables necessary for understanding the interactions among the variables? and (3) Do children first learn that more than one variable needs to be taken into consideration to solve the problem and only later understand how those variables interact and affect one's cognitive abilities, or are these concepts
acquired at the same time?

In general, performances of the 4 and 5-year-olds were better when understanding of the separate effects of person, task and strategy variables was required. In relation to condition 1, children were able to effectively choose the correct picture card as well as give an adequate explanation as to why that particular card had been chosen. This absence of significant age differences in relation to the understanding of the separate effects of the person, task and strategy variables was not surprising. Indeed, these findings confirmed previous reports. Kreutzer et al. (1975) have noted the ability of even very young children to effectively deal with problems where such knowledge was needed, even when children’s explanations about the problems were demanded. It is of interest to note that performances of 7-year-olds did not differ across the conditions and the type of responses recorded. Seven-year-olds performed at the ceiling level across all three conditions and both types of responses recorded.

Performances of the 4-year-old children differed significantly from the 5- and 7-year-olds on conditions where their knowledge of the interactions of variables was needed. In relation to condition 2, when compared to 5- and 7-year olds, 4-year-olds performed poorly across both dependent measures. They often failed to give an appropriate explanation as to why that particular card had been chosen. Five and 7-year-olds performed better across both dependent measures. They were able to correctly choose an appropriate picture card and were also able to give an adequate explanation as to why that particular card
had been chosen. It needs to be mentioned that the performances of the 7-year-olds were better than the performances of the 5-year-olds for both the measures, even though the difference between the groups was not statistically significant. It seems obvious then that the addition of an extra variable significantly affected the performances of the 4-year-olds, but not the 5 and 7-year-olds. This ability of the 5-year-olds to understand the way variables interact and affect one's cognitive performances is a major finding of the present study.

In relation to condition 3, when compared to 5- and 7-year olds, the 4-year-olds performed poorly across both dependent measures. The 5- and 7-year-olds performed well across both the measures, however, the performances of the 5- and 7-year-olds differed significantly (p<.05) in relation to the number of correct explanations. These findings seem to indicate that: (1) the addition of a third variable affected significantly only the performances of the 4-year-olds, but not those of the 5- and 7-year-olds; (2) the performance of children of all three ages were similar for condition 3 and condition 2. The addition of a third variable did not then make the task qualitatively more difficult. Once a child understood that paying attention to more than one variable was needed to solve the problem, it did not matter whether the total number of variables was 2 or 3, and (3) the understanding of three-way interactions of variables continues to grow beyond the initial understanding of such interaction at age 5.

Wellman et al. (1981) also indicated that 5-year-olds do understand the interactions among memory variables. The study, however, looked only at the two-way interaction of variables, and only at the number of
correct choices, but not at the number of correct explanations given by a child. Recently, studies in other areas of development have shown that 5-year-olds are capable of understanding the way variables interact. Anderson and Cuneo (1978) indicated that preoperational children are able to consider both height and width in order to make judgments of quantity. Surber (1977) looked at the ability of children to consider intentions and consequences in moral judgments and found that 5-year-olds are capable of integrating those attributes.

These studies clearly indicated nonegocentric and noncentered thinking of the 5-year-olds. As such the findings disagreed with the Piagetian notion of what typical 5-year-olds can do. According to Piaget's theory of cognitive development, 5-year-olds are in general seen as unable to consider more than one factor, variable or perspective in order to deal with the task effectively. Piaget and Inhelder (1969) showed that preschool children did poorly on the tasks used to assess concepts such as decentration, irreversibility, etc. According to the authors, children failed to do well because they 'centered' their attention to some single feature salient or interesting to them, thus neglecting other task-relevant features.

One reason for such discrepancy in the results could be attributed to the methods used. Indeed, the methods used are very important. Wellman et al. (1981) and Flavell et al. (1970) stated that the reason their 5-year-olds failed to do well on the tasks was due to the difficulty of the task and the task instructions. Therefore, when children fail to do well on a task an important question that must be asked is: Did they fail because of the difficulty of
the task instructions or because they did not understand the concept in question?

The question: "To what extent is understanding of the separate effects of the person, task and strategy variables necessary for understanding of the interactions among the variables?" cannot be addressed. Since the majority of children performed well on condition 1, the necessary comparisons between the conditions cannot be made to answer such a question. Condition 1 was made easy intentionally. This was done to assure better understanding of conditions 2 and 3 since the major concern of the study was to assess the understanding of the interactions of the variables. However, the results for the 4-year-olds appear to indicate that knowledge of the separate effects of the variables precedes knowledge of the combined effects; the extent to which single variable knowledge is a necessary prerequisite for multiple variable knowledge cannot be determined on the basis of this study's results.

Flavell and Wellman (1977) suggested that the knowledge of simple memory variables continues to develop after age 5 and even after age 10. The finding of the present study suggesting that the 5-year-olds understood quite well the interactions, leads one to think that complete understanding of the effects of the variables separately is not a necessary requirement for understanding their interactions.

Children's scores for the number of correct choices were consistently better than children's scores for the number of correct explanations. This was true for all three conditions and all ages except the 7-year-olds who performed at ceiling level across all the
tasks. The discrepancies in the scores tended to be related to the age of the child and the difficulty of the task. The younger the child and the harder the task the greater the differences between the scores were observed. Thus for very young children, the awareness that more than one variable needs to be taken into consideration to solve a problem seems to emerge before the awareness of how those variables interact and affect one's cognitive abilities.

In relation to the findings of children's understanding of the interactions of variables, it would be of interest to: (1) train 4-year-olds and see whether or not different training strategies would improve their understanding of the interactions and (2) look at the relationships between the metacognitive awareness and cognitive behaviors. Does the awareness that more than one variable needs to be taken into consideration to solve the problem indeed affect the child's actual behavior?

The second purpose of the present study was to assess whether or not children's understanding of the importance of person, task and strategy variables follows the same pattern of development across memory and communication. The results indicate that children's understanding of variable category is remarkably similar across the two cognitive domains, for all three age groups tested, for all three conditions and for both types of responses recorded. This finding is consistent with that of Yussen and Bird (1979), which indicated that the pattern of understanding of simple variables was the same for memory, communication and attention. Additionally, however, this study shows that the same pattern of development also holds true when
children's understanding of the two- and three-way interactions among these variables is assessed. These two studies are the only ones providing empirical support for the existence of 'common insights' that children have across different cognitive domains in relation to the variable category.

Flavell (1976) stated: "We psychologists tend to think that there is only one cognitive phenomenon called 'memory' and another, wholly different and unrelated one called 'communication'. . . . The reality is that there are deep commonalities among such cognitive phenomena and explicating these commonalities may give us a more integrated view of cognitive development" (pg. 6).

What seems to be an issue here is the distinction between heterogeneity and homogeneity of cognitive development. Does cognitive development appear to be more homogenous (the level and style of child's thinking tends to be very similar across different situations, tasks and cognitive domains) or does it appear to be more heterogenous (the level and style of child's thinking varies across different situations, tasks and cognitive domains)? Needless to say, the issue of homogeneity and heterogeneity of cognitive development is one of the most controversial in the field.

There are a number of difficulties involved in testing for homogeneity and/or heterogeneity of development. One is methodological. The questions that needs to be asked is: Are the tests that are being used to tap the awareness of a particular concept across cognitive domains equally sensitive? Perhaps a particular test is more suited
to test for the awareness of a concept in one cognitive domain than in another domain. The other difficulty could be caused by individual differences, e.g., a child might have enjoyed doing something more, has spent more time doing it and, therefore, would perform much better when tested than on something he/she is not interested in. Situations like this would make development appear more heterogeneous. On the other hand, a child may attempt to solve all the problems in a more even fashion, what Siegler (1981, p. 65) calls "fall-back-rules". Situations like this would make development appear more homogeneous.

The present study clearly indicates homogeneity of development across two cognitive domains, across the three age groups tested for the understanding of the importance of a limited set of variables. However, before such conclusions could be accepted, more research is necessary on a wider variety of variables and cognitive domains. It would be also of interest to address the Sensitivity category introduced by Flavell and Wellman (1977).
SUMMARY

The purpose of the present study was: (1) to look at when children become aware of how different variables presented individually and in combination influence one's memory and communicative performances, and (2) to assess whether or not children's understanding of these variables follows the same pattern of development across memory and communication. The variables tested were: person (who is doing the memorizing/communicating), task (what is to be remembered/communicated) and strategy (how to memorize/communicate).

Eighteen 4, 5 and 7-year-old children participated in the study. The stimuli consisted of 18 sets of 3 or 4 different picture cards with drawings of easily recognizable objects. The same stimuli were used for both the memory and communication tasks in order to assure constancy among variables in terms of difficulty. A child, however, was asked to respond to the stimuli differently. On each task three conditions were tested: (1) judging the difficulty of a memory and a communication task based on variations in one variable only, either person, task or strategy, (2) judging the difficulty of a memory and a communication task based on variations in two variables together, person x task, person x strategy, strategy x task and (3) judging the difficulty of a memory and a communication task based on variations in all three variables simultaneously, person x task x strategy. All tasks were administered during one session. Responses recorded were both the chosen picture card and an explanation given by the child as to why that particular card had been chosen.
No main effect of cognitive domain was found, suggesting that performances of children seem to be the same across both cognitive domains.

Performance of the 4, 5 and 7-year-old children did not differ when their knowledge of the separate effects of the person, task and strategy variables was assessed. However, performance of the 4-year-olds, but not 5 and 7-year-olds differed significantly on the conditions where their knowledge of the interactions of the variables was assessed. Four-year-olds performed poorly across both conditions and both dependent measures. Five and 7-year-olds performed better across both conditions and both measures, however, performances of the 5 and 7-year-olds differed significantly for condition 3 in relation to the number of correct explanations. These findings seem to indicate that: (1) the addition of variables affected significantly only the performances of 4-year-olds, but not 5 and 7-year-olds, (2) the performances of children of all three ages were similar for condition 3 and condition 2 and (3) the understanding of three-way interaction of variables continues to develop beyond the initial understanding of such interaction at age 5.
REFERENCES


ACKNOWLEDGMENTS

To Dr. Jacques D. Lempers, my major professor, I am very grateful for his guidance and assistance throughout my graduate education.

To my friends and colleagues at the Institute of Child Health and Human Development, NIH, I want to express my gratitude for their understanding, encouragement and support. Special thanks to Dr. Robert Klein for his expert assistance with data analysis.

To Drs. Don Charles, Dianne Draper, Robert Fuqua, J. Herwig and Robert Strahan for serving on my advisory committee, I want to express my appreciation.

To my parents, Vjeko, Thomas, Nicholas and Ruzica for their love, I am most grateful.
APPENDIX A: STIMULI
APPENDIX B: INTERACTION EFFECTS
Figure 1. Number of Correct Choices as a Function of Age and Condition
Figure 2. Number of Correct Explanations as a Function of Age and Condition
APPENDIX C: MEANS AND STANDARD DEVIATIONS FOR THE TWO COGNITIVE DOMAINS, THREE CONDITIONS AND THE THREE AGE GROUPS
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APPENDIX D: INTERACTION EFFECTS PRESENTED SEPARATELY FOR BOYS AND GIRLS
Figure 1. Number of Correct Choices as a Function of Age and Condition
Taken Separately for Boys and Girls
APPENDIX E: MEANS AND STANDARD DEVIATIONS OF SCORES PRESENTED SEPARATELY FOR BOYS AND GIRLS
Table 2. Means and Standard Deviations of Scores Presented Separately for Boys and Girls for the
Three Age Groups, the Three Conditions and over Domains Combined

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