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Training and transfer of mnemonic skills in children's paired-associate and serial recall.

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TRAINING AND TRANSFER OF MNEMONIC SKILLS IN CHILDREN'S PAIRED-ASSOCIATE AND SERIAL RECALL

by

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ABSTRACT

The purposes of the present study were to determine whether young children would use previously-trained memory skills in an entirely new memory task and whether a previously-trained rehearsal skill would be used more than a more complex sentence skill. Ninety-six second-grade Ss were presented with either a serial or paired-associate training task under one of the following three instruction conditions: (a) standard instructions to remember the items; (b) instructions to rehearse the items; (c) instructions to join the items in sentences. One week later half the Ss who originally received a serial task were presented with another similar serial transfer task while the other half were presented with an entirely new paired-associate transfer task. Half the Ss who originally received a paired-associate task were presented with another similar paired-associate transfer task while the other half were presented with an entirely new serial transfer task.

The results showed that the Ss used their previously-trained strategies when the transfer task was entirely new as well as when it was similar to the original training task in which the strategies were once trained. In general, the less difficult rehearsal strategy was used by more Ss in the transfer tasks than the more complex sentence strategy. Both rehearsal and sentence training

facilitated recall in the paired-associate training task but only sentence training facilitated recall in the paired-associate transfer task. In the serial tasks neither rehearsal nor sentence training resulted in enhanced recall.

PREFACE

The present research was a result of the inspiration provided the author by the work of Dr. Akira Kobasigawa in children's memory processes. The author wishes to gratefully acknowledge the extremely valuable guidance of Dr. Kobasigawa whose assistance to the author extended from the study's inception to the final written copy. The author would also wish to extend his appreciation to the other members of the doctoral committee, Drs. Gediminas Namikas, Robert Orr and Arthur Smith, for their constructive contributions.

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CHAPTER I

INTRODUCTION

In the past few years there has been considerable interest in "inducing" or training children to use more efficient memory skills (e.g., Hagen & Kingsley, 1968; Rosner, 1971). These studies have trained children to label in serial recall (SL) tasks (e.g., Hagen & Kingsley, 1968; Hagen, Meacham & Mesibov, 1970), to rehearse in SL and free recall (FR) tasks (e.g., Hagen, Hargrave & Ross, 1973; Keeney, Cannizzo & Flavell, 1967; Kingsley & Hagen, 1969; Rosner, 1971), to generate syntactic links or sentences in paired-associate (PA) and FR tasks (e.g., Jensen & Rohwer, 1965; Levin, 1972; Milgram, 1967; Rosner, 1971) and to categorize conceptually related items in FR tasks (e.g., Moely, Olson, Halwes & Flavell, 1969). The results of these studies have revealed that depending on the age of the child and the nature of the memory strategy, children can be trained to use more efficient skills.[1]

The studies cited above appear to have both theoretical and practical implications. Theoretically, the studies tend to support the contention of Flavell (1970) that memory development consists

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1. For a review of the literature and suggestions for future research see Appendix A.

largely of the application of efficient memory skills (e.g., labelling, rehearsal). Based on the assumption that age differences in recall reflect underlying age differences in the use of memory skills, the above studies have generally indicated that children's recall is improved when they are trained to use more efficient skills.

Furthermore, it has been proposed by several investigators that the above research may have important educational implications (e.g., Flavell, 1970, 71; Rohwer & Ammon, 1971). At the present time school-age children are usually given materials to learn but are not instructed in more efficient ways of going about the task of remembering. Typically, children are left to use their own memory strategies, whatever they may be. It may be feasible therefore, to devise training procedures wherein the teacher instructs students in the systemmatic use of more efficient memory skills. In this way much more emphasis could be placed on the importance of the child's studying and memorizing activities than has been the case previously.

An examination of previous training studies reveals that children were trained to use memory strategies on specific recall tasks (i.e., either SL, PA, or FR). However, there is no information if children use these trained skills in other memory situations. If children are to derive optimal benefit from the training procedures, then the use of these skills should not be limited to a single memory task, but instead the skills should be used on other memory tasks as well.

The notion that children generalize memory strategies has theoretical support. Flavell (1970) has proposed that as the child becomes increasingly adept or proficient at using a particular memory skill he begins to use it in a much wider variety of memory-related

situations. According to Flavell:

> In the case of verbal rehearsal, for example, we could suppose that the growing child increasing overlearns verbal-label responses to object stimuli, becomes increasingly skillful at rapid, subovert articulation of a string of labels, becomes better attuned to the sequencing and recycling (starting again at the first word) "rules" of repeated rehearsal, and the like. As these component skills mature, verbal rehearsal becomes a more serviceable and hence more readily elicitable response pattern in a variety of appropriate situations, including those in which it could serve to mediate recall.' (1970, p. 205)

Ideally therefore, children should be able to use memory skills on a variety of memory problems. Whereas previous training studies have demonstrated that children can be trained to use these skills on single training tasks they have not demonstrated that children can use these skills on more than one task.

Although the training in previous studies may have been successful, there are difficulties in evaluating the success of training when the transfer task is the same as the task used in training (i.e., specific transfer task). It is possible, for example, that the transfer task itself may elicit the previously-trained strategy because it was associated with the strategy during training. Similarly, the E's presence might be cause for the child to use the strategy if the same E previously trained the child to use the strategy. One improvement over previous training studies therefore, would be the use of a new recall task which the child has not previously encountered (i.e., nonspecific transfer task). It is very unlikely that a new transfer task would elicit the strategy because of a previous strategy-task association. Consequently, the child's transfer of the skill would constitute better evidence of the effectiveness of training.

It is of interest therefore, to investigate children's transfer of memory skills to new memory tasks and to examine the conditions which may lead to an increase in the amount of transfer. One variable which may be important in determining the amount of transfer may be the complexity or relative difficulty of using the memory skill itself. If a child is trained to use a more complex and difficult strategy, such as producing sentences in a particular task, then he may experience more difficulty in using that complex strategy in a new task than he would in using a more simple and easier strategy such as rehearsal. Stated simply, the amount of transfer may be a function of the complexity of the memory strategy.

On the basis of the above discussion two independent variables were selected for the present study in order to examine children's transfer of memory skills. The first variable was the type of transfer task: a specific transfer task similar to the one used in training and a nonspecific transfer task different from the one used in training. The second variable was the type of memory skill: a control group given standard memory instructions, a group given instructions in the use of an efficient but simple rehearsal strategy, and a group given instructions in the use of a more complex sentence strategy. Thus the specific purposes of the present study were: (a) to train children to use rehearsal and sentence strategies, (b) to examine the transfer of these skills to specific and nonspecific transfer tasks and (c) to determine whether the complexity of the strategy affected the amount of transfer.

The plan of the study was as follows. One group of second-grade children served as controls and were given standard memory instructions;

a second group was given rehearsal instructions; and a third group was given sentence instructions. Half the children in each of these three groups learned a list of SL items while the other half learned a list of PA items. One week later the Ss were examined for the transfer of memory strategies. Half the Ss trained on the SL task were tested for specific transfer on another SL task while the other half were tested for nonspecific transfer on a new PA task. Half the Ss trained on the PA task were tested for specific transfer on another PA task while the other half were tested for nonspecific transfer on a new SL task.

The age level, memory strategies and tasks employed by the present study were selected for the following reasons. Second-grade children do not spontaneously generate sentences (e.g., Jensen & Rohwer, 1965) nor purposeful rehearsal (e.g., Flavell, 1970) to improve their recall. It was assumed therefore, that children at this age level would not spontaneously generate these strategies unless they were previously trained to use these skills.

Rehearsal and sentence strategies were selected for the following reasons. Firstly, rehearsal is a more primitive and simpler strategy than sentences (e.g., Flavell, 1970). Secondly, second-grade children benefit from sentence training (e.g., Jensen & Rohwer, 1965; Levin, 1972; Milgram, 1967) and slightly younger first-grade children benefit from rehearsal training (e.g., Keeney et al., 1967).

The SL task was selected because rehearsal training facilitates children's SL performance (e.g., Keeney et al., 1967; Kingsley & Hagen, 1969). The PA task was selected because PA learning is facilitated by sentences (e.g., Jensen & Rohwer, 1965; Levin, 1972; Milgram, 1967). The combination of rehearsal and PA learning was included in the

present study to extend the findings of rehearsal training (e.g., Kingsley & Hagen, 1969) to children's PA learning and to enable a comparison of the relative effectiveness of sentences and rehearsal as strategies in PA and SL learning.

The hypotheses of the present study fell into two categories: (I) those hypotheses concerned with the transfer of memory skills and (II) those hypotheses concerned with recall.

Hypothesis Ia More children trained to use rehearsal and sentence strategies would use these strategies in the transfer tasks than untrained control children.

Hypothesis Ib Sentence and rehearsal strategies would be used by more children in the specific transfer condition than in the nonspecific transfer condition because the children were trained to use the strategies in a task similar to the specific transfer task.

Hypothesis Ic More children would use the simpler rehearsal strategy than the more difficult sentence strategy in both transfer conditions.

Hypothesis IIa Since sentence strategies facilitate PA recall (e.g., Milgram, 1967) then those children trained to produce sentences would remember more than control children in both PA training and transfer tasks.

Hypothesis IIb If the sentence strategy is used by more children in the specific PA transfer condition than in the nonspecific PA transfer condition (i.e., Hypothesis Ib) then recall would be higher in the specific PA transfer condition than in the nonspecific PA transfer condition.

CHAPTER II

METHOD

Subjects:

The Ss were 96 grade 2 children, (55 boys and 41 girls) ranging in chronological age from 7.4 years to 10.1 years with a mean age of 8.1 years. Table 7 in Appendix D presents information concerning sex and mean chronological age of the Ss in the control, rehearsal and sentence groups.[2]

Design:

Sixteen Ss (9 boys and 7 girls, in most cases) were randomly assigned to one of the six training groups of control-SL, control-PA, rehearsal-SL, rehearsal-PA, sentence-SL, sentence-PA. One week after training half the Ss in each of the SL training groups were randomly assigned to the specific transfer condition and were presented with another SL task. The remaining SL Ss were assigned to the nonspecific transfer condition and were presented with a PA task. Half the Ss in each of the PA training groups were randomly assigned to the specific transfer condition and were presented with another PA task. The remaining PA Ss were assigned to the nonspecific transfer condition and were presented with a SL task. In total there were 12 different transfer groups with eight Ss in each group. The male-female ratio

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2. During the study 2 Ss were replaced, one was absent for the transfer session, one due to experimenter error.

in each of the transfer groups remained approximately the same as in the training groups.

In training the independent variables were training task (SL,PA), strategy (control, rehearsal, sentence) and trials (two) and the dependent measure was the amount of recall. In transfer the independent variables were transfer condition (specific, nonspecific), transfer task (SL,PA), strategy (control, rehearsal, sentence) and trials (two). In transfer the two dependent measures were (1) the use of memory skills in the transfer tasks and (2) amount of recall.

Materials:

The materials in the present study consisted of black line drawings of familiar objects and animals. In each task half of the pictures were of the animal-object variety while the other half were of the object-object variety. The PA materials were presented on 15.2 x 12.7 cm. white cards with the stimulus picture on the left side and the response picture on the right side. The PA training task consisted of eight picture-pairs with two additional pairs serving for practice trials. The SL training task consisted of the same eight PA picture-pairs and the same two practice pairs.[3] The eight SL pairs were presented in the form of two smaller tasks of four pairs each (i.e., eight individual items) with four of the eight SL items randomly selected in each of the two SL tasks as

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3. The present SL task differed from other SL tasks (e.g., Kingsley & Hagen, 1969) in an attempt to equate the difficulty of SL and PA tasks. To accomplish this the SL items were presented in pairs and only half of the presented SL items served as recall items.

recall items. In this way Ss in both SL and PA groups were exposed to the same number of items (i.e., eight PA pairs and four plus four or eight SL pairs) and were required to recall the same number of items (i.e., eight PA items and four plus four or eight SL items).

The specific SL and PA transfer tasks consisted of an additional eight pairs of items. The nonspecific SL and PA transfer tasks consisted of the same specific transfer task items plus an additional two pairs for practice trials. Since there were two recall trials in all tasks two sets of PA stimuli were prepared for the two PA recall trials. Examples of the materials used in the present study are presented in Appendix B.[4]

Procedure:

The overall procedure consisted of two sessions, an initial training session followed one week later by a transfer session. The tasks were administered individually to each S with the S sitting at a table opposite E. All sessions were tape recorded.

PA Training Session. Prior to the administration of the PA items the Ss in this condition were instructed as to the nature of the PA task requirements. The Ss were instructed as follows:

> Today we're going to play a memory game. I'm going to show you some pictures of things which go together and you are to remember which things go together. Later I'll show you only one of the pictures and you are to tell me the name of the picture that went with it.

Each S was then presented with two practice pairs. After the two practice pairs were presented E presented the two stimulus pictures and said "What went with this one?" Following S's anticipation E

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4. A complete list of the pictorial materials is available on request from the author.

presented the appropriate stimulus-response pair to confirm or correct S's response. After establishing that the S understood what was required of him E proceeded to the training aspect of this session using the same two practice pairs.

Control Condition Ss in this condition were instructed as follows:

> Now I'm going to show you these pictures again and I want you to remember them as well as you can. Here's a picture of a cow and a tie. Here's a picture of a shoe and a ball.

Rehearsal Condition Ss in this condition were instructed as follows:

> Now I'm going to show you a special way that you can use to remember which pictures go together. Every time I show you the pictures you say their names out loud over and over again until I show you the next pictures. Here's a picture of a cow and a tie so you say cow-tie, cow-tie, cow-tie. Now you try it. The next picture is a show and a ball so you say show-ball, shoe-ball, shoe-ball as many times as you can. Now you try it.

Sentence Condition Ss in this condition were instructed as follows:

> Now I'm going to show you a special way that you can use to remember which pictures go together. Every time I show you the pictures I want you to make up a story out loud about the two pictures. Here's a picture of a cow and a tie so you might say the cow is wearing the tie. Now you make up a story. The next picture is a shoe and a ball so you might say the shoe kicked the ball. Now you make up a story.

After the rehearsal and sentence Ss used the strategies on the two practice pairs E presented the two practice stimuli and tested the Ss for recall. The control Ss were again tested for recall on the same practice items.

Following the initial practice trials Ss in the rehearsal and sentence groups were instructed as follows:

> You see how _____ (saying the names over and over again, making up stories about the pictures) helps you to remember more. Now I want you to use the same way of remembering that I taught you on these new pictures.

E told Ss in the control condition "Now I have some more pictures for you to remember." E then presented the remaining eight PA training pairs at a 10 second rate with a five second inter pair interval. The first recall trial followed immediately after the presentation of the eight pairs. The stimulus items were presented at a 10 second rate with a five second interstimulus interval. As each stimulus item was presented E said "What went with this one?" A second recall trial followed 10 seconds after the first. The order of presentation of the stimulus items was randomized for each recall trial.

SL Training Session Prior to the administration of the SL items the Ss in this condition were instructed as to the nature of the SL task requirements. The Ss were instructed as follows:

> Today we're going to play a memory game. I'm going to show you some pictures and I want you to remember where I put them. After I have covered up the pictures so that you can't see them I'll point to some of them and I want you to tell me the names of the ones I point to.

E then presented the two practice pairs, the first placed face-up then face-down followed by the second pair first placed face-up then face down next to the first pair. On the blank side there was a vertical black line dividing each pair in half, denoting a separate space for each hidden picture. E then pointed to two of the hidden pictures in a left-to-right order and said "What was this one?" As S attempted to name each one it was turned face-up to confirm or correct S's response. After establishing that S understood the SL task requirements E proceeded to the training aspect of the study using the same two practice pairs in the same manner.

Control Condition Ss in this condition were instructed as follows:

> Now I'm going to show you these pictures again and I want you to remember them as well as you can. Here's a picture of a cow and a tie. Here's a picture of a shoe and a ball.

Rehearsal Condition Ss in this condition were instructed as follows:

> Now I'm going to show you a special way that you can use to remember where the pictures are. As I place the pictures on the table you say their names over and over again until I show you the next pictures. Here's a picture of a cow and a tie so you say cow-tie, cow-tie, cow-tie. Now you try it. The next is a picture of a shoe and a ball so you say shoe-ball, shoe-ball, shoe-ball as many times as you can. Now you try it.

Sentence Condition Ss in this condition were instructed as follows:

> Now I'm going to show you a special way that you can use to remember where the pictures are. As I place the pictures on the table you make up a story out loud about the two pictures. Here's a picture of a cow and a tie so you might say the cow is wearing the tie. Now you make up a story. The next is a picture of a shoe and a ball so you might say the shoe kicked the ball. Now you make up a story.

After the Ss practiced on the two pairs the E again tested for recall by pointing to two of the hidden items.

Following the initial practice trials Ss in the rehearsal and sentence groups were instructed as follows:

> You see how _____(saying the names over and over again, making up stories about the pictures) helps you to remember more. Now I want you to use that same way of remembering that I taught you on these new pictures.

Ss in the control condition were told "Now I have some more pictures for you to remember", E then presented the first four of the eight SL pairs in one long horizontal row extending from S's left to his right. The pairs were presented face-up for 10 seconds then face-down, followed five seconds later by the next pair of items, placed adjacent to the first pair. After the presentation of the

fourth pair E pointed in a left-to-right order to positions one, four, five and seven at a 10 second rate with a five second interstimulus interval. As E pointed to each picture he said "What was this one?" The second recall trial followed 10 seconds after the first with E pointing to the same hidden items in the same manner. The second SL task was administered immediately after the second recall trial of the first SL task. E collected the first SL task items and said "Now I have some more pictures for you to remember in the same way." The second SL task was administered identical to the first, with two recall trials, and in this task the recall items were in positions two, three, six and eight.

In both rehearsal and sentence training conditions the training criterion was that the strategy be executed on all eight pairs of items. If the S stopped using the strategy or did not begin to use it E prompted verbally. Following the training session all the Ss were thanked for participating and told they performed well. In addition E told Ss in the rehearsal and sentence conditions the following:

> You see how easy it is to remember the pictures when you use the special way that I taught you. I want you to remember that special way of remembering because it will help you remembering in a new game which I will show you next week.

Transfer Session One week later all of the Ss were examined for the transfer of memory skills. In the transfer sessions the administration of items was identical to training except that E provided no prompting.

Specific Transfer The specific PA and SL transfer tasks consisted of eight new pairs of items presented in the same way as in the PA and

SL tasks used in training, with two recall trials. Prior to the task the Ss were instructed as follows:

> I have another memory game for you today. When I show you the pictures I want you to use the best way of remembering that you know and please speak out loud so I can hear you.

Nonspecific Transfer The nonspecific PA and SL transfer tasks consisted of the same eight pairs used in the specific transfer condition plus an additional two new pairs for practice trials.

Nonspecific PA Transfer Ss in this condition were instructed as follows:

> I have a new memory game for you today. I'm going to show you some pictures of things that go together. Later I'll show you only one of the pictures and you are to tell me the name of the picture that went with it. When I show you the pictures I want you to use the best way of remembering that you know to remember the pictures. Please speak out loud so I can hear you.

E then presented the two practice pairs and then the two stimulus pictures to allow S to anticipate the correct response. Following S's response the correct stimulus-response pair was shown to confirm or correct S. Following practice E told these Ss:

> Now we're going to play this memory game using new pictures. Use the best way you know to remember the pictures and please speak out loud so I can hear you.

The remaining eight pairs were then presented in a manner identical with other PA tasks.

Nonspecific SL Transfer Ss in this condition were instructed as follows:

> I have a new memory game for you today. I'm going to show you some pictures and I want you to remember where I put them. After I have covered up the pictures so that you can't see

> them I'll point to some of them and I want you to tell me the names of the ones I point to. When I show you the pictures I want you to use the best way of remembering that you know to remember the pictures. Please speak out loud so I can hear you.

E then presented the two practice pairs and pointed to two of the pictures, once covered, and asked S "What was here?" As S responded E turned the picture over to confirm or correct S's response. Following practice E told these Ss:

> Now we're going to play this memory game using new pictures. Use the best way you know to remember the pictures and please speak out loud so I can hear you.

The remaining eight pairs were then presented in a manner identical with other SL tasks. The items randomly selected as response items in both specific and nonspecific SL transfer tasks were the same. In the first task the items occupied positions one, three, four and eight and in the second task the response items were positions two, three, five and seven. The order of presentation of all PA and SL items used in both training and transfer tasks is presented in Appendix C.

Classification of Subjects

During the administration of the transfer tasks each S's verbal activities were observed and recorded by E as S studied the to-be-recalled items. On the basis of these observations the Ss were placed into one of the following categories: no overt strategy, naming, rehearsal or sentence. Ss were placed in the first category if E did not observe the use of any verbal strategy. Ss were placed in the second category if naming was the only strategy used. Ss in the third category were those who repeated the names

of at least one pair of items. Ss in the fourth category were those who produced at least one sentence. A sentence, as defined here was the use of a syntactic link such as a verb or preposition, but not a conjunction, to join a pair of items.

Measure of Recall

The measure of recall in the PA tasks was the number of correct responses in each of the two recall trials. In the SL tasks the measure of recall on trial one was the total number of correct responses on the first trial of both SL tasks. Similarly, trial two recall was measured by the total number of correct responses in the second trial of both SL tasks.

CHAPTER III

RESULTS

Training Session

All Ss appeared to understand the PA and SL task requirements and the Ss in the rehearsal and sentence groups readily complied with the initial instructions to practice the appropriate strategies. When the first task items were presented some prompting by E was required to initiate Ss' production of strategies but thereafter all 32 Ss in each strategy group continued generating the appropriate strategies for all of the remaining task items. The number of Ss who required prompting following the initial instructions is presented in Table 1. A chi-square test (using the Yates correction factor) revealed that significantly more Ss in the sentence condition required prompting by E during the presentation of the first pair of items than Ss in the rehearsal condition ($\chi^2=7.49$, $df=1$, $p < .01$).

In the sentence condition Ss did not appear to have any difficulty in producing acceptable sentences (i.e., joining the items with a verb or preposition). The majority of sentences were expressed in the past tense (i.e., 73.5%) while the remainder were in the present tense (i.e., 26.5%). Fifty-six percent of the sentences expressed a positional relationship usually with an intransitive verb (e.g., the clock was on the table) while forty-four percent expressed an action relationship with a transitive verb (e.g., the monkey blows the horn).

Table 1

Number of Subjects Receiving Prompt During Training

	Prompt	No Prompt
Rehearsal	17	15
Sentence	28	4

Although all of the Ss in each of the strategy groups produced the appropriate strategies (i.e., either rehearsal or sentences) Ss in the control group did not all use the same strategies. In the control group 24 Ss were observed not using any verbal strategy, six Ss used a naming strategy and two Ss were observed rehearsing. None of the control Ss produced sentences.

Mean recall in the training session as a function of Training Task, Strategy and Trials is presented graphically in Figure 1. These data were analyzed by means of a 2 (Training Task) x 3 (Strategy) x 2 (Trials) analysis of variance. The results are summarized in Table 8 in Appendix D.

The main effects of Training Task ($F=12.65$, $df=1/90$, $p < .001$) and Strategy ($F=22.90$, $df=2/90$, $p < .001$) were significant. The analysis also revealed a significant Training Task x Strategy interaction ($F=25.82$, $df=2/90$, $p < .001$), a significant Training Task x Trial interaction ($F=5.42$, $df=1/90$, $p < .05$) and a significant Training Task x Strategy x Trial interaction ($F=4.34$, $df=2/90$, $p < .05$).

In order to examine the above second-order interaction and to determine the effects of strategy training in each training task, additional 3 (Strategy) x 2 (Trials) analysis of variance were calculated on the mean recall scores, presented in Figure 1, for each training task separately. A summary of the analysis for the SL training task is presented in Table 9 in Appendix D. The results of this analysis revealed no significant main effects nor interaction. The mean recall scores of the sentence and rehearsal groups did not differ significantly from those of the control group.

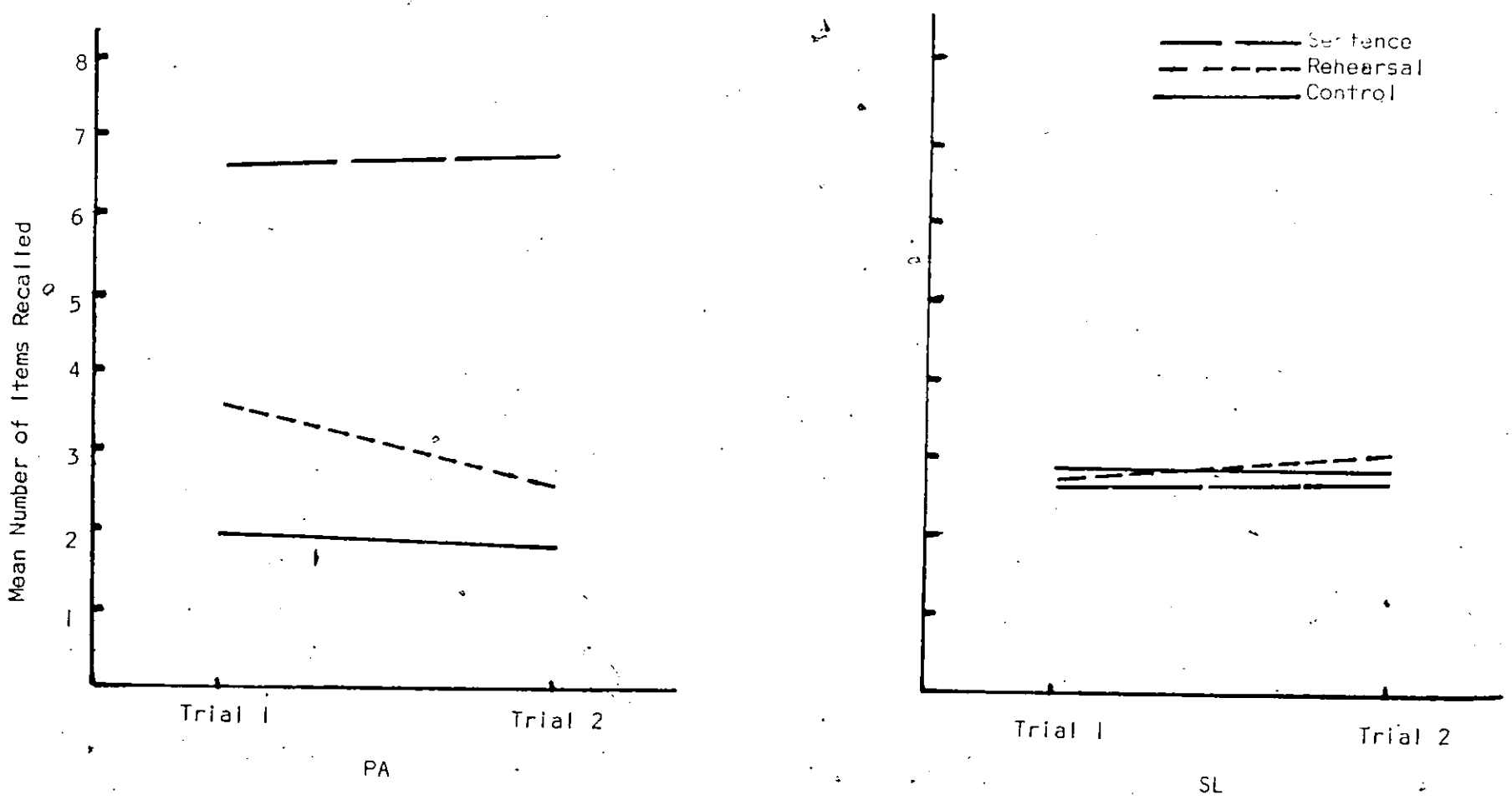


Figure 1. Mean Total Recall as a Function of Training Task, Strategy and Trials

A summary of the analysis for the PA training task is presented in Table 10 in Appendix D. The results revealed a significant main effect for Strategy (F=49.21, df=2/45, $p < .001$), indicating that the mean recall of the sentence group ($\bar{X}$=6.66) was significantly greater ($p < .005$) than the mean recall of the rehearsal group ($\bar{X}$=3.06) which was significantly greater ($p < .05$) than the mean recall of the control group ($\bar{X}$=1.84). There was also a significant main effect for Trials (F=5.11, df=1/45, $p < .05$), indicating that mean recall on the first PA trial ($\bar{X}$=4.02) was significantly greater than mean recall on the second PA trial ($\bar{X}$=3.68). The analysis also revealed a significant Strategy x Trial interaction in the PA training task (F=5.67, df=2/45, $p < .01$). This Strategy x Trial interaction, as may be seen in Figure 1, can be explained by the fact that on trial 1 the sentence group recalled significantly more than the rehearsal group (t=4.23, df=45, $p < .005$) and the rehearsal group recalled significantly more than the control group (t=2.28, df=45, $p < .025$). On trial 2 however, although the difference between the sentence and rehearsal groups remained significant (t=5.90, df=45, $p < .005$) the difference between the rehearsal and control groups was no longer significant (t=1.14, df=45, $p > .10$). The reason there were significant differences between all three groups on trial 1 but not on trial 2 was due to the fact that the recall scores of the sentence and control groups did not change significantly across trials ($p > .10$) but the recall scores of the rehearsal group decreased significantly across trials (t=3.04, df=45, $p < .005$).

Transfer of Mnemonic Skills

The number of Ss E observed using strategies in each strategy

Table 2

NUMBER OF SUBJECTS USING STRATEGIES AS A FUNCTION OF TRANSFER CONDITIONS AND STRATEGIES

GROUP	TRANSFER CONDITION	NO OVERT STRATEGY	NAMING	REHEARSAL	SENTENCE
CONTROL	SLSL	5	2	1	0
	SLPA	5	2	1	0
	PAPA	4	2	2	0
	PASL	4	3	1	0
REHEARSAL	SLSL	0	0	8	0
	SLPA	0	0	8	0
	PAPA	0	0	8	0
	PASL	0	0	8	0
SENTENCE	SLSL	3	1	0	4
	SLPA	1	0	0	7
	PAPA	3	0	0	5
	PASL	1	1	0	6

group (i.e., control, rehearsal, sentence) and each transfer condition (i.e., SLSL, SLPA, PAPA, PASL) is presented in Table 2. In order to determine the overall effectiveness of rehearsal and sentence training the number of Ss using strategies was collapsed across all transfer conditions in each strategy group.

Table 3 presents the number of Ss observed rehearsing in the control group and the rehearsal group. In the rehearsal condition the majority of Ss rehearsed all of the task items. A chi-square test (using the Yates correction factor) comparing the proportion of Ss in both groups observed rehearsing revealed a highly significant effect for rehearsal training (X^2=43.21, df=1, $p < .005$).

Sentence training was also highly effective since no control Ss were observed using a sentence strategy while 68.75% of the sentence Ss were observed producing sentences. Sentences were either produced for all of the task items or not at all. The method used to analyze the kinds of sentences produced was the same as that used in training. There were almost as many sentences expressing a positional relationship (48.6%) as an action relationship (51.4%). Similar to training, the majority of sentences were in the past tense (72.8%) while the remainder were in the present (27.2%).

Table 4 presents the total number of Ss producing strategies in the rehearsal and sentence groups. A chi-square test (using the Yates correction factor) comparing the number of Ss who rehearsed in the rehearsal condition with the number of Ss who produced sentences in the sentence condition revealed that significantly more Ss transferred the rehearsal strategy than the sentence strategy (X^2=9.60, df=1, $p < .005$).

Table 3

Number of Subjects Using Rehearsal in Rehearsal and Control Groups

	Present	Absent
Control	5	27
Rehearsal	32	0

Table 4

Number of Subjects Using Strategies in Rehearsal and Sentence Groups

	Present	Absent
Rehearsal	32	0
Sentence	22	10

The remaining analyses were aimed at determining whether the number of Ss using strategies was affected by transfer condition (i.e., specific, nonspecific), transfer task(i.e., SL, PA) or strategy complexity (i.e., rehearsal, sentence). The specific transfer condition data consisted of the total number of Ss using strategies in the two specific transfer conditions (i.e., SLSL, PAPA). The nonspecific transfer condition data consisted of the total number of Ss using strategies in the two nonspecific transfer conditions (i.e., SLPA, PASL). The PA transfer task data consisted of the total number of Ss using strategies in the two PA transfer tasks (i.e., PAPA, SLPA). The SL transfer task data consisted of the total number of Ss using strategies in the two SL transfer tasks (i.e., SLSL, PASL).

Table 5 indicates the number of Ss using rehearsal and sentences as a function of transfer condition and transfer task. The same number of Ss in the rehearsal condition rehearsed in the specific transfer condition as in the nonspecific transfer condition (i.e., 16 Ss). More Ss used sentences in the nonspecific transfer condition (i.e., 13 Ss) than in the specific transfer condition (i.e., 9 Ss) but this difference was not significant.

Table 5 also shows the number of Ss using rehearsal and sentences as a function of transfer task. The same number of Ss in the rehearsal condition rehearsed in the SL transfer task as in the PA transfer task (i.e., 16 Ss). Almost as many Ss used sentences in the SL transfer task (i.e., 10 Ss) as in the PA transfer task (i.e., 12 Ss).

Table 6 shows the number of Ss using strategies as a function of

Table 5

Number of Subjects Using Strategies as a Function of Transfer Condition and Transfer Task

Rehearsal

	Present	Absent
Specific	16	0
Nonspecific	16	0

Sentence

	Present	Absent
Specific	9	7
Nonspecific	13	3

Rehearsal

	Present	Absent
SL	16	0
PA	16	0

Sentence

	Present	Absent
SL	10	6
PA	12	4

Table 6

Number of Subjects Using Strategies as a Function of Strategy Complexity

Specific Transfer

	Present	Absent
Rehearsal	16	0
Sentence	9	7

Nonspecific Transfer

	Present	Absent
Rehearsal	16	0
Sentence	13	3

SL Transfer Task

	Present	Absent
Rehearsal	16	0
Sentence	10	6

PA Transfer Task

	Present	Absent
Rehearsal	16	0
Sentence	12	4

strategy complexity. Since these analyses involved comparing groups with relatively small numbers of Ss the Fisher Exact Probability Test was used (e.g., Siegel, 1956). The results showed that rehearsal was used by significantly more Ss than sentences in both the PA transfer task (p=0.050) and the SL transfer task (p =0.017) with the difference being more pronounced in the SL transfer task. The difference between the number of Ss using rehearsal and sentences in the nonspecific transfer condition was not significant (p=0.112) while significantly more Ss used rehearsal than sentences in the specific transfer condition (p=0.003).

Summarizing the above results, the transfer of rehearsal and sentence strategies was not influenced by specific or nonspecific transfer conditions or by either SL or PA transfer tasks. However, the use of strategies in the transfer tasks was influenced by strategy complexity. Rehearsal was used by more Ss than sentences in both SL and PA transfer tasks and in the specific transfer condition but not in the nonspecific transfer condition.

Transfer Recall

Mean total recall as a function of Transfer Task, Transfer Condition, Strategy and Trials is presented graphically in Figures 2 and 3. These data were analyzed by means of a 2 (Transfer Task) x 2 (Transfer Condition) x 3 (Strategy) x 2 (Trials) analysis of variance. The results are summarized in Table II in Appendix D. The analysis revealed a significant main effect for Strategy (F=8.32, df=2/84, $p < .001$) and a significant Transfer Task x Strategy Interaction (F=9.59, df=2/84, $p < .001$). Although there were no other

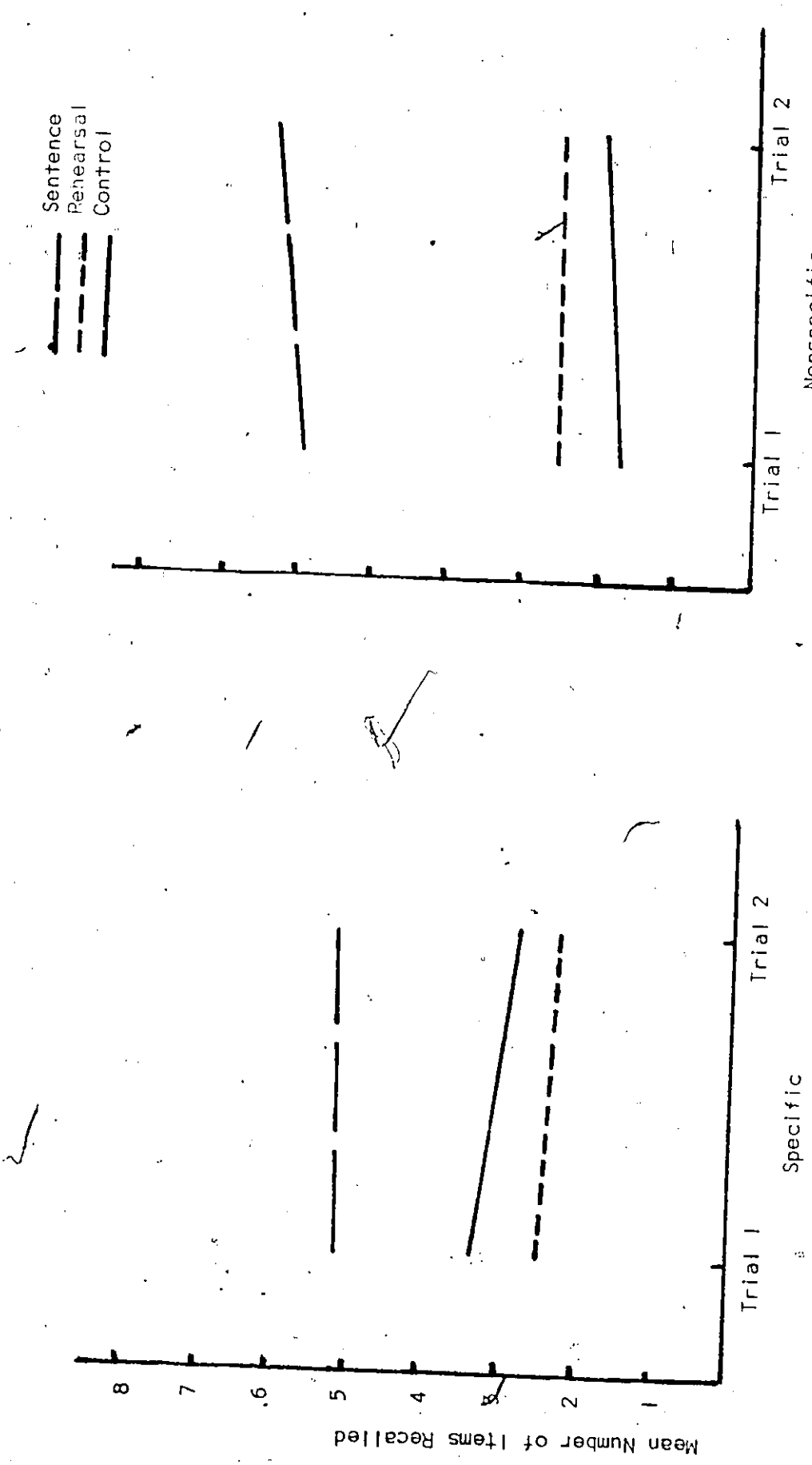


Figure 2. Mean Total Recall in the SL Transfer Task as a Function of Transfer Condition, Strategy and Trials.

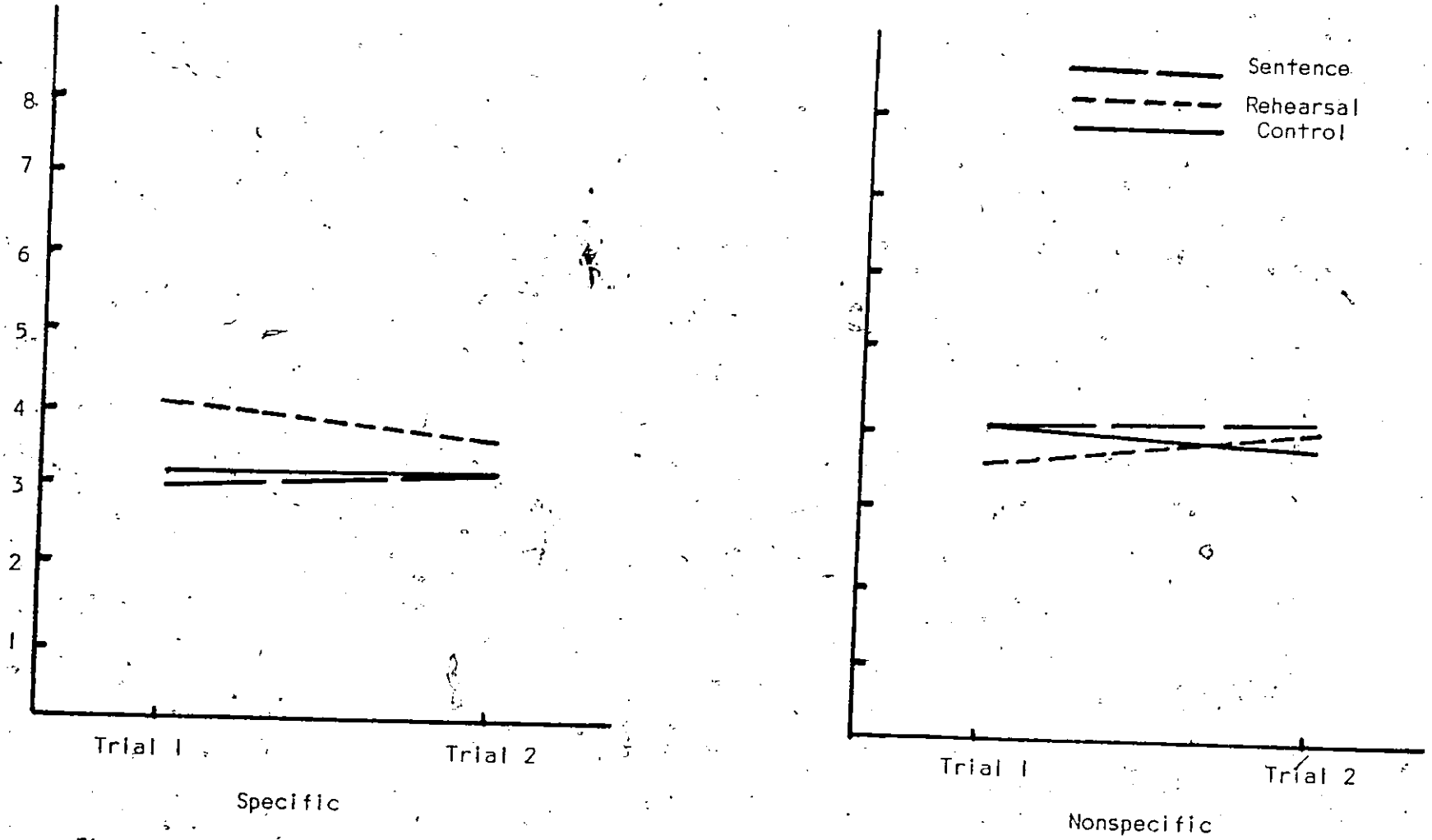


Figure 3. Mean Total Recall in the PA Transfer Task as a Function of Transfer Condition, Strategy and Trials

significant main effects nor interactions, in order to examine the above Transfer Task x Strategy interaction and to examine the effects of the major factors of Strategy and Transfer Condition in each transfer task, additional 3 (Strategy) x 2 (Transfer Condition) x 2 (Trials) analysis of variance were calculated on the mean recall scores, presented in Figures 2 and 3, for each transfer task separately. A summary of the analysis for the SL transfer task is presented in Table 12 in Appendix D. The results revealed no significant main effects nor interactions. Mean recall of the rehearsal and sentence groups did not differ significantly from the control group.

A summary of the analysis for the PA transfer task is presented in Table 13 in Appendix D. The results revealed a significant effect for Strategy (F=21.44, df=2/42, $p < .001$). Mean recall of the sentence group ($\bar{X}$=5.59) was significantly greater ($p < .005$) than the mean recall of both the rehearsal ($\bar{X}$=2.44) and control ($\bar{X}$=2.47) groups whose means did not differ significantly ($p > .10$). There were no other significant main effects or interactions.

As is evident from Figures 2 and 3 the above Transfer Task x Strategy interaction may be explained by the fact that sentence training facilitated recall only in the PA transfer task, not in the SL transfer task. Moreover, in the PA transfer task sentence training facilitated recall equally in the specific and nonspecific transfer conditions.

Summary of Results Relevant to Hypotheses

Use of Mnemonic Skills Hypothesis 1a, stating that more Ss trained

to use rehearsal and sentence strategies would use these strategies in the transfer tasks than untrained control Ss was clearly supported. All of the Ss trained to rehearse used this strategy in the transfer tasks while only a few control Ss were observed rehearsing. Sentence training was also highly effective since most of the sentence-trained Ss used this strategy in the transfer tasks while none of the control Ss were observed producing sentences.

Hypothesis Ib dealt with a comparison of the number of Ss using rehearsal and sentence strategies in the specific and nonspecific transfer conditions. The hypothesis stated that both strategies would be used by more Ss when the transfer task was similar to the training task (i.e., specific transfer) than when the task was entirely different from the training task (i.e., nonspecific transfer). This hypothesis received no support since the similarity between the transfer and training tasks did not influence the number of Ss using either rehearsal or sentence strategies.

Hypothesis Ic stated that more Ss would use the less difficult rehearsal strategy than the more difficult sentence strategy. This hypothesis was generally supported. Although the difference between the number of Ss rehearsing and producing sentences in the nonspecific transfer condition was not significant the trend was in the predicted direction.

Recall Hypothesis IIa stated that sentence strategies would facilitate recall in the PA training and transfer tasks. This hypothesis was confirmed in that those Ss trained to produce sentences remembered more than the control Ss in the PA training task and in both the specific and nonspecific PA transfer tasks.

Hypothesis IIb stated that sentences would facilitate recall more in the specific PA transfer condition than in the nonspecific PA transfer condition. This hypothesis was not supported since the facilitation of sentences was equal in both specific and nonspecific PA transfer conditions.

CHAPTER IV

DISCUSSION

Use of Memory Skills

Previous studies concerned with training young children to use memory skills have examined the effectiveness of training by children's use of the skills in transfer tasks similar to the ones in which the Ss were originally trained to use the skills (e.g., Hagen et al., 1973; Keeney et al., 1967; Milgram, 1967). In these studies, however, the overall success of the training procedures has remained unclear. There is no information if the children can use their skills in tasks other than those in which the skills were once trained. If training is to be successful then children should be able to use their previously-trained skills in different types of memory tasks, not just in those transfer tasks which are similar to the training task.

The major purpose of the present study was to examine the above question by training young children to use memory skills and then examining the use of these skills in two types of transfer tasks. One transfer task was similar to the task in which the strategies were trained. The other transfer task was entirely new to the child and different from the task in which the strategy had been trained. It was reasoned that children's use of the previously-trained memory skills in the entirely new transfer task would provide better evidence that the children had been successfully trained to use memory skills. An additional purpose of the present study was to determine

whether the effects of training would be influenced by the relative complexity of the memory strategy that the children were trained to use. To examine this question one group of children was trained to use a simpler and less difficult rehearsal strategy and a second group was trained to use a more difficult and complex sentence strategy.

The results revealed that the training procedures used by the present study were highly effective. In the first place, children used their previously-trained skills in the entirely new transfer task as well as in the transfer task which was similar to the training task. The effectiveness of training was further demonstrated by the finding that more of the trained-Ss used rehearsal and sentence strategies in the transfer tasks than control Ss. The finding that Ss used their strategies in the entirely new task indicates that the induction technique utilized by the present study and other studies (e.g., Jensen & Rohwer, 1965; Milgram, 1967) does not restrict children's use of memory skills to the tasks in which they were originally trained. Instead, the findings indicate that these training procedures teach children not only the use of certain strategies but also that the strategies can be used in different types of memory tasks.

Children's use of previously-trained memory skills was influenced by the relative complexity or difficulty encountered in using the skill. In general, it appears that the less difficult and more primitive rehearsal strategy (e.g., Flavell, 197) required less training than the sentence strategy (i.e., required less prompting) and was more readily transferred to other recall tasks than the more difficult and later-to-develop sentence strategy. Although the total

number of Ss who rehearsed was significantly greater than the number of Ss who used sentences, this difference was not significant when the transfer task was different from the training task, but the trend was in the predicted direction. Rehearsal condition ceiling effects were the probable cause of this smaller difference. A larger sample size might have broadened the difference between the number of Ss producing strategies in the rehearsal and sentence conditions.

The finding of the present study that the Ss continued to rehearse in the transfer tasks is surprising when compared with the findings of other induced rehearsal studies (e.g., Hagen et al., 1973; Keeney et al., 1967) that Ss stopped rehearsing in subsequent transfer tasks. There are however, several methodological differences between the present study and previous studies which may account for these discrepant findings. In the first place, although the present Ss were told about the beneficial effects of rehearsal on their recall during the training session, Ss in previous studies were not given this information and this may have resulted in an extinction of the rehearsal strategy (e.g., Flavell, 1970; Keeney et al., 1967). Secondly, the instructions given at the beginning of the transfer session to "use the best way" may have been a strong prompt for the present Ss to use the previously-trained rehearsal strategy. Thirdly, since the present Ss were somewhat older than the Ss in previous induced rehearsal studies they may have retained the strategy to a greater extent than the younger Ss of previous studies. Finally, the present study induced a somewhat easier noncumulative rehearsal strategy whereas previous studies have induced a cumulative rehearsal strategy which may be more difficult for younger Ss (e.g., Kingsley & Hagen, 1969).

Summarizing the above discussion, it appears that young children can generalize previously-trained mnemonic skills to entirely different recall tasks. The extent of this generalization appears to be largely related to the difficulty the young child encounters in using the skill, with the relatively simple rehearsal skill being used more than the more complex sentence skill.

Recall Performance

Training children in the use of rehearsal and sentence strategies resulted in no facilitation in the SL training or transfer tasks. The findings with the sentence strategy are consistent with the findings of other studies (e.g., Jensen & Rohwer, 1965; Levin, 1970) that sentences serving to link successive pairs of SL items do not improve recall. In order for sentences to improve SL recall it appears that at least three successive items should be related within one larger sentence (e.g., Levin, 1970). While the noncumulative rehearsal strategy did not result in enhanced SL recall, other studies (e.g., Kingsley & Hagen, 1969) have found that an induced cumulative rehearsal strategy does result in enhanced SL recall. It is also possible that rehearsal failed to facilitate SL recall because the present SL task differed in certain respects (e.g., items presented in pairs, only half of the pictures serving as recall items) from the SL tasks which previous investigators have typically used (e.g., Kingsley & Hagen, 1969).

Both rehearsal and sentence training facilitated recall in the PA training task but the sentence strategy was obviously the most effective. Sentences maintained a high level of recall across both trials of the PA training task while the recall level of the rehearsal

strategy was not as high as the sentence strategy initially on the first trial and even showed a decrease on the second trial. This suggests that rehearsal produces only temporary associative bonds between items which rapidly fade whereas the associative bonds produced by sentence strategies are much more permanent.

In the PA transfer tasks sentences facilitated recall to the same extent when the PA transfer task was similar to the original PA training task and when the PA transfer task was different from the original SL training task. This finding was likely due to the fact that the same number of Ss used sentences in both PA transfer conditions. Rehearsal training showed no facilitation in recall in the PA transfer tasks. Previous induced rehearsal studies have attributed a decrease in recall in SL transfer tasks to Ss' not continuing to rehearse (e.g., Hagen et al., 1973, Keeney et al., 1967). This was not the case in the present study however, since all Ss continued to rehearse in the PA transfer tasks and yet there was no facilitation as there had been in the PA training task.

If rehearsal does produce temporary bonds between items, as was suggested above, then the rehearsal-training group should have remembered more than the control group on trial one of the PA transfer task as they did on trial one of the PA training task because all of the rehearsal Ss continued to rehearse. However, the recall scores of these two groups did not differ on either recall trial of the PA transfer task. It is possible that the rehearsal group would have remembered more than the control group on trial one except that the control Ss may have spontaneously started to use their own covert strategies, such as rehearsal, thus improving their recall up

to the level of the rehearsal group.

A second possible reason why rehearsal facilitated recall in the PA training task but not in the PA transfer task may be that rehearsal is not actually a more effective strategy that whatever strategies the control Ss may have been using. Perhaps the rehearsal Ss were more highly motivated to perform well during training than the control Ss because they were being taught to use a new strategy. During the transfer session however, the same rehearsal Ss may have mechanically reproduced the rehearsal strategy but were not as highly motivated to perform as well as they had performed during training.

Concluding Comments

The present study set out to examine whether young children would use previously-trained memory skills in an entirely new memory task as well as one which was similar to the task in which the skills were trained. The finding that the Ss used their skills equally in both types of transfer tasks suggests that it was not merely transfer task similarity which was responsible for children's use of previously-trained strategies. The results imply that Ss' use of strategies was active not passive nor under the control of the similarity between transfer and training tasks. The finding that the trained-Ss used their strategies in the new task and that more trained-Ss than control Ss used strategies suggests that the trained-Ss were acting in an intentional or purposeful manner in an attempt to perform well in the new task. This behaviour of the trained-Ss appears to be very similar in nature to the kind of behaviour Flavell (1970) refers

to as "planfulness" used to describe children's developing "tendency to look for present means to the attainment of future ends." In the present study the trained-Ss appeared to be acting in a planful manner when they used a strategy which, because of their previous training experience, they believed would assist their recall in the new task.

The present study does provide information as to what is necessary for young children to be successfully trained to use memory skills. The findings indicate that children will continue to use strategies, regardless of whether or not the strategy facilitates recall, provided the children have reason to believe that the strategy is effective. If young children are to be successfully trained to use more efficient memory skills, then the training procedures should include at least two essential elements. First, the children should be taught to use memory skills which do, in fact, facilitate their recall. Second, the procedures should ensure that the children are aware of the beneficial effects of the strategy on their recall performance.

The explanation that young children's awareness of the effectiveness of a strategy plays an important role in their future use of the strategy could be tested using a 2 x 2 design. One group of first or second-grade nonrehearsers could be taught an effective cumulative rehearsal strategy in a SL task while a second group could be taught an ineffective noncumulative rehearsal strategy. Half the Ss in each group would receive no information while the other half would be told about the beneficial effects of rehearsal on recall. One week later another SL task would be administered. If Ss' awareness

of the effects of rehearsal on recall plays a role in determining their use of the strategy then it would be predicted that Ss receiving no information would stop rehearsing even when the strategy had already proven effective. It would also be predicted that Ss told of the beneficial effects of rehearsal on their recall would continue rehearsing even when the strategy had already proven ineffective in facilitating their recall.

APPENDIX A

REVIEW OF THE LITERATURE

Recently, there has been considerable interest in the development of children's memory processes. The readers are referred to an aticle by Flavell (1970) for a review of this research. The results of several investigations have revealed that with increasing age there are corresponding changes in the child's spontaneous use of skills which are applied to solve memory problems. For example, Flavell, Beach and Chinsky (1966) attempted to monitor the spontaneously emitted verbalizations of kindergarten, second and fifth-grade children in a memory task. The authors observed that the older children verbalized the names of the to-be-recalled pictures more than the younger children as a means to improve their recall for the pictures. Research with older subjects has revealed the use of even more complex techniques than the labelling of pictures. Martin, Boesma and Cox (1965) interviewed college students after a memory task and asked them to report the techniques they used to remember the items. The subjects reported using an array of strategies such as rehearsal, cue words, category words, syntactic links in order to improve their recall.

The studies reported above appear to support Flavell's (1970) contention that memory development consists largely of the application of more efficient memory skills. Assuming therefore,

that older children use more efficient memory skills than younger children, several investigators have attempted to train children to use more efficient memory skills (e.g., Hagen & Kingsley, 1968; Rosner, 1971). The procedures adopted in most of these training studies have been basically the same. Prior to the administration of the memory task one group of subjects is instructed to use a particular memory strategy to remember the items (e.g., rehearsal) while a control group of subjects is not instructed in the use of the strategy. The results of this type of training have generally indicated that children's recall is enhanced when they are trained to use more efficient skills.

The purpose of this review section is to examine previous studies which ave attempted to train children to use more efficient memory skills. The review will be organized according to the variables believed, by the present author, to be important in this area of research. The review will be divided into three sections: (a) types of training studies, (b) task variables which may influence the effects of training, and (c) age variables which may influence the effects of training.

Types of Training Studies

In this section there will be a review of the studies which have trained children to use the skills of labelling, rehearsal, syntactic links or sentences, categorizing conceptually related items into common categories and imagery. In addition, there will also be a discussion of some recent Russian studies in this area.

Labelling

Labelling has been selected as a strategy by various investigators since it has been found that when objects are given verbal labels they are easier to remember (e.g., Rohwer, 1968). Children trained to use labelling have typically been instructed to name aloud the to-be-remembered items as they are presented. Studies which have trained children to use a labelling strategy have made frequent use of the serial (SL) learning paradigm in which the subject is presented with the items in a definite order and later is required to remember the items in the same order of presentation. In a series of studies Hagen and his colleagues (e.g., Hagen & Kingsley, 1968; Hagen, Meacham & Mesibov, 1970) have examined to effects of labelling training across a wide range of ages including nursery school and grades 1, 2, 3, 4, 5, 6, 8 and college students. The results of these studies have indicated that labelling facilitated the SL recall of subjects in the intermediate age ranges (i.e., grades 1, 2, 3, 4) but did not facilitate the recall of nursery school children or older children in grades five through college.

Rehearsal

Since labelling makes objects more memorable then repetition or rehearsal of the labels should make them even more memorable. Subjects trained to use this skill have been instructed either to repeat the names of the items several times as each is presented (i.e., noncumulative rehearsal) or to repeat the names of all of the preceding items that have been presented as each new item is presented (i.e., cumulative rehearsal). Although children have been trained to use both types of rehearsal strategies

(e.g., Kingsley & Hagen, 1969; Rosner, 1971) their relative effectiveness has not been compared in any one study. While more investigators interested in the effects of rehearsal training have tended to use SL tasks (e.g., Hagen, Hargrave & Ross, 1973; Keeney, Cannizzo & Flavell, 1967; Kingsley & Hagen, 1969) one study made use of a free recall (FR) task (e.g., Rosner, 1971). In a FR task the to-be-remembered items may be recalled in any order, unlike the SL task where a definite order is required. Rehearsal training has been shown to facilitate the SL recall of nursery school, kindergarten and first-grade children (e.g., Hagen et al., 1973; Keeney et al., 1967; Kingsley & Hagen, 1969) but no facilitation was observed in the FR performance of first, fifth and ninth-grade children (e.g., Rosner, 1971).

Sentences

Investigators have selected this strategy because the generation of syntactic links between items increases the associative strength between the items thus rendering them more meaningful and memorable. The strategy itself requires that the recall items be joined with syntactic links, such as verbs or prepositions. Although the effects of sentence training have been examined in children's FR and SL recall (e.g., Jensen & Rohwer, 1965; Rosner, 1971) the majority of studies have made use of the paired-associate (PA) learning paradigm (e.g., Jensen & Rohwer, 1965; Levin, 1972; Milgram, 1967). In a PA task the subject is presented with several stimulus-response pairs to remember. After all of the pairs have been presented only the stimulus items are presented and the subject's task is to provide the correct response for each stimulus

item. The earliest training study with normal children was that of Jensen and Rohwer (1965). In that study the PA and SL recall performance of children in grades kindergarten through twelve was examined. Half the subjects were instructed to learn the items by joining them in sentences while the other half named the items. The results showed that sentences facilitated the PA performance of subjects in grades two through eight but did not facilitate recall at the kindergarten level nor above grade eight. There was no facilitation in the SL task at any age level. Rosner (1971) instructed one group of her subjects in grades one, five and nine to join FR items by generating syntactic links. Her results showed that syntactic link training facilitated FR recall significantly at the fifth-grade level and only slightly at the ninth-grade. There was no facilitation for the youngest subjects.

Categorization

This strategy has been selected for training purposes since memory for items may be greatly increased if the subject groups items into the same conceptual category (e.g., vehicles such as car, truck, bus) in order to remember them. In an FR task the test items may be selected from several well-defined categories (e.g., vehicles, animals, vegetables) and if the subject reorganizes the randomly presented items back into their proper categories recall is usually enhanced. Moely, Olson, Halwes and Flavell (1969) trained children in kindergarten and grades one and three to group randomly presented items, drawn from several categories, into their proper categories in order to improve their recall.

The results showed that all three age levels benefited from the grouping training.

Imagery

Although the studies reported thus far have been generally concerned with verbal memory skills there is now ample evidence that visual imagery also plays an important role in children's memory processes. The readers are referred to an article by Rohwer (1970) for a review of this research. Rohwer (1970) reported the facilitative effects of imagery on children's PA recall when the imagery is "imposed" by means of presenting the picture pairs in the form of a pictorial interaction as opposed to when the pictures are presented in the traditional side-by-side manner. Assuming that interacting images produce better recall several investigators have attempted to train children to generate their own interacting images when they were presented with side-by-side pictures or objects (e.g., Clarkson, Haggith, Tierney & Kobasigawa, 1973; Levin, 1972; Levin & Kaplan, 1972; Wolff & Levin, 1972; Wolff, Levin & Longobardi, 1972). The results of these studies have revealed that kindergarten children do not benefit from imagery instructions while older children in grades two through six do benefit from imagery instructions.

Russian Research

The objectives of Russian training studies appear to be very similar to the studies already reviewed in that training is used so that children will use the memory skills at an earlier age than they would normally without the benefit of training. Smirnov,

Istomina, Mal'tseva and Samokhvalova (1971-72) have reported a series of studies in which preschool and elementary school children were trained to use logical memory skills. The skills were logical in that they involved the use of conceptual categorization as an aid to memory. In the first study preschool children were trained to use the skill of conceptual association to remember the names of objects. The procedure was that of a "matching" process in which the children were trained over a series of increasingly difficult steps to match or associate pictures of objects with pictures of the same objects, pictures of objects with pictures that represented that class of objects, pictures of objects with the names of objects and category pictures with the names of objects. Finally the pictures were covered and the children were permitted to uncover them in order to remember the names of the objects. The results showed that almost all of the children used the pictures to remember the names and recall was 150-200% higher when the children used the pictures than when they did not. In addition, the authors reported that one year after training the recall of the trained children was almost twice that of the control groups.

A second study involved the training of conceptual classification of individual words with second and fourth-grade children. The procedure was similar to that of the first study in that the children were exposed to increasingly difficult steps of training. The subjects were instructed first to find categories for all of the to-be-remembered words and then to place all of the to-be-remembered words into their proper categories. The results revealed that these instruction procedures produced increases in recall of 28.3%

and 26.3% for the second and fourth-grade children, respectively.

A third training study was concerned with whether second, fourth and sixth-grade children could be instructed to use a special analytical skill as a memory aid for text material. The study was also concerned with conceptual classification in that the subjects were required to group similar ideas which expressed the same theme. Again the procedure involved training the children to proceed through increasingly difficult steps of analyzing text materials. First the children were required to extract the main ideas by asking themselves questions such as "Whom or what is being spoken of?" and then to generalize the ideas by expressing them in their own words and finally to reverse this process by recognizing that their generalized ideas were specifically expanded in the text. The results of this study revealed that a large majority of fourth and sixth-grade subjects used this analytical skill spontaneously to memorize new material without prompting. Although the second-grade children could perform the strategy during training they did not do so spontaneously afterwards but required special encouragement.

In summarizing the results of these studies the authors point to two factors essential for the successful training of children. In the first place the training procedures should involve two main steps: first the skill is taught as an independent action (e.g., pointing out the existence of categories) and second the skill is used as a memory technique. The second necessary condition for training is that the children should be instructed in direct memory operations such as learning that similar elements belong to a conceptual category and reverse operations such as learning that a

given conceptual category contains a number of similar elements.

Although the above studies, including the Russian research, generally indicate that children can be trained to use efficient memory skills, the effectiveness of training children to use any one particular memory skill appears to depend heavily on certain task variables and on the age of the child. In the next section there will be a review of some of the task variables which have been found to play an important role in children's use of efficient memory strategies.

Task Variables

The task variables to be discussed in this section include the nature of the memory task, the nature of the task materials, the measure of memory, and the nature of the experimenter's instructions to the subject.

Nature of the Memory Task

Although children have been trained to use more efficient memory skills it is unlikely that the skills discussed above would result in improved recall in all of the memory tasks which investigators have frequently used (e.g., PA, SL, FR). For example, training children to categorize items into conceptual categories could interfere with performance in a SL recall task. While the categorization strategy typically calls for the reorganization of items, SL recall requires that the items be recalled in exactly the same way they were originally presented.

Although the above example is speculation there have been studies which have revealed that strategies effective in one type of task are not necessarily effective in naother type of memory task. For example, although rehearsal training facilitated the SL recall

of first-grade children (e.g., Keeney et al., 1967) Rosner (1971) discovered that first-grade children did not benefit from rehearsal instructions in a FR task.

In some cases however, it may be that although a strategy is not effective in one task, a slight modification of the strategy could improve its effectiveness. Jensen and Rohwer (1965) found that sentences facilitated children's PA recall but not SL recall. This negative finding in the SL task however, may have been due to the fact that the subjects were instructed to produce sentences containing only two successive items. Bower and Clark (1969) found the SL performance of college students was enhanced when they were instructed to include all the SL items in a longer sentence or narrative. In addition, Levin (1970) reported that sentences provided by the experimenter facilitated the SL performance of fourth and fifth-grade children provided at least three items were included in each sentence.

Nature of Task Materials

While the large majority of training studies have used pictorial materials as the to-be-remembered items (e.g., Hagen et al., 1973; Hagen & Kingsley, 1968; Hagen et al., 1970; Jensen & Rohwer, 1965; Kingsley & Hagen, 1969; Milgram, 1967; Moely et al., 1969; Rosner, 1971) to the knowledge of the author there have been only two studies which have compared the effects of training using both pictures and words as recall materials. Levin and Kaplan (1972) observed that sixth-grade children remembered more following imagery training in a PA task when the materials were pictures than when they were words. The nature of this picture-word difference was further

investigated in a study reported by Levin (1972) in which second and fifth-grade children were trained to generate interacting images or sentences. Each group was presented with a PA task in which half the materials were word pairs and half were picture pairs. The results indicated that the second-grade children performed poorer when the materials were words than when they were pictures irrespective of whether they were generating sentences or interacting images. The fifth-grade children performed almost equally well with either pictures or words but there may have been a ceiling effect with the older age level. More specifically, pictures may have resulted in better recall than words but the older subjects may have been prevented from performing any better because the PA list was too short.

Measure of Recall

While several investigators interested in the effects of imagery training on PA recall have adopted verbal recall as their measure of performance (e.g., Clarkson et al., 1973; Levin & Kaplan, 1972) recent evidence suggests that this measure of recall may handicap the young child. Paivio (1969) has proposed that the young child has difficulty in decoding his mediating image of picture materials to the required verbal response. If Paivio's decoding hypothesis is correct then it may not be possible to train young children to use an imagery strategy if the child is required to respond verbally. However, if a recognition procedure is used wherein the child is not required to respond verbally but instead points to the correct response picture which he recognizes as being the correct associate then the decoding problem may be averted. Evidence in support of

this hypothesis was recently obtained by Levin (1972) in a study reported earlier. In that study second-grade children benefited from imagery training much more when picture recognition was used than when verbal recall was used as the dependent measure of recall performance.

Instructions to the Subject

In two studies already discussed (i.e., Keeney et al., 1967; Kingsley & Hagen, 1969) it was reported that rehearsal instructions facilitated the SL recall of nursery school and first-grade children. In addition, subjects in the Keeney et al. (1967) study stopped using the rehearsal strategy on a subsequent SL transfer task administered after the training session. In both of the above studies however, the training consisted not only of rehearsal instructions but prompting was also provided whenever the subjects stopped using the rehearsal strategy. It is possible therefore that the prompting may have been partly responsible for the observed facilitation of rehearsal training. In order to examine the effects of prompting on rehearsal instructions Hagen et al. (1973) instructed younger (XCA=5.8 years) and older XCA=7.3 years) children to rehearse in a SL task. Half the children at each age level received prompting while the other half received no prompting. The results showed that rehearsal facilitated recall only at the younger age level and only when prompting was provided. Also, there was no carry-over of the beneficial rehearsal strategy to a SL transfer task administered one week later with no prompting. It appears that at this age level prompting does play an important

role in rehearsal training and in retrospect it is not surprising that the subjects in the original induced rehearsal study of Keeney et al. (1969) stopped rehearsing after the training session since prompting was no longer available to them.

It has frequently been reported in this review paper that children at one age level benefit from training while those at another age level do not (e.g., Hagen et al., 1970; Jensen & Rohwer, 1965). In the following section the author will discuss some of the reasons why children at various age levels in previous studies did not benefit from training.

Age

An examination of previous training studies reveals that children did not benefit from training for one or more of the following age-related reasons: (a) they were too young to use the strategy efficiently, (b) children in the untrained control group were spontaneously generating their own strategies thus improving their recall up to the level of the trained subjects, and (c) older subjects' performance was interfered with when they were required to use less efficient strategies.

The Strategy Is Too Difficult for the Young Child

In some studies it has been observed that the younger child was simply unable to use the skills that he was being trained to use (e.g., Jensen & Rohwer, 1965; Kingsley & Hagen, 1969; Wolff & Levin, 1972; Wolff, Levin & Longobardi, 1972). Jensen and Rohwer (1965) observed that while older children (i.e., grade two and older) experienced little difficulty in generating sentences

joining PA items their younger kindergarten subjects did not produce the required syntactic links but instead tended to join the items with conjunctions, such as "and", which subsequently detracted from their recall performance. Kingsley and Hagen (1969) attempted to train nursery school children to rehearse the names of a series of pictures as they were presented one-by-one (i.e., cumulative rehearsal). It was observed that only a few of the children correctly rehearsed the entire sequence of items after they had all been presented. While these young subjects could rehearse the first two or three items the rehearsal of four or five items was too difficult for them.

Similar deficiencies in young children have been observed when researchers have attempted to train them to use an imagery strategy. Wolff and Levin (1972) and Wolff, Levin and Longobardi (1972) attempted to train kindergarten children to generate interacting images in order to improve their recall in a PA task. The authors observed that the kindergarten children reported being unable to experience an interacting image of two separated PA objects and thus performed poorly in the recall task.

Control Subjects' Spontaneous Use of Strategies

With increasing age children spontaneously begin to use more efficient memory strategies without the aid of training (e.g., Flavell, 1970). In a training study it is possible that older untrained control subjects could perform as well as the trained subjects because of their spontaneous production of more efficient strategies to improve their recall. Jensen and Rohwer (1965) observed that although their younger subjects benefited from sentence training the older subjects did not because their performance did not differ

from the untrained control group. The authors interpreted this finding as indicating that the older control subjects were spontaneously generating their own sentences which improved their recall up to the level of the sentence-trained group. This may or may not have been the case however, since the control subjects could have been rehearsing the items which facilitated their recall up to the level of the sentence group which could show no further improvement because of the ceiling effects which were apparent in this study.

Interference

Assuming that older subjects spontaneously generate their own efficient memory strategies, then requiring them to use less efficient strategies could result in interference and detract from their normal recall performance. There have been studies which have shown this interference effect as a result of instructing older subjects to use less efficient strategies (e.g., Hagen et al., 1970; Rosner, 1971). Hagen et al. (1970) reported that although induced labelling facilitated the SL recall of young children, ages six and eight, above that of the control group, there was a detrimental effect of labelling for college students. The college students who were required to label the SL items performed poorer than the control subjects who were free to learn the items in whatever way they chose. Rosner (1971) observed that the FR performance of ninth-grade children was lower when they were given rehearsal instructions than when they were given standard FR instructions. From these results it appears that older subjects may spontaneously generate more efficient memory strategies and

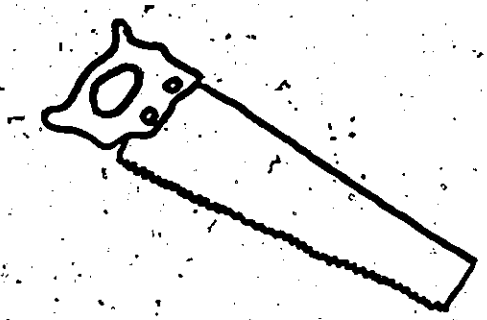
instructing them to use less efficient strategies such as labelling or rehearsal may interfere with this spontaneous activity and result in poorer performance.

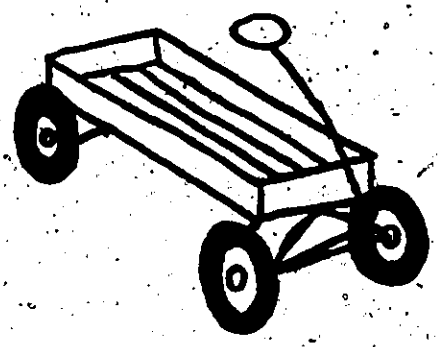
Although the above variables, including task and age variables, have all been reviewed separately in each section they are not independent but instead in any one memory situation they may all interact in a very complex manner. For example, while older children can use a more complex sentence strategy younger kindergarten children cannot (e.g., Jensen & Rohwer, 1965). Younger children however, can use a simpler rehearsal strategy (e.g., Kingsley & Hagen, 1969) provided they are prompted to do so (e.g., Hagen et al., 1973) and recall will be enhanced provided the task used is SL not FR (e.g., Hagen et al., 1973; Rosner, 1971).

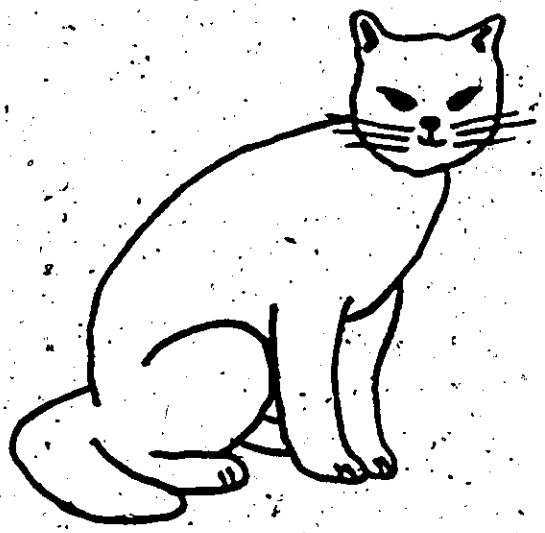
In light of the above discussion it appears that in order to train children to use more efficient memory skills considerations concerning strategy, task and age variables must be taken into account. With a few exceptions (e.g., Keeney et al., 1967; Milgram, 1967) the effectiveness of training has been measured indirectly by means of recall performance. What is needed in future studies is better and more direct evidence of the effectiveness of training. More systemmatic measures of the child's actual use of strategies in memory tasks and use of strategies in tasks other than the training task are possible directions for future research.

APPENDIX B

EXAMPLES OF MATERIALS







APPENDIX C

ORDER OF PRESENTATION OF SL ITEMS

TRAINING TASK 1

Study Period	Trial 1 Recall	SL Position	Trial 2 Recall	SL Position
1. clock-table	1. clock	1	1. clock	1
2. fish-phone	2. phone	4	2. phone	4
3. rope-jar	3. rope	5	3. rope	5
4. dog-bike	4. dog	7	4. dog	7

TRAINING TASK 2

1. pencil-cake	1. cake	2	1. cake	2
2. bird-dress	2. bird	3	2. bird	3
3. candle-house	3. house	6	3. house	6
4. monkey-horn	4. horn	8	4. horn	8

TRANSFER TASK 1

Study Period	Trial 1 Recall	SL Position	Trial 2 Recall	SL Position
1. chain-dish	1. chain	1	1. chain	1
2. chicken-flag	2. chicken	3	2. chicken	3
3. pipe-bed	3. flag	4	3. flag	4
4. elephant-hat	4. hat	8	4. hat	8

TRANSFER TASK 2

1. saw-wagon	1. wagon	2	1. wagon	2
2. cat-umbrella	2. cat	3	2. cat	3
3. lamp-book	3. lamp	5	3. lamp	5
4. rabbit-ladder	4. rabbit	7	4. rabbit	7

ORDER OF PRESENTATION OF PA ITEMS

TRAINING

Study Period	Trial 1 Recall	Trial 2 Recall
1. clock-table	1. bird	1. candle
2. fish-phone	2. fish	2. dog
3. rope-jar	3. clock	3. pencil
4. dog-bike	4. rope	4. clock
5. pencil-cake	5. monkey	5. fish
6. bird-dress	6. candle	6. monkey
7. candle-house	7. dog	7. rope
8. monkey-horn	8. pencil	8. bird

TRANSFER

Study Period	Trial 1 Recall	Trial 2 Recall
1. chain-dish	1. chicken	1. lamp
2. chicken-flag	2. chain	2. rabbit
3. pipe-bed	3. saw	3. pipe
4. elephant-hat	4. rabbit	4. chicken
5. saw-wagon	5. lamp	5. chain
6. cat-umbrella	6. elephant	6. cat
7. lamp-book	7. pipe	7. saw
8. rabbit-ladder	8. cat	8. wagon

APPENDIX D

Table 7

Mean Age and Sex Composition of the Three Training Groups

GROUP	MALES	FEMALES	MEAN CHRONOLOGICAL AGE IN YEARS
Control	18	14	8.18
Rehearsal	18	14	8.00
Sentence	19	13	8.16

Table 8

Summary of Analysis of Variance of Training Task, Strategies and Trials

Source	df	MS	F
Between Ss			
(A) Task	1	52.08	12.65**
(B) Strategies	2	94.27	22.90**
A x B	2	106.27	25.86**
Error	90	4.12	
Within Ss			
(C) Trials	1	0.52	1.12
A x C	1	2.52	5.42*
B x C	2	1.02	2.19
A x B x C	2	2.02	4.34*
Error	90	0.47	

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

Table 9

Summary of Analysis of Variance of Strategies and Trials in SI Training Task

Source	df	MS	F
Between Ss			
(A) Strategies	2	0.22	0.05
Error	45	4.15	
Within Ss			
(B) Trials	1	0.38	0.70
A x B	2	0.09	0.16
Error	45	0.54	

Table 10

Summary of Analysis of Variance of Strategies and Trials in PA Training Task

Source	df	MS	F
Between Ss			
(A) Strategies	2	200.32	49.21***
Error	45	4.07	
Within Ss			
(B) Trials	1	2.66	5.11*
A x B	2	2.95	5.67**
Error	45	0.52	

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

Table 11

Summary of Analysis of Variance of Transfer Task, Transfer Condition, Strategies and Trials

Source	df	MS	F
Between Ss			
(A) Transfer Task	1	0.88	0.15
(B) Transfer Condition	1	3.80	0.64
(C) Strategies	2	49.26	8.32**
A x B	1	5.01	0.85
A x C	2	56.72	9.59**
B x C	2	5.92	1.00
A x B x C	2	5.54	0.94
Error	84	5.92	
Within Ss			
(D) Trials	1	0.01	0.01
A x D	1	0.05	0.12
B x D	1	1.51	3.77*
C x D	2	0.35	0.87
A x B x D	1	0.26	0.64
A x C x D	2	0.47	0.12
B x C x D	2	0.10	0.25
A x B x C x D	2	0.57	1.42
Error	84	0.40	

* $.05 < p < .10$

** $p < .001$

Table 12

Summary of Analysis of Variance of Strategies, Transfer Condition and Trials in SL Transfer Task

Source	df	MS	F
Between Ss			
(A) Transfer Condition	1	8.76	1.26
(B) Strategies	2	0.76	0.11
A x B	2	2.26	0.32
Error	42	6.92	
Within Ss			
(C) Trials	1	0.01	0.03
A x C	1	0.26	0.82
B x C	2	0.07	0.23
A x B x C	2	0.44	1.42
Error	42	0.31	

Table 13

Summary of Analysis of Variance of Strategies, Transfer Condition and Trials in PA Transfer Task

Source	df	MS	F
Between Ss			
(A) Transfer Condition	1	0.04	0.01
(B) Strategies	2	105.21	21.43**
A x B	2	9.19	1.87
Error	42	4.90	
Within Ss			
(C) Trials	1	0.04	0.08
A x C	1	1.50	3.09*
B x C	2	0.32	0.66
A x B x C	2	0.21	0.45
Error	42	0.48	

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

APPENDIX E

RAW RECALL DATA 1

CONDITION: Control
SL Training Task
SL Transfer Task

	Training				Transfer			
	Task 1		Task 2		Task 1		Task 2	
Subject	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
1	6	6	3	3	1	2	2	2
2	4	4	2	2	1	1	1	1
3	1	0	2	0	0	0	2	2
4	1	1	1	0	1	0	1	1
5	1	1	0	1	1	1	0	0
6	1	3	0	0	2	2	2	2
7	0	0	3	3	3	3	3	3
8	1	1	2	2	2	2	3	3

RAW RECALL DATA 2

CONDITION: Control
SL Training Task
PA Transfer Task

	Training				Transfer	
	Task 1		Task 2			
Subject	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
9	0	1	3	3	4	4
10	3	3	1	1	3	3
11	1	1	2	2	1	0
12	2	2	1	1	1	1
13	1	1	2	2	3	2
14	0	0	3	3	1	2
15	0	0	3	3	0	2
16	1	2	0	0	1	2

RAW RECALL DATA 3

CONDITION: Control
PA Training Task
PA Transfer Task

	Training		Transfer	
Subject	Trial 1	Trial 2	Trial 1	Trial 2
17	3	3	3	3
18	1	1	3	2
19	1	0	5	3
20	1	1	1	3
21	0	1	2	0
22	1	1	4	3
23	2	3	4	4
24	1	1	5	4

RAW RECALL DATA 4

CONDITION: Control
PA Training Task
SL Transfer Task.

Subject	Training		Transfer			
			Task 1		Task 2	
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
25	1	0	1	2	1	1
26	2	1	0	0	2	2
27	3	3	2	2	1	1
28	3	2	3	2	1	0
29	5	4	3	3	4	4
30	2	2	2	2	2	2
31	1	1	2	2	1	1
32	4	4	3	3	4	4

RAW RECALL DATA 5.

CONDITION: Rehearsal
SL Training Task
SL Transfer Task

	Training				Transfer			
	Task 1		Task 2		Task 1		Task 2	
Subject	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
33	2	2	2	2	3	3	1	1
34	2	2	1	2	2	3	1	1
35	1	1	2	2	4	4	3	3
36	2	2	2	2	4	4	2	2
37	2	2	1	0	2	1	1	1
38	0	0	2	1	2	0	1	1
39	2	2	1	2	2	2	2	2
40	1	1	1	1	2	1	0	0

RAW RECALL DATA 6

CONDITION: Rehearsal
SL Training Task
PA transfer Task

	Training				Transfer	
	Task 1		Task 2			
Subject	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
41	1	1	2	2	2	3
42	0	1	1	1	1	0
43	2	2	3	4	4	4
44	1	1	2	2	5	4
45	2	1	2	2	3	2
46	1	0	0	0	2	3
47	1	2	0	2	3	3
48	0	1	2	2	0	1

RAW RECALL DATA 7

CONDITION: Rehearsal
PA Training Task
PA Transfer Task

Subject	Training Trial 1	Training Trial 2	Transfer Trial 1	Transfer Trial 2
49	4	3	2	3
50	3	4	4	4
51	3	4	1	1
52	4	2	4	1
53	2	2	2	2
54	4	4	1	2
55	3	4	4	4
56	1	1	2	1

RAW RECALL DATA 3

CONDITION: Rehearsal
PA- Training Task
SL Transfer Task

Subject	Training		Transfer			
			Task 1		Task 2	
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
57	2	1	2	2	1	1
58	3	3	2	2	0	0
59	3	2	2	2	1	1
60	2	0	2	3	1	1
61	4	3	2	2	2	2
62	2	0	0	0	3	3
63	4	3	4	4	4	4
64	5	5	2	3	1	2

RAW RECALL DATA 9

CONDITION: Sentence
SL Training Task
SL Transfer Task

	Training				Transfer			
	Task 1		Task 2		Task 1		Task 2	
Subject	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
65	1	1	3	2	3	4	4	4
66	0	0	2	2	2	2	0	0
67	2	2	2	1	1	1	1	1
68	3	3	3	3	4	4	1	1
69	0	0	0	0	1	2	0	0
70	1	1	1	1	2	1	0	1
71	2	2	3	4	1	1	2	2
72	1	0	0	0	2	1	0	0

RAW RECALL DATA 10

CONDITION: Sentence
SL Training Task
PA Transfer Task

	Training				Transfer	
	Task 1		Task 2			
Subject	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
73	2	2	2	2	6	7
74	2	2	2	4	7	7
75	1	3	1	1	4	4
76	1	1	2	1	7	7
77	0	2	0	0	4	5
78	0	0	0	1	6	6
79	2	1	1	1	7	8
80	0	0	3	3	6	6

RAW RECALL DATA 11

CONDITION: Sentence
PA Training Task
PA Transfer Task

Subject	Training Trial 1	Training Trial 2	Transfer Trial 1	Transfer Trial 2
S1	6	8	8	8
S2	7	7	7	7
S3	6	7	3	2
S4	6	7	1	2
S5	8	8	8	8
S6	8	7	3	3
S7	8	8	7	7
S8	4	4	4	4

RAW RECALL DATA 12

CONDITION: Sentence
PA Training Task
SL Transfer Task

Subject	Training		Transfer			
			Task 1		Task 2	
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
89	9	8	4	4	1	1
90	4	5	1	1	4	4
91	8	8	3	3	2	2
92	7	6	4	4	1	2
93	8	8	2	3	3	0
94	7	7	3	3	1	2
95	6	6	1	0	0	2
96	3	4	1	1	1	1

APPENDIX F

RAW STRATEGY TRANSFER DATA 1

No Strategy = NS, Naming = N, Rehearsal = R, Sentence = S

CONTROL CONDITION

SLSL		SLPA		PAPA		PASL	
Subject	Strategy	Subject	Strategy	Subject	Strategy	Subject	Strategy
1	NS	9	NS	17	N	25	NS
2	NS	10	R	18	NS	26	NS
3	NS	11	NS	19	NS	27	N
4	R	12	NS	20	NS	28	N
5	NS	13	N	21	R	29	N
6	N	14	N	22	N	30	NS
7	NS	15	NS	23	R	31	NS
8	N	16	NS	24	NS	32	R

RAW STRATEGY TRANSFER DATA 2

REHEARSAL CONDITION

SISL		SLPA		PAPA		PASL	
Subject	Strategy	Subject	Strategy	Subject	Strategy	Subject	Strategy
33	R	41	R	49	R	57	R
34	R	42	R	50	R	58	R
35	R	43	R	51	R	59	R
36	R	44	R	52	R	60	R
37	R	45	R	53	R	61	R
38	R	46	R	54	R	62	R
39	R	47	R	55	R	63	R
40	R	48	R	56	R	64	R

RAW STRATEGY TRANSFER DATA 3

SENTENCE CONDITION

SLSL		SLPA		PAPA		PASL	
Subject	Strategy	Subject	Strategy	Subject	Strategy	Subject	Strategy
65	N	73	S	81	S	89	S
66	NS	74	S	82	S	90	NS
67	S	75	S	83	NS	91	S
68	S	76	S	84	NS	92	S
69	S	77	NS	85	S	93	S
70	S	78	S	86	NS	94	S
71	NS	79	S	87	S	95	S
72	NS	80	S	88	S	96	N

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