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EFFECTS OF TRAINING IN REPETITION AND MEDIATION ON PAIRED-ASSOCIATE LEARNING AND PRACTICAL MEMORY IN THE AGED

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ABSTRACT

The purpose of this study was to determine whether training elderly persons in certain learning strategies would result in improved performance on subsequent memory tests, both of a laboratory and practical nature. A review of previous work suggested that a large part of memory decline in the non-senile elderly may be interpreted as problems in learning rather than in retention. Hulicka and Grossman (1967) and Canestrari (1968a) reported that instructing older Ss to use mediation in learning paired associates resulted in improved performance. However, there has been no evidence, and some question, that such training would generalize beyond the immediate paired-associate task. Also, there has been little work to assess the relationship between such laboratory studies of memory and real life memory difficulties for the non-senile aged.

Forty Ss, aged 60 to 86, were assigned to five groups matched on initial performance on paired-associate learning. All Ss were seen on five consecutive days. The initial session involved testing on paired-associate learning and the administration of three practical memory tests (recall of a personal narrative, a grocery list, and names and occupations for photographed persons). The next three sessions were devoted to training and testing. The five groups were given, respectively, training in the use of a

repetition strategy, training in the use of a mediation strategy, practice in learning paired associates, no training or practice but a similar amount of social attention (attention-control), and no treatment. For the repetition and mediation groups, training consisted of appropriate instructions and guided practice with one paired-associate list. These training sessions ended with testing on another paired-associate list. A fifth session included final testing on paired-associate learning and the readministration of the three practical memory tests. During the first and final sessions, Ss were asked what strategies they were using to learn and remember the material.

The results indicated that training, both in repetition and in mediation, was effective in improving performance on the immediate paired-associate task. On subsequent testing for generalization effects, however, the mediation group showed an increase in errors, while the repetition group maintained their improved level of performance; questioning after testing suggested that the repetition group actually adopted a mediation strategy on their own. The improved performance of the repetition group was not a strong effect; analysis of the paired-associate test performance of all five groups indicated no significant group differences. There was a significant trials effect across all groups, resembling a W pattern of decline and rise in errors on successive days.

Based on Ss' reports of strategy use, two groups of Ss were identified: those who, independent of training they had received, adopted a mediational strategy for paired-associate learning and those who did not. The performance of these two groups differed significantly: the mediation-developers showed a clear and steady improvement and the non-mediators showed daily fluctuations in error scores.

There was no generalization from training on paired-associate learning to the practical memory tests. The only significant change on the practical tests was an improvement on recall of the personal narrative, attributed to increased interest in the material.

It was concluded that, while increased use of mediation is effective in improving performance on paired-associate learning for elderly persons, explicit training in its use was not successful; instructions which increase the S's attention to the task and prompt him to develop his own strategy may be more effective. Some suggestions were made for continued efforts to identify the factors related to the extension of laboratory results to application on general memory difficulties of the aged.

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INTRODUCTION

Aging involves many changes, characterized by a decline of functioning in several areas. As people get older, they usually experience more chronic illnesses, have more physical complaints, less acute perception, and less agile mental functioning. In general, across a variety of measures, when the old and the young are compared, the old typically do poorer by whatever standard is applied.[1]

There has been particular interest among psychologists in charting the course of mental functioning (general intelligence, problem-solving, learning, memory, etc.) across time. While there are exceptions both in terms of areas of functioning and in terms of individual differences, evidence generally supports the idea of less efficient and less successful performance on many tasks of mental functioning. Memory has been identified as one ability showing particular deterioration and is often most readily acknowledged by the aged themselves as declining with age.

In contrast to an extensive literature documenting and delineating age-related changes in memory and other processes, there has been almost no interest in attempting to remediate

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[1] "Old" for the purposes of this paper may be considered as over 60 years of age; however, some of the differences reported (as compared to a 20-30 year old standard) may appear even earlier.

these changes. It has not been shown that such changes are inevitable. Although neurological bases have been supposed to underlie age-related decline, these have not been identified. Moreover, it has been suggested that sociological, motivational, and expectancy factors may contribute to inferior performance (Reese, 1973; Sherwood, 1967); thus, the logical conclusion is that such decline might be avoided or at least diminished by appropriate intervention. It is interesting to note that remedial efforts with memory problems in the elderly have been limited to severe disorders, where neurological damage may perhaps be more readily assumed and where psychological intervention may be less appropriate. For example, the Geriatric Reality Orientation Program at the Tuscaloosa VA Hospital, based on repeated presentation of factual information and a generally supportive and encouraging ward atmosphere, has reported surprising success even with patients whose memory disorder has progressed to the point of not remembering their own names (Taulbee & Wright, 1971). In contrast, the less dramatic problem of memory decline in normal aging has in practice been accepted as inevitable, and there have been no efforts to alter its course.

The following discussion will present a review of the literature related to research on learning/memory tasks with aged populations and the possible bases for age-related changes in certain aspects of memory functioning. Before suggesting psychological interventions, the primary

question to be explored is what do elderly persons do, or fail to do, that interferes with remembering?

Not all aspects of memory functioning show decline with age. For instance, in the course of normal aging, memory for the distant past seems to remain relatively intact. There are, of course, methodological problems involved in assessing such memory as it is often impossible to determine the accuracy of such memories; moreover, as Botwinick (1973) pointed out, distant memories may have been more often rehearsed than recent events and so better retained. Similarly, it appears that immediate memory, such as measured by digit-span type tests demanding immediate and direct recall of material presented, also shows little or no decline with age. Bromley (1958) found no difference between age groups on standard (forward) digit span tests, and Talland (1967) reported no age differences in free recall of words.

However, it is on tasks in between these two extremes of distant and immediate recall that age-related memory problems occur: that is, on tasks where the individual is presented with material and must do something more than immediately repeat it. For example, in aged subjects, immediate memory shows decline when there are such stress components as material surpassing capacity or requiring reorganization, or other distracting conditions (Inglis & Ankus, 1965; Talland, 1967; Taub, 1966). Similarly,

short-term retention, the recall of information several seconds or longer after presentation, is more difficult for older persons, especially when there is intervening activity (Welford, 1959). Tasks which require the learning and remembering of new associations, such as in paired-associate learning, also present significant difficulties for older persons (Gilbert, 1941; Gilbert & Levee, 1971; Korchin & Basowitz, 1957; Ruch, 1934; Zaretsky & Halberstam, 1968).

There has been much attention directed towards identifying the psychological processes responsible for these observed memory difficulties. As a basis for theorizing, memory has been rather simplistically conceptualized as involving registration, storage, and recall. One popular view of memory dysfunction in older persons has been that the aged experience difficulty in registration, before the material is placed in long-term storage (Talland, 1968). Welford (1951, 1959) has suggested that age-related memory difficulties stem from limitation of receptive capacity and greater susceptibility to disruption of short-term storage by intervening activity; that is, the older person more easily loses information before it can be processed into long-term memory.

More recently, another view has proposed that the elderly have trouble, not in storing information, but in retrieving it from storage (Craik, 1968; Schonfield, 1965).

There is some evidence to indicate difficulties in retrieval (Anders & Fozard, 1973; Craik, 1968; Schofield, 1965). However, such difficulties are not directly relevant to the present research; the rest of this review will focus on problems related to the registration process.

While the distinction between learning (acquisition) and memory (recall) is not clear-cut, especially when considering short-term retantion tasks, it does appear that much of what has been labelled memory decline in the elderly may actually be a learning problem. Evidence supporting this view comes from several studies that have found that when old and young Ss learned paired associates to the same criterion, there were no age differences in subsequent recall (Hulicka, 1967; Hulicka & Weiss, 1963; Wimer & Wigdor, 1958); it took the older persons more trials to learn, but once having learned they retained the material as well. Similar findings of no age differences in recall have been reported when amount of original learning has been statistically controlled, both for paired-associate learning (Davis & Obrist, 1966; Gladis & Braun, 1958) and for recall of a narrative passage (Moenster, 1972). It should be noted, however, that contradictory results have been obtained (Hulicka & Rust, 1964; Wimer, 1960). Arenberg (1973) has suggested that the determining variable may be the meaningfulness of the material to be retained; procedural differences may also account for some of the discrepancies.

Acknowledging that initial learning may be a crucial factor in the memory performance of older persons, several investigators have manipulated aspects of the learning situation to determine effects on performance. Canestrari (1963) showed that older persons do significantly better on self-paced paired-associate learning than under paced conditions; the relative improvement for younger persons was considerably smaller. Similar results were obtained when comparing longer to shorter intervals in paced trials (Arenberg, 1965; Canestrari, 1968; Monge & Hultsch, 1971).

This improvement effect seems to operate in two ways: increased learning time and increased response time. There has been considerable discussion of the relative importance of these two factors. The fact that the improved performance is largely due to a drop in omission rather than commission errors plus observations that Ss tend, under self-pacing, to increase their response time and not study time have suggested that the effect of self-pacing or slower paces is to permit demonstration of what was already learned.

Eisdorfer (1967, 1968a) has argued strongly in favor of a performance rather than learning deficit and has proposed that the effect is not due to an inability to respond quickly but because of anxiety interfering with performance. He suggested that, contrary to the common stereotype of the elderly as in a low state of arousal, they are actually at a high level of autonomic activity in the task situation

and any further increase in anxiety (e.g., because of demands for a quick response) will interfere with performance rather than facilitate as it would for a less aroused person. There is little evidence to contradict Eisdorfer's emphasis on the aged benefiting from more time to respond.

However, it should be noted that Eisdorfer's work has involved serial learning where learning and response time cannot be easily differentiated and that his data did not preclude the possibility of a learning effect in addition to a performance effect. There are other studies of paired-associate learning (where acquisition and response time can be manipulated separately) which indicate that increased time to learn is also an important and beneficial factor in memory functioning (Arenberg, 1965: Canestrari, 1968a).

These latter studies have suggested that the effective role of longer time intervals or self-pacing may be in permitting the older individual the time needed for relevant learning or registration processes (Canestrari, 1968a, 1968b). Under Welford's conceptualization, information in short-term storage is more easily disrupted in older persons by incoming stimuli; therefore a longer interval between stimuli would be advantageous in permitting clearance from short-term to long-term storage.

Canestrari has further suggested that the absence of time pressures permits the older person time to form mediators to facilitate learning. His argument was based

on the observations of Hulicka and Gorssman (1967) that older persons less often reported using mediators in paired-associate learning than did younger persons. Moreover, it appeared that when they did use mediators, they relied more on verbal in contrast to visual mediators than did younger persons. These observations have subsequently been confirmed by Rowe and Schnore (1971). Canestrari suggested that such verbal mediators would take longer to develop; thus increased learning time would be especially beneficial to older persons in permitting them time to develop mediators.

There has been no direct comparison of the use of mediators under paced vs. self-paced conditions. Hulicka, Sterns, and Grossman (1967) found that, under instructions to form mediators, unlimited learning time seemed more helpful than unlimited response time; however, they did not report whether unlimited learning time was actually used to form mediators. Thus Canestrari's suggestion as to increased time permitting greater use of mediators and thereby improving performance remains just supposition.

There have, however, been efforts to see if encouraging the use of mediators through instructions does in fact improve performance. Hulicka and Grossman (1967) found that instructing Ss to form a visual image combining both items of the pair resulted in increased use of mediators and in improved performance over a no-instruction group;

this improvement was greater for old than for young Ss. Ss who were instructed to form a particular image, or to think of a particular phrase combining the items, improved less than did those instructed to form their own image. Canestrari (1968a) similarly found improved performance when Ss were provided with verbal or visual mediators; this improvement was largely in terms of a reduction in omission errors, with little change in commission errors. In neither study did the performance of the older Ss improve to the level shown by younger Ss. Moreover, improved performance was demonstrated only under the special experimental conditions; that is, while the Ss did use mediational strategies more under instructions to do so than under standard conditions, there was no indication that the use of such strategies would generalize to subsequent tasks (of the same or different nature).

Eisdorfer (1968b) specifically questioned whether older persons would learn to use mediators spontaneously. However, on memory tasks other than paired-associate learning, repeated testing sessions (over days or months) have resulted in improved performance, apparently through Ss' learning how to approach the task (Peak, 1968, 1970; Taub, 1973; Taub & Long, 1972). Observations of Taub and Long (1972) suggested that both old and young Ss did change their strategies on digit-span tests with successive practice, but Taub's (1973) efforts specifically to train

an effective strategy (of clustering digits) were not successful. Similarly, Riegel (1965) reported that older Ss were able to change their implicit set to become more efficient on certain verbal tasks, but did not benefit, and in fact often did poorer, when the experimenter gave explicit directions to permit a more efficient performance.

In the studies of Hulicka and Grossman (1967) and Canestrari (1968a), there was little or no difference in effectiveness between visual and verbal mediators in improving performance. The distinction between visual and verbal mediation is one that has been investigated in the nongerontological literature, generally without explicit definition. Visual or imaginal mediation is usually described as mediation based on a mental image combining the two items to be recalled; verbal mediation consists of a word phrase combining the two items. It has been suggested that overall imaginal mediation may be the more effective strategy.

This conclusion has usually involved a consideration of the concrete/abstract quality of the words. Paivio, Yuille, and Smythe (1966) found that Ss who reported having used imaginal mediators were more successful in learning concrete word pairs than those reporting the use of verbal mediators; the two strategies were equally effective with abstract pairs. In contrast, when Yuille and Paivio (1968) instructed Ss to use certain learning strategies, they

concluded that both imaginal and verbal mediators are easily discovered and utilized with concrete stimuli; however, with abstract stimuli, it is relatively easy to think of verbal mediators, but they tend to be of little help in recall, while imaginal mediators are difficult to discover but tend to be more effective. In the only report which included (but did not differentiate) elderly individuals, Rowe and Schnore (1971) found imagery and verbal mediation equally effective for concrete word pairs (based on reports of spontaneous strategies) and verbal mediation slightly more effective for abstract pairs. The inconsistencies among these reports may reflect differences between spontaneous and instructed mediation, discrepancies between instruction and actual use of mediators, age differences, or perhaps procedural differences. They may also be due to unreliable reports of strategy use; as Canestrari (1968a) pointed out, the distinction between visual and verbal mediation is a difficult one to make.

Hulicka and Grossman (1967) and Canestrari (1968a) did not pay specific attention to the concrete/abstract dimension, but most if not all of their paired words appeared to be concrete and easily visualized; based on the findings of Yuille and Paivio (1968) and of Rowe and Schnore (1971), visual and verbal mediators would be expected to be equally effective. The distinction between visual and verbal mediators would appear to have little practical significance for the learning of concrete materials, especially

for a non-college student and presumably nonintrospective population, who may find the distinction both difficult and meaningless.

From studies discussed above, it would appear that part of the difficulty experienced by older persons on paired-associate learning is a failure to use a mediational strategy for learning. Similarly in a concept identification task, Crovitz (1966) reported that failure to verbalize the concept was directly related to inability to learn and that this failure was apparently receptive to training which included verbalizing. But just why older persons do not use effective learning strategies, such as younger persons do, is not clear.

Canestrari (1968a) suggested two possibilities: loss of abstractive ability due to neurological changes and lack of recent experience in formal learning situations. A third possibility--lack of interest or motivation in the task--must also be considered. Mediation involves an active response to the learning task and it may be that the older person takes a passive role in the learning situation. This might be explained in terms of a general withdrawal as suggested by disengagement theory[2] (Cumming & Henry, 1961), or it might be specific to the learning task. For instance, Hulicka (1967) reported difficulty in obtaining Ss'

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[2] This theory proposed that aging involves a mutual and beneficial withdrawal or disengagement on the part of the individual and society.

cooperation on standard paired-associate tasks, but no difficulty when the task involved learning names paired with occupations. The materials used in most studies have typically had little relevance to every day life or meaningful situations.

Whatever the basis of the failure to use mediation, it should be stressed that it is responsive to manipulations such as instructing or prompting. Thus Kausler (1970) discussed the findings on the use of mediators in terms of Flavell's production deficiency, rather than a true mediational deficiency (Flavel, Beach & Chinsky, 1966). Much the same basic issue pertains here: can the individual be trained to use mediation spontaneously? Although the answer with small children appears to be negative (Keeney, Cannizzo & Flavell, 1967), it is not at all certain that the two similar cases of failure to produce mediators represent comparable levels of cognitive development.

It should be pointed out that the failure to use mediators does not account for all of the observed memory decline in the elderly. In neither Hulicka and Grossman's (1967) nor Canestrari's (1968a) study did the performance of older Ss improve to the level of young Ss. The same is true for studies involving manipulations of pacing of material. Nevertheless, the presented evidence does indicate that failure to use a mediational strategy when appropriate is one factor contributing to inferior

performance in the elderly; moreover, there may well be a solution to this problem. There are undoubtedly other factors, of various levels of conceptualization: slower and less effective search and retrieval (Anders & Fozard, 1973; Craik, 1968), interference of short-term storage by the process of making a response (Inglis & Ankus, 1965; Talland, 1967), the tendency to withhold response (Korchin & Basowitz, 1957; Silverman, 1963), the self-fulfilling expectation of poorer memory (Reese, 1973). Possibly, some of these factors may be so bound to neurological changes with age that they are not susceptible to modification.

Other strategies, besides mediation, have been investigated to a lesser degree. Rehearsal, or repetition of the material to be retained, has generally been considered to be beneficial to memory. Meacham (1972) briefly reviewed evidence for its effectiveness. Hunter (1964), in discussing effective techniques of memorizing, pointed out the importance of active repetition in that it duplicates the response to be demanded later (an advantage of repetition over mediation, in which the individual may respond with an irrelevant aspect of his association). When Yuille and Paivio (1968) instructed college students to use repetition, visual, or verbal mediation in learning paired associates, the repetition group was less successful in initial trials but eventually performed comparably to the mediation groups. This finding, however, was in terms of what technique was

instructed, not what technique was used; post-experimental questioning indicated that the repetition group less often used their assigned technique. Paivio, Yuille, and Smythe (1968) reported repetition, as determined by Ss' reports of use, less effective than mediational strategies.

There has been little attention to the use of repetition or its utility as a learning strategy for elderly persons. Both Hulicka and Grossman (1967) and Rowe and Schnore (1971) presented but did not discuss data indicating a low percentage use (8-16%) of repetition. Rowe and Schnore reported that, when used, it seemed as effective as mediational strategies (this statement included Ss of different ages and was not specific to the elderly); Hulicka and Grossman's data for their older Ss showed repetition less effective. Some possibly relevant data were reported by Arenberg (1968); retention of digits was improved when Ss read digits aloud rather than seeing and hearing them or just seeing them. Arenberg concluded that the addition of auditory input was more beneficial to old than to young Ss, while active responding helped both groups comparably. Arenberg (1967, 1968) suggested that the individual will learn what he says, and that any approach--prompting, clustering of items, reading the item--that increases the chance of the Ss saying the response will improve learning.

The evidence for the effectiveness of repetition as a learning strategy is not so strong as that for mediational strategies. It may be a generally useful technique but less specifically appropriate for paired-associate learning. However, just as it was suggested earlier that the failure to use mediation may be a matter of low motivation, so the failure to use repetition may indicate a passive response to a learning situation which requires some active involvement. Increased use of repetition may represent a degree of active response that might improve performance.

Suggestions of how to increase the use of learning strategies, either mediation or repetition, may be found in the clinical literature on training cognitive strategies for complex tasks--for instance, the work of Meichenbaum and others in training impulsive children to direct themselves to perform more slowly and cautiously on various problems (Meichenbaum & Goodman, 1971) and the work of D'Zurilla and Goldfried (1973) in training clients in more effective problem solving. Both of these research programs have been based on analysis of the cognitive processes necessary to successful performance and then training, through modeling, instruction, and guided practice in the appropriate strategies. Meichenbaum (1972) has suggested the extension of such approaches to a geriatric population, but to date no empirical work has been reported. The application of such an approach to memory represents a

departure from the traditional, rather static study of memory in terms of stimulus parameters (e.g., associative strength between words); modification efforts would require consideration of memory in terms of what the individual does and what oeprations he selects to use (Meacham, 1972).

From the review thus far, there are three major points underlying the study to be discussed: (a) memory decline in the elderly, as evidenced on paired-associate learning and other similar tasks, may reflect more of a learning problem than a retention problem; (b) at least part of the inferior learning performance is due to a failure to use appropriate strategies, such as mediation or perhaps repetition; and (c) training in an appropriate cognitive strategy may result in improved performance. Before proceeding further, one final point must be considered. Training to improve the performance of the aged on paired-associate tasks has in itself little practical significance. What is desired is to improve the memory functioning of the elderly in areas where difficulties interfere with daily functioning. Unfortunately, those areas have not been identified. The gerontological literature with all its great attention and documentation of memory deficits with increasing age gives little indication of just what effects such deficits have in the daily life of elderly non-senile persons. We must rely on anecdotal evidence to suggest some specific problem areas: failure to recall names, placement of objects, shopping lists, etc.

The basis for the present research was the suggestion that the memory functioning of elderly persons in their daily lives might be improved through appropriate training in cognitive strategies. Lacking an adequate survey of the real memory problems of the non-senile aged, a training program must focus either on laboratory type tasks such as paired-associate learning, whose relevance to daily problems is unknown, or on tasks suggested by anecdotal evidence, where measurement is difficult. It was decided to attempt some bridging of the gap between laboratory and real problems by investigating the effect of training on paired-associate learning and its generalization to more meaningful tasks. The practical measures selected consisted of two free recall tasks (recall of a personal narrative and of a grocery list) and one paired-associate type task (recall of names and occupations of photographed persons); the same learning strategies were assumed to be applicable to both the laboratory tasks and these practical tasks.

A link between poor performance and failure to use mediation has been demonstrated, as described earlier, and we may expect that training to increase the use of mediation or another active strategy would improve performance. Although earlier work on training in cognitive strategies included modeling techniques as well as instructions and practice, the present study relied on instructions and guided practice. While this decision was based primarily

on a preference for simplicity in what was essentially an exploratory study, it should be noted that a young graduate student model may not serve the same function for an elderly S as an adult does for a child or a therapist for a client.

It was recognized that the poorer performance of the aged on laboratory type memory tasks and the failure to use an active learning strategy may be related to a lack of familiarity with the tasks. Therefore adequate assessment of the effects of training *per se* required controls for practice effects. Similarly a control for attention factors was considered necessary, because of the presumed decrement in social stimulation that aged persons may experience--thus perhaps making them more responsive to social reinforcement.

The purpose of the present study was to determine the effect of training in a learning strategy on performance in a subsequent paired-associate learning task and to assess the relationship between such a laboratory type memory task and more practical indices of memory. After determining initial performance levels on paired-associate learning and practical memory measures (Session 1), Ss were trained in a learning strategy, either repetition or mediation, using paried associates (Sessions 2, 3, and 4). Another group received non-directed practice on the same task--to control for the possibility that increased practice

with the task would in itself result in improved performance. A fourth group spent a comparable amount of time on an irrelevant task (copying designs) but was given praise and encouragement just as were the training and practice groups. The fifth group received no treatment but was tested on each day; it was not possible to totally eliminate social attention for this group, but the extent of interaction and reinforcement was considerably lower than for the others. These five groups, the repetition group, the mediation group, the practice groups, the attention-control group, and the no-treatment group, constituted the five treatment levels. Following each of three training sessions, the Ss were again tested for performance on paired-associate learning.

During a final testing session (Session 5), all Ss were again tested on paired-associate learning (as a further test of the S's ability to use a trained strategy spontaneously) and on the practical memory tests, to assess the generalization of strategies used on paired-associate learning to situations occurring in everyday life.

Since previous work has not considered the questions of increasing the spontaneous use of learning strategies or the association between paired-associate learning and practical memory, the present study may be viewed as somewhat exploratory. The following hypotheses were made: (1) training in a learning strategy will improve performance

on paired-associate learning. For mediation, such a prediction is well-founded in the work of Hulicka and Grossman (1967) and Canestrari (1968a). For repetition, there is a less sound basis. However, to the extent that the poor performance of the elderly is a result of passivity to the task, the encouraging of any more active response may be beneficial. (2) Improvements in performance following training will be maintained on subsequent non-directed paired-associate tests. (3) Ss in the three other groups are expected to show less improvement than those in the explicit training groups. All of the Ss do receive repeated experience in paired-associate testing (the practice group, however, receives more of it) and may develop more appropriate learning strategies on their own or simply become more familiar with the task and hence less anxious.

Given the lack of prior investigation of practical memory tests, hypotheses about the generalization of learning strategies to practical memory tasks must be considered even more tentative. Nevertheless, it does appear that the same strategies are applicable in the laboratory and in real life, and it was suggested that Ss who received explicit training on paired-associate learning would improve on practical memory performance.

METHOD

Subjects

The subjects in this study were 40 individuals over the age of 60, residing in low or moderate income housing for the elderly.

Initial attempts to obtain Ss by group appeals made at resident meetings yielded very few volunteers. However, when approached on an individual basis (either by referral of housing management or other Ss or simply by random choice), about 60% of those so contacted agreed to participate, resulting in a group of 71 individuals. Of these 16 persons never actually participated in the project, either because of illness or because they changed their minds before the first session. Another 14 persons did not participate beyond the first session; 11 individuals found the paired-associate task too difficult or too strange and refused to continue, and three persons achieved perfect scores on the first paired-associate list and were discontinued since no improvement on their performance was possible. One S was discontinued because he would not comply with directions; he often looked covertly at the response card while pretending to think of the response and resisted the E's efforts to control this behavior.

The remaining 40 individuals, 28 women and 12 men, constituted the subject sample.

All Ss could speak, understand, and read English, as determined by observation. They were assigned to five groups, each comprised of eight persons. An effort was made to match the groups on initial performance on paired-associate learning. The first five Ss were assigned randomly to groups. Group assignment for subsequent Ss was made by considering each S's initial score and the composition of each group at that point; for example, a S who achieved a low score on the first paired-associate test would be assigned to a group for which the mean score at that point was higher than average. Since Ss were recruited throughout the course of the study and the full range of initial performance levels was not known until the last S was recruited and tested, this procedure only approximated the desired matching.

As described in Table 1, the five groups were roughly comparable on age, WAIS Vocabulary scores, and educational level. Subsequent tests indicated that the groups did not significantly differ on any of these dimensions.

Table 1

Description of Ss

	Age		Vocabulary		Education (in years)	
	$\bar{X}$	Range	$\bar{X}$	Range	$\bar{X}$	Range
Group 1 (Repetition)	72.2	66-83	11.8	9-15	11.4	8-16
Group 2 (Mediation)	70.9	64-82	10.1	7-15	9.5	4-14
Group 3 (Practice)	71.4	64-78	11.5	9-14	10.9	7-16
Group 4 (Attention-control)	73.5	64-81	10.5	8-16	11.5	8-17
Group 5 (No-treatment)	72.2	60-86	11.5	5-15	10.0	4-16

Materials

Eight lists of ten word pairs each were prepared to be used for paired-associate learning. Three of these were designated for training and five for testing purposes; these lists are presented in Appendix A and Appendix B respectively. Stimulus words were selected from Palermo and Jenkins (1964) and from Postman (1970) association lists; these were common words, mostly nouns such as doctor, street, bread, hand, etc. Response words were chosen and paired to stimulus words according to the following criteria: common nouns, with AA or A values on the Thorndike-Lorge frequency count (1944),

and an association value of less than 1 in 1000 between stimulus and response according to norms for college students (Palermo & Jenkins, 1964; Postman, 1970), since appropriate norms are not available for an aged population. Word pairs were combined into lists such that the association value between any stimulus word and any response word on the same list was no greater than 1 in 500. No word was used as either stimulus or response more than once. Stimulus words and word pairs were typed in capital letters .25 inch high on plain white 3 inch by 5 inch cards. The cards were arranged into decks of 20 cards, with a stimulus card preceding the appropriate word pair card. The order of presentation for the test lists and for the training lists was randomized over Ss.

Three practical memory tests (personal narrative, grocery list, and names and faces) were prepared, each with two forms. For the personal narrative (Appendix C), items selected were assumed to be intelligible and of some probable interest to the Ss, such as where the E lived, how long she had been in Hawaii, her family composition and background; seven such items were included in each form of the narrative. The grocery list (Appendix D) consisted of eight common food items. A similar range of items was included in each list; that is, each included staples, meat or fish, vegetable, beverage, and seasonings. For each form of the names and faces tested, eight photographs were

selected representing a wide age range and various ethnic groups; four males and four females were included in each set. Surnames consistent with the apparent ethnic background and assumed to be fairly common were assigned to the photographs; in assigning occupations, sex role stereotypes were considered (for example, a female nurse or bank teller, male carpenter or police officer). The names and occupations used are listed in Appendix E. For each test, the order of presentation for the two forms was balanced across Ss.

For the task of copying designs used in the attention-control group, three sets of ten designs each were assembled from designs of the Benton Visual Retention Test (Benton, 1955) and from additional similar designs.

Procedure

Each S was seen individually on five consecutive days. The sessions lasted generally between 30 and 45 minutes and were held in the S's apartment or, in four cases, in a quiet room adjacent to the lobby of the residence. For all Ss the first session consisted of testing on the WAIS Vocabulary Scale, a brief period of casual conversation, followed by testing on paired-associate learning and the three practical memory tests. Sessions two through four varied for members of the different groups but generally included the appropriate experimental treatment (e.g.,

training in the use of a particular learning strategy), a brief conversation period, and testing on a paired-associate list. The fifth session was the same for all Ss and included a brief conversation and testing on a paired-associate list and on the three practical memory tests.

Session 1

The first session began with standard administration of the WAIS Vocabulary Scale. The E then engaged the S in conversation, generally about the S's background. At the end of this conversation, lasting about five minutes, the E introduced the rest of the testing session, saying, "I want to tell you some things about myself; later I will ask you to see what you remember of what I tell you." The E then related seven facts about herself and reminded the S that he would later be asked about those facts.

The E then presented the S with a deck of cards for paired-associate learning (a test list). The format of the deck was explained and the S was told to go through the cards to learn which words went together; the E gave an example using the first word pair of what would be demanded on subsequent trials. As the S looked at each card, the E pronounced the words aloud. Progress through the list was self-paced. Beginning with the second trial, the E asked the S to give the appropriate response before looking at the word pair card. Trials continued to the criterion of one

perfect trial or 12 trials. Following the last trial, the E asked the S about the use of any strategies in learning, saying "What did you do to try to remember which words went together?"

Testing on paired-associate learning was followed by testing for recall of the personal narrative related earlier. The S was asked what he remembered of what the E had told about herself; these responses were recorded. The E then questioned about the use of any strategies ("Did you do anything particular to remember what I told you?").

The D then presented the second practical memory test, recall of a grocery list. She asked the S to pretend that he was going to the store and gave him a list of eight items to buy, pausing between each item long enough to permit repetition (whether or not the S actually did repeat). Following a delay of about 10 seconds, during which the E rearranged papers, the E asked the S what he had been told to buy. Responses were recorded and again the S was questioned on the use of any strategies.

For the final practical memory test, names and faces, the E told the S taht she would show him pictures of some people, telling him their names and occupations, that the series would be shown twice and then the S would be asked to identify each picture. Each picture was handed to the S and introduced by saing, for example, "This is Mrs. Chang; she is a school teacher." The E paused before presenting

the next picture long enough to permit repetition. After two presentations, the S was asked to identify each picture with name and occupation and subsequently questioned on the use of any strategies.

Sessions 2, 3, and 4

In these sessions, Ss were trained to use a particular learning strategy in conjunction with a paired-associate task. The five groups included those trained to use a repetition strategy, those trained to use a mediation strategy, those receiving practice, and an attention and a no-treatment control. For each S, sessions two through tour were identical in format. Each training session was followed by testing on paired-associate learning.

Repetition. Training in the use of the repetition strategy consisted of explaining to the S that learning and remembering are often made easier if the S repeats the item a couple of times. Then directions were given for the S to be sure, in learning the list of paired-associates, to repeat each word pair aloud a couple of times. The S was then given a training list of ten paired associates and asked to learn which words went together. On the first trial, the E frequently reminded the S to repeat the word pairs a couple of times; such prompts were faded on subsequent trials, as the S applied the technique without direction. The E recorded on each word pair whether or not

the S actually repeated as instructed. Otherwise, the procedure was the same as during the initial paired-associate testing. After reaching criterion of one perfect trial or 12 trials, the S was engaged in conversation about his family, activities, or background (usually prompted by the E's asking about objects or pictures in the room).

After about five minutes of such conversation, the S was given a test list of paired associates with no explicit directions as to learning strategy. Testing using this list followed the same procedure as in the initial session, with no questioning as to the strategy being used.

Mediation. Training in the use of the mediation strategy followed a procedure similar to that for repetition. The E explained to the S that learning and remembering are often made easier if the S can form an association between the two items, that even when no logical association comes to mind, the S might form a mental image "like a cartoon picture" combining the two in some way. An example was given using the first word pair of the training list for that day. The S was then given the training list and urged to take time with each pair to try to picture the items together in some way. Prompts to form mediational links were given frequently on the first trial and faded on subsequent trials. After reaching criterion of one perfect trial or 12 completed trials, the S was questioned about the image or link he had formed for each pair--to determine if mediation was indeed

used; his responses were recorded.

After a brief conversation break, the S was given a test list of paired associates with no explicit directions as to strategy. As described for the repetition group, testing followed the same procedure as in the initial session, with no questioning as to strategy being used.

Practice. Ss in the practice group were given a training list of paired associates with no explicit directions as to possible learning strategies. After reaching criterion and a brief conversation period, they were tested on a paired-associate test list, following the same procedures used in testing the other groups described above.

Attention-control. In this condition, each S was given blank paper and a pencil and asked to copy a set of designs. As he completed each design and as appropriate during the drawing itself, he was praised for his work. When he had completed the ten designs or after about 20 minutes (three Ss gave so much care and time to each design that they were given fewer than ten designs), the S was engaged in conversation briefly and then tested on paired-associate learning under conditions similar to the first testing session.

No treatment. Following a brief conversation, the S was tested on paired-associate learning under the same procedure as in the initial testing.

Session 5

The final session was the same for all Ss and similar to the first session, omitting only the WAIS Vocabulary test. The S was briefly engaged in conversation, at the end of which the E related to the S seven facts about herself, with the announcement that she would later ask the S what he remembered. Testing on a paired-associate list followed; the S was questioned on the use of any learning strategy. The S was then asked to recall the personal narrative that had been related earlier, and was again questioned on the use of any strategy. Testing on the other practical memory tests, grocery list and names and faces, followed, as in the first session, with questioning on strategies.

Following the completion of testing, the E briefly explained the purpose of the study, pointed out the potential usefulness of strategies such as repetition and mediation, and attempted to answer any questions the S might have about the study or memory functioning in general.

RESULTS

The data were classified by treatment and test trials and analyses of variance were computed for a two factor experiment with repeated measures on one factor. The dependent measures were number of errors on paired-associate tasks and number of correct responses on practical memory tests.

The number of treatment levels and of trials differed for various dependent measures. To determine the immediate effectiveness of training strategies on the paired-associate task, errors during training sessions were analyzed as a 3 X 3 analysis of variance design, training groups (repetition, mediation, and practice) by training sessions. To assess generalization of training strategies, paired-associate test errors were analyzed as a 5 X 5 (groups by test sessions) analysis of variance design, and performance on the practical memory tests (number of correct responses) as a 5 X 2 design (groups by test sessions).

Pre-test Scores

The five groups in this study did not differ significantly on age, educational level, or WAIS Vocabulary scores (see Table 1, p. 24). In addition, there were no significant differences among the five groups on initial

performance levels for paired-associate learning or for the practical memory tests (see Table 2). Also, the correlations among the tests were not significant.

Performance During Training

The mean error scores for the repetition, mediation, and practice groups during training sessions (sessions 2, 3, and 4) are shown in Table 3. The summary table for the analysis of variance for these scores is presented in Table 4. A significant group effect ($p<.01$) was obtained. There were no significant differences across trials or due to groups by trials interaction.

Comparison of mean performance over the three sessions by the Newman-Keuls' test (Winer, 1971) revealed significant differences between the repetition and practice groups ($p<.01$) and between the mediation and practice groups ($p<.05$); the difference between the repetition and mediation groups was not significant.

During each training session, the E also recorded whether the S had used the strategy as instructed; that is, she observed whether or not the S actually repeated the word pair or asked the S to describe the association used for each word pair. From these records the actual use of the instructed strategy was computed. For the repetition group, this was defined as the percentage of times the S

Table 2

Means and Standard Deviations of Initial Performance Scores on Various Tests

	Paired-Associate Errors $\bar{X}$/SD	Personal Narrative Correct Resp. $\bar{X}$/SD	Grocery List Correct Responses $\bar{X}$/SD	Faces--Correct Responses Names $\bar{X}$/SD	Faces--Correct Responses Occupations $\bar{X}$/SD
Groups					
Repetition	29.5/17.3	4.7/1.1	6.0/1.1	4.5/1.8	6.8/1.3
Mediation	35.8/34.2	3.5/1.1	6.0/1.1	4.0/2.0	6.6/1.5
Practice	30.2/23.1	4.2/1.6	5.5/1.2	3.8/1.8	6.6/1.4
Attention-control	35.8/27.2	3.1/1.8	5.5/0.9	3.9/2.4	6.0/1.4
No-treatment	28.1/20.5	3.8/1.1	5.9/1.0	3.9/1.6	7.0/1.1

Table 3

Mean Error Scores During Training Sessions

	Session 2	Session 3	Session 4	Mean
Groups				
Repetition	11.5	12.0	11.4	11.6
Mediation	8.4	9.0	12.9	10.1
Practice	29.4	27.9	31.0	29.4

Table 4

Summary of Analysis of Variance of Error Scores on Paired-associate Learning During Training Sessions

Source	SS	df	MS	F
Between Ss				
Groups	5541.58	2	2770.79	6.37*
S(G)	9139.96	21	435.24	
Within Ss				
Trials	68.25	2	34.12	.47
Groups X Trials	67.67	4	16.92	.23
Trials X S(G)	3059.42	42	72.84	

* $p<.01$

was observed to repeat aloud while viewing the word pair, excluding times immediately following a correct response (that is, if the S had responded correctly, repetition of the word pair on that trial was not expected). For the mediation group, use of the instructed strategy was defined as the number of word pairs for which, on subsequent questioning, the S reported having used some type of association (either visual or verbal).

Correlations between scores on the use of the instructed strategy and improvement in that training session over initial performance (that is, errors during training session/errors on first paired-associate test) were then computed. A significant r of -.74 ($p<.01$) was obtained for the mediation group. That is, the greater the use of a mediation strategy, the lower the ratio of errors during training to initial errors; or in other words, the greater the use of a mediation strategy, the greater the improvement during training. The corresponding correlation for the repetition group ($r=-.12$) was not significant.

Performance on Paired-associate Tests

The mean error scores of the five groups of Ss on the five paired-associate tests are shown in Table 5 and graphed in Figure 1. The summary table of the analysis of variance for these scores is presented in Table 6. A significant

Table 5

Mean Error Scores on Five Paired-associate Tests

	Test 1	Test 2	Test 3	Test 4	Test 5
Groups					
Repetition	29.5	15.1	14.9	6.2	8.2
Mediation	35.8	16.6	20.0	14.6	27.5
Practice	30.2	19.4	31.6	23.0	36.2
Attention-control	35.8	30.6	33.0	25.1	37.0
No-treatment	28.1	26.1	31.9	29.8	22.9
Mean	31.9	21.6	26.3	19.8	26.4

Table 6

Summary of Analysis of Variance of Error Scores
Paired-associate Tests

Source	SS	df	MS	F
Between Ss				
Groups	7150.72	4	1787.68	.81
S(G)	76840.70	35	2195.45	
Within Ss				
Trials	3597.22	4	899.30	5.30*
Groups X Trials	4056.28	16	253.52	1.49
Trials X S(G)	23773.30	140	169.81	

* $p<.001$

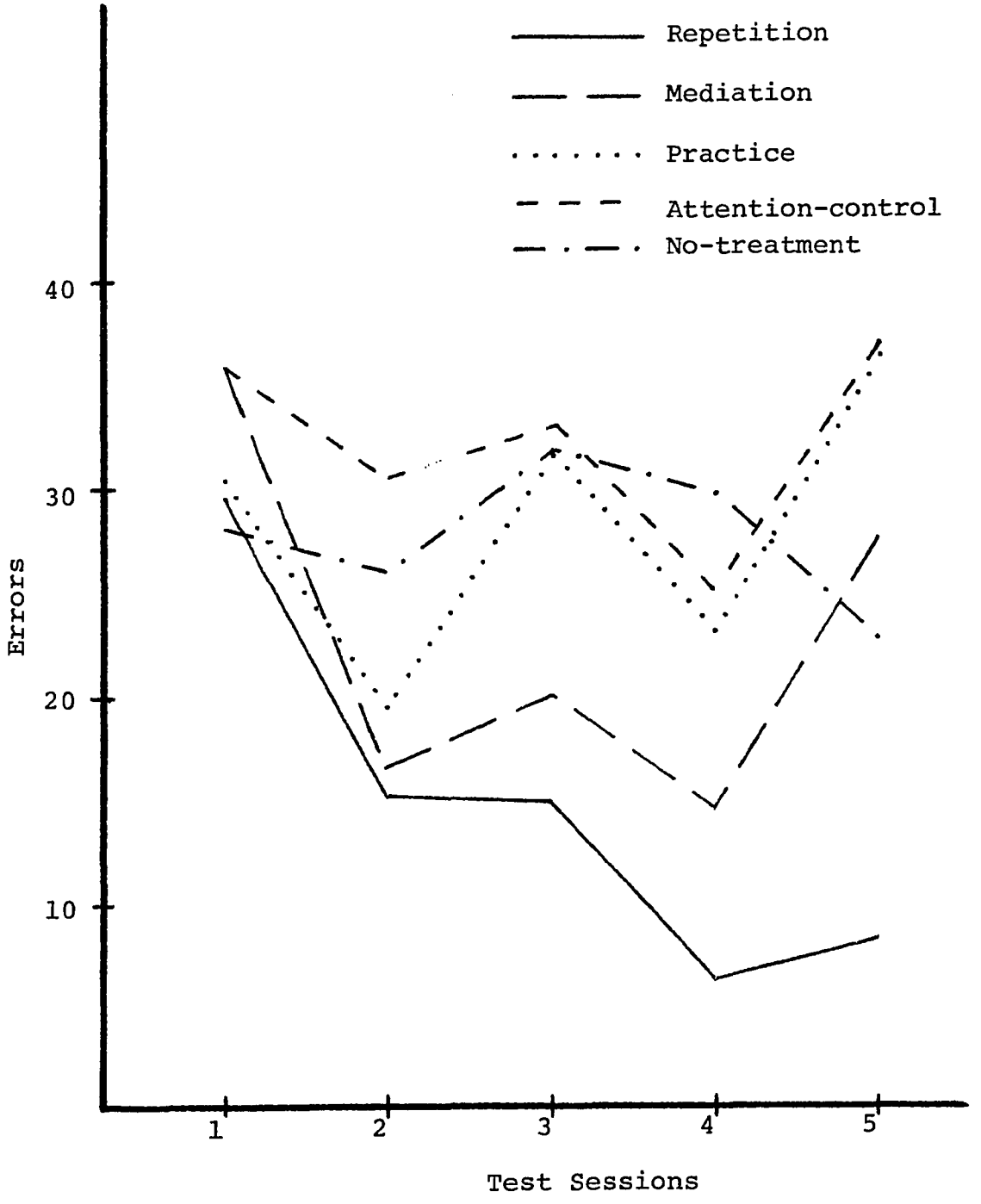

Fig. 1. Error Scores by Trials for Five Groups

trials effect was obtained, with no significant differences among groups.

The trials effect resembled a W pattern, of initially high errors, a decrease, a rise in the third session, a second decrease, and a rise in the final session. Comparison of means by the Newman-Keuls technique revealed significant differences between sessions 1 and 2 ($p<.05$) and between sessions 1 and 4 ($p<.01$); no other significant differences were obtained.

The group by trials interaction was not significant ($P=.11$). As seen in Figure 1, the W pattern noted for the combined groups was reflected in each group, with the exception of the no-treatment control.

An alternative test of the generalization of training strategies to subsequent paired-associate tests was provided by a 3 X 3 X 2 analysis of variance on error scores classified by groups, trials (sessions 2, 3, and 4), and learning situation (i.e., performance during training vs. testing). The group by learning situation interaction approached significance ($p<.07$). Further analysis of this interaction showed a simple main effect of learning situation (training *vs*. test) for the mediation group ($p<.05$) but no difference between training and test performance for the repetition or practice groups. Table 7 presents the mean of error scores for the three groups on training and testing, collapsed for sessions 2, 3, and 4.

Table 7

Combined Mean Error Scores on Training and Test Paired-associate Lists during Training Sessions

	Training	Test
Groups		
Repetition	11.6	13.1
Mediation	10.1	17.1
Practice	29.4	24.7

Reports of Strategy Use

In addition to recording the use of instructed strategies during training, the E questioned each S, following the first (Session 1) and final (Session 5) test paired-associate lists, on what if any strategies he had used. The responses were categorized as repetition, active mediation, passive association, idiosyncratic, and no strategy (see Appendix F for a full description of criteria used in differentiating strategies). Repetition simply involved the S repeating the word pair to himself or aloud. The distinction between active mediation and passive association has not been made in previous work, but seemed warranted on general inspection of the Ss' reports. Active mediation was considered a true learning strategy in which the S tried to form some association for each word pair. For example, one S reported that she would try to connect the words in

some way, and that when it was hard to think of an association, she would simply picture the two together. Passive association was not considered a true strategy; the S merely reported that for some of the word pairs he noticed some association which helped him in recall; however, he did not seek to form an association if none "popped into mind". Idiosyncratic strategies usually involved the S's focussing on letter combinations, such as noting that "jump" ended in "p" and "plant" started with "p".

As a partial check on the reliability of this categorizing system, the Ss' reports were categorized on two occasions separated by several days. The same category assignment was made on both occasions for 96% of the reports. The few disagreements were resolved by a third rating.

Table 8 presents the reports of the Ss in each group for the final paired-associate test. There were too few Ss to test whether apparent differences were significant.

Table 8

Strategy Use on Final Paired-associate Test

	Strategies			
	Repetition	Mediation	Association	None
Groups				
Repetition	0	7	1	0
Mediation	0	3	2	3
Practice	1	2	1	4
Attention-control	0	3	2	3
No-treatment	0	5	2	1

The relation between the strategy used and paired-associate test performance is indicated in part by the graph of mean error scores for Ss who, on the final test, reported each of the strategies, active mediation, passive association, and no strategy. Data for the single S who reported a repetition strategy are not included.

Based on these reports of strategy use for the first and for the final paired-associate test, two groups of Ss were selected: 12 mediation developers, those who had reported a passive association, indiosyncratic, or no strategy on the first test and reported active mediation on the last test, and 11 non-mediators who reported the same strategy, either none or passive association, on both days (there were no Ss who reported idiosyncratic strategies on both days). Ss who reported mediational strategies on both days (7 Ss), or who switched from no strategy to passive association, or other combinations were eliminated from this analysis. The mean error scores on test paired-associate lists for five sessions are shown in Table 9. The analysis of variance for these groups revealed significant effects of groups, trials, and groups by trials interaction (see Table 10). The mediation developers showed a clear and fairly steady decline in errors, whereas the non-mediators showed the W pattern of fluctuating error scores noted in other analyses.

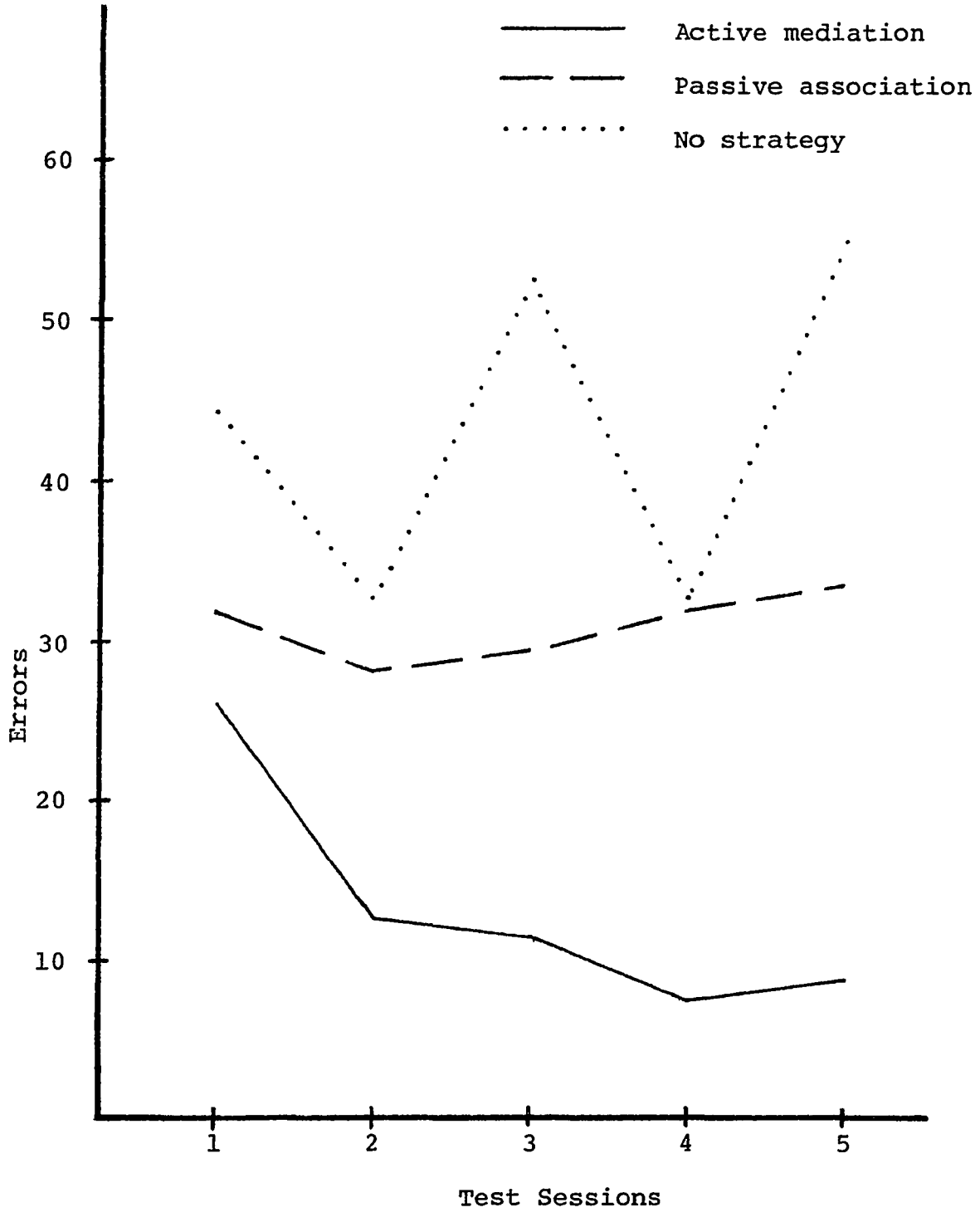

Fig. 2 Error Scores by Trials for Ss Reporting Various Strategies.

Table 9

Mean Error Scores on Paired-associate Tests for Mediation-developers and Non-mediators

	Test 1	Test 2	Test 3	Test 4	Test 5
Mediation-developers	33.7	17.1	15.1	7.9	9.9
Non-mediators	42.5	29.5	49.9	34.2	46.2

Table 10

Summary of Analysis of Variance for Paired-associate Errors by Mediation-developers and Non-mediators

Source	SS	df	MS	F
Between Ss				
Groups	16171.69	1	16171.69	10.65*
S(G)	31899.84	21	1519.04	
Within Ss				
Trials	4380.12	4	1095.03	5.74**
Groups X Trials	3639.73	4	909.93	4.77*
Trials X S(G)	16016.13	84	190.67	

* $p<.005$

** $p<.001$

These two groups, mediation-developers and non-mediators, did not differ on age, educational level, or WAIS Vocabulary score.

Practical Memory Tests

The summary table for the analysis of variance for correct responses on the personal narrative test (Sessions 1 and 5) is presented in Table 11. Significant effects for groups and for trials were obtained. Although none of the individual comparisons of group means by Newman-Keuls test revealed significant differences, the attention-control group did score lower than the other groups on both testing occasions (e.g., see Table 2). This group effect was attributed to imperfect initial matching. The trials effect reflected an increase in number of correct responses from a mean of 3.8 on the first day to a mean of 4.3 on final testing.

Analyses of variance for the other practical memory tests revealed no significant differences.

Ss had been questioned following each practical memory test on the use of any learning strategies. Their reports were categorized as described in Appendix G. A number of different strategies were reported, although by far the most common report was of no strategy. There were no apparent differences among groups in reports of strategy use. Table 12 shows the number of Ss in each group who

Table 11

Summary of Analysis of Variance for Correct Responses on Personal Narrative

Source	SS	df	MS	F
Between Ss				
Groups	29.17	4	7.29	2.66*
S(G)	95.83	35	2.74	
Within Ss				
Trials	3.83	1	3.83	4.01**
Groups X Trials	3.59	4	.90	.94
Trials X S(G)	33.45	35	.96	

* $p<.05$
** $p<.06$

Table 12

Reports of Strategy Use on Final Testing of Various Practical Memory Tests

	Personal Narrative		Grocery List		Names and Faces			
					Names		Occupations	
	Strategy	None	Strategy	None	Strategy	None	Strategy	None
Groups								
Repetition	2	6	4	4	1	7	3	5
Mediation	1	7	4	4	2	6	3	5
Practice	1	7	5	3	1	7	3	5
Attention-control	2	6	5	3	1	7	3	5
No-treatment	2	6	5	3	1	7	5	3

on final testing reported some strategy and those who reported none. The very small number of Ss who reported each of various strategies made more refined analyses impractical.

Performance on the practical memory tests was compared for those Ss who had developed a mediational strategy for paired-associate learning vs. those who had not. No significant differences were obtained.

DISCUSSION

The purpose of this study was to determine whether training elderly persons in certain learning strategies would result in improved performance on subsequent memory tests, both of a laboratory and practical nature. Preliminary to this basic issue was, of course, the question of whether training in a strategy had any immediate effect on performance.

The results confirmed the findings of Hulicka and Grossman (1967) and of Canestrari (1968a) that instructing older persons to use a mediational strategy on a paired-associate learning task results in superior performance on that immediate task as compared to a non-instructed group. Moreover, correlations between actual strategy use and improvement confirmed that this improvement during training was directly related to the degree to which the S did in fact follow instructions to form mediators.

Similarly, instructing Ss to use a repetition strategy also resulted in superior performance on the immediate paired-associate task; this improvement was equal to that demonstrated by Ss instructed to use the mediational strategy. However, unlike the mediation group, there was for the repetition group no significant correlation between the extent to which the S was observed to use the

instructed strategy and his improvement during training over his initial performance.

Thus, although it appears that training in the two strategies (repetition and mediation) was equally effective, closer examination suggested that the two types of training produced improvement in different ways. Questioning after each training list indicated that all of the Ss in the mediation group did form mediators in learning the word pairs; they improved in performance to the extent that they used such a strategy. However, the comparable improvement of the repetition group does not seem attributable to the use of repetition, as indicated by the nonsignificant correlation between use of repetition and improvement. The basis for this improvement, therefore, is not clear from the data obtained during the training sessions.

One possible explanation for the improvement in performance of the repetition group comes from inspection of Ss' responses to questioning following the final paired-associate test. At that time, seven of the eight Ss in the repetition group reported using a mediational strategy. It seems plausible to assume that they were also using such a strategy, in addition to repetition, during training sessions. In fact, comments made by several Ss during the repetition training indicated that besides repeating the words they were trying to form associations.

Thus it may be that the two groups, whether instructed to use repetition or mediation, both improved their performance by using a mediational strategy. Ss in the practice group apparently did not use a mediation strategy (as indicated by reports following the final paired-associate test) and indeed did not improve their performance. The basis for the two training groups' use of a mediational strategy presumably lies in the instructions (the only variable differentiating them from the practice group). It seems most plausible to assume that the reason the Ss in the mediation group used a mediational strategy is that they were told to do so. Instructions, however, besides conveying specific task commands, may also have resulted in increased attention to the task and perhaps also in the expectation that performance might be improved. Increased attention to the task may operate, through the process of prompting the S to develop an effective learning strategy, to produce improved performance. Ss in the repetition group may have found repetition ineffective and been prompted to search for mediators.

The data clearly indicate the immediate effectiveness of training in learning strategies and suggest that increased use of mediation is the basis for obtained improvement. On the other hand, the results relevant to the problem of obtaining generalization of such improvement were not so clear-cut. In fact, on tests immediately

following training, the mediation group showed an increase in errors; performance for Ss in the repetition and practice groups did not change. Again inspection of Ss' reports on strategy use for the final paired-associate test suggests an explanation for these findings. While all Ss in the mediation group had used mediators to varying degrees during training, only three of the eight Ss reported using such a strategy on the final test. Apparently the others in this group did not continue their use of a mediation strategy from training to testing. One reason for this failure to continue use of mediation during testing may be related to observations during training that several Ss appeared to resent the E's reminding them to take time to form associations. Possibly, on testing where such instructions were omitted, the Ss may have chosen to discard the strategy.

This apparent resentment toward being instructed was also observed on the part of S in the repetition group, and it is clear on the final paired-associate test that they too dropped the repetition strategy when no longer instructed to use it. However, their performance did not drop on the tests immediately following training, presumably because they continued to use a mediation strategy which they had adopted on their own to supplement repetition.

This failure of direct training to encourage the use of a strategy and thereby improve performance for the aged has been reported in previous studies (Riegel, 1965; Taub, 1973).

Elderly Ss can improve their performance on memory tasks by adopting appropriate strategies, but available evidence gives little indication as to ways to effect the adoption of such strategies. Direct instructions to do so were effective only for the immediate task; they did not result in generalization of the strategy to subsequent tests. However, one training condition (repetition training) did appear to result in generalization of improved performance to subsequent tests. As discussed earlier, the maintained improvement may have been the result of continued use of a mediation strategy which the S had developed on his own. Apparently then, while instructed use of a strategy did not generalize to subsequent tasks, spontaneous use did; where the S himself has developed the strategy, he continues to use it. The question remains of how to encourage the S to develop a strategy, without telling him to do so.

It was suggested earlier that a secondary effect of the training instructions used here may have been increased attention to the task which prompted the S to search for an effective strategy. Thus instructions which direct greater attention to the task without giving specific suggestions may be successful in encouraging Ss to develop strategies.

This conclusion is based on observations of the performance of the repetition group. Both the analysis of training and test scores for the same day and the graph of daily test scores for all groups suggested that the

repetition group maintained an improved performance level after training. However, this apparently was not a strong enough trend to reach significance when all five groups were compared on daily test performance.

Besides pointing to the failure of direct instructions to effect adoption of a strategy and thus improve performance, results of the present study can also eliminate practice or social attention (in terms of praise or encouragement) as, in themselves, producing improved performance. Other relevant variables have not been identified. The present study did differentiate two groups on the basis of whether or not the S adopted a mediational strategy during the course of the study; mediation-developers improved in performance, and non-mediators did not. Unfortunately these two groups were not clearly differentiated on any of the demographic variables measured here.

There remains one major finding related to the paired-associate learning performance to be discussed. A significant trials effect was obtained in the analysis of variance of the paired-associate test error scores for the five groups. This trials effect did not represent a clear steady improvement over sessions. On the second and fourth tests, Ss made fewer errors than on the first day. Since performance on the third or fifth day was not significantly poorer than that on the second or fourth, it could be argued that the apparent rise in errors on the third and

fifth day was merely chance variation in performance. However, the occurrence of the W pattern in four of the five groups suggests that the fluctuation in performance was a reliable finding. It may be assumed that factors other than learning/memory capacity are responsible for this fluctuation, but it is not apparent what those factors may be.

Given the failure to obtain a significant effect of training on subsequent paired-associate learning tests, it was not surprising to find that training did not affect performance on practical memory tasks. Initial correlations indicated little relationship among the various memory tests. The practical memory tests were clearly different from the paired-associate tests in terms of the Ss' familirity with the task requirements and materials; all of the tests differed among themselves in terms of the task demands (e.g., the length of time the material was to be retained, apparent associative strength among items, etc.). Nevertheless, it was expected that strategies applied to paired-associate learning would be applicable to the practical tasks. Neither training in strategies nor the S's own development of a strategy for paired-associate learning resulted in improved performance on practical tasks. A very few Ss did report using repetition or associational strategies on certain tasks; however, the most common report for the practical tests was of no strategy. It

may be that because of familiarity with the tasks, the Ss were less likely to think of them as tasks to be worked at or as something which they could learn to do better, and thus they were less likely to think to apply a particular strategy to them.

While training in strategies did not generalize to improve performance on the practical memory tasks, there was improvement shown by the combined groups on recall of the personal narrative. This material may have been of greater interest to the Ss on the final day after having become acquainted with the E during the week; thus greater attention to the narrative may have resulted in better retention. This suggestion was supported by comments made by some Ss.

In addition to conclusions discussed thus far based on test results, some comment should be made about certain observations made over five days of interaction. It was very refreshing to a psychologist beginning research with the aged to find that in almost all cases testing sessions were positive and warm social experiences. Although there were significant and discouraging difficulties in recruiting Ss, sessions once begun usually were, quite simply, enjoyable. Most of the Ss were eager to help and apparently very open in their conversation, often bringing up what seemed to have been significant disappointments in their lives. They offered the E snacks or meals, showed off

family photographs or craft work, and in general treated the E like a guest rather than an intruder. After the final session, some Ss presented the E with gifts. Several commented that they were grateful for the chance to "get my mind working again".

Suggestions for Future Research

The results of this study indicated that older persons can improve their performance on paired-associate learning tests by adopting a mediational strategy, but that telling them to do so is not effective in producing generalized improvement. It is possible that the apparent resistance to instructions was specific to a task viewed as somewhat meaningless and impractical. Instructions to use a specified strategy on more practical tasks might be more readily accepted as having some purpose.

Alternatively, the rejection of instructed strategies may in part reflect the rejection of advice from a younger and/or another person. If so, efforts to improve performance by enhancing strategy use may require more active and responsible involvement by the Ss themselves, for instance, a project in which Ss were encouraged to devise their own strategies, apply them, and report on their successes. It was suggested earlier that the training instructions used in the present study may have served to increase attention to the task and thus prompted the

development of an effective learning strategy. Further research should attempt to identify those variables which do encourage Ss to develop their own strategies.

Elderly persons, like most psychologists, do not seem to think of memory problems as something which might be changed. Many of the Ss in the present study acknowledged some daily memory problems, forgetting for example where they had placed objects, some detail from the distant past, shopping needs, appointments, or names. Very few, however, expressed concern about such incidents. If possible, they relied on written lists or notes. Otherwise, they often reported having consciously adopted an attitude of acceptance, saying that if they did not become upset about the incident and simply waited, they would eventually recall the item. A few Ss expressed some amusement at their difficulties, and a couple expressed anger or frustration. But by far the most common attitude stated was acceptance. It may be, of course, that this attitude was unique to a possibly biased sample of individuals more alert and less complaining than their peers. Nevertheless, if memory performance is to be improved, such acceptance must be challenged.

This lack of concern about difficulties in remembering raises some doubt as to whether memory problems in the non-senile aged are significant enough to warrant remediation efforts. As pointed out in the introduction to this

study, there is little information on what the real memory problems of the elderly are. Baseline data of everyday difficulties in memory over a wide age range are needed to better define the extent and nature of the problem.

The present study was conceived in part as an attempt to apply the results of laboratory studies of memory in the aged to practical situations. In effect, will a procedure designed to enhance paired-associate learning generalize to a task involving practical matters like a grocery list and names and faces? It was assumed, despite differences in the familiarity of the tasks and interest level of the materials, that the same processes were relevant to both types of memory tasks and that improved performance in one would lead to improvement in the other. Results do support that part of our hypotheses which held that use of a mediational strategy would improve performance on paired-associate learning. However, this improvement did not generalize to practical tasks. Thus, the present study demonstrated improvement in the laboratory but not in real life.

Given this indication that elderly persons can improve on certain memory tasks, questions remain of how to extend this improvement to practical tasks (where the real concern for improvement lies). This is a familiar problem in efforts to proceed from a successful experimental demonstration to a therapeutic program. Possible solutions here would include

minimizing the generalization issue by working directly with real life problems, thus sacrificing the greater control permitted by basic research. Or one might seek to enhance the similarity between laboratory and practical tasks--for example, through questions and discussion, increasing the S's attention to the practical tests as tasks to be worked at, rather than simple automatic exercises. It is clear that an experimenter's recognition of similarity between laboratory and real life is not sufficient to bridge the gap; further work is needed to identify those procedures which will link the two problems.

APPENDIX A

PAIRED-ASSOCIATE LISTS USED FOR TRAINING

Training List 1

boy - egg
numbers - building
river - law
tobacco - horse
cabbage - picture
guns - fly
square - nose
light - church
soldier - roof
foot - grass

Training List 2

butterfly - market
doors - face
find - pen
blossom - judge
salt - skin
eating - railroad
ocean - knee
music - iron
hammer - wind
beautiful - army

Training List 3

house - ship
dinner - lake
buying - hole
girl - rock
city - eye
thief - hat
moon - shake
whistle - forest
sit - milk
bed - heart

APPENDIX B

PAIRED-ASSOCIATE LISTS USED FOR TESTING

Test List 1

bread - camp
carry - star
jump - plant
cold - gift
chair - storm
priest - wash
cars - bird
scissors - dollar
dark - cow
earth - gate

Test List 2

needle - water
letter - party
hand - corner
stand - cat
sleep - smoke
working - stone
head - cotton
king - air
stove - lesson
paper - sad

Test List 3

cheese - sign
doctor - floor
bath - shade
speak - rich
woman - newspaper
sheep - machine
table - officer
citizen - paint
stomach - board
afraid - fish

Test List 4

garden - school
shoes - book
fruit - day
man - gold
fingers - island
dogs - fire
butter - sky
soft - hall
baby - ice
lion - dust

APPENDIX B (cont.)

Test List 5

window - dress

people - silk

cottage - meat

carpet - mouth

child - box

street - arm

kittens - tree

running - hair

sell - valley

spider - queen

APPENDIX C

PERSONAL NARRATIVE

Form A

I have been in Hawaii for four years.

When I first came here, I lived in Hilo.

I now live in Kaneohe.

My husband is a psychologist.

His name is Patrick.

In a couple of months, I will be moving to Washington, D. C.

I went to college there.

Form B

I grew up in Rhode Island.

My husband is from the East Coast too.

My parents still live in Rhode Island.

My mother is a retired school teacher.

My father is still working in business.

I have a brother named John.

He is a lawyer.

APPENDIX D

GROCERY LIST

Form A	Form B
fish	rice
tea	salt
onions	juice
cabbage	tomatoes
shoyu	soup
cooking oil	vinegar
garlic	chicken
eggs	cheese

APPENDIX E

NAMES AND FACES

Form A

Mrs. Chang - school teacher

Mr. Anderson - gas station attendant

Mr. Yoshida - real estate salesman

Mrs. Lopez - housewife

Mrs. King - hairdresser

Mr. Kimura - policeman

Miss Bennett - nurse

Mr. Worden - carpenter

Form B

Mr. Cole - insurance agent

Mrs. Santos - waitress

Mr. Torres - construction worker

Mrs. Wong - secretary

Mr. Young - store clerk

Mrs. Sato - social worker

Miss Hanson - bank teller

Mr. Nakama - doctor

APPENDIX F

CRITERIA FOR CATEGORIZING STRATEGIES REPORTED FOR PAIRED-ASSOXIATE LEARNING

A survey of Ss' reports of what strategies they used to learn paired associates suggested five general categories: repetition, active mediation, passive association, idiosyncratic, and no strategy. Each of these was defined in detail before categorizing individual reports.

Repetition: The S reported repeating the words to himself or aloud. It was necessary in some cases to rely on further comments to distinguish between two meanings of the word "repeated": as a strategy for learning and referring to the repeated presentation of the paired-associate list.

Active Mediation: The S reported trying to think of an association for each word pair. This strategy was differentiated from passive association by the S's seeing it as something he did; some effort on his part, some thinking or searching was acknowledged. Ss who reported associations for more than half of the word pairs, even without verbalizing the strategy, were considered to be using active mediation.

Passive Association: The S reported that he noticed some association between the two items in some word pairs.

This seemed to be an association that "popped into mind"; the S did not attempt to think of an association if none occurred to him immediately. This category included reports such as "I didn't do anything special, but this list was easy because of 'kittens in a tree' and 'window dressing'." Such associations were reported for no more than four of the word pairs.

Idiosyncratic Strategy: The S reported some strategy other than repetition or mediation. This usually consisted of using letter combinations to link words, such as "There are two l's in 'sell' and two l's in 'valley'."

No Strategy: The S could identify no techniques that helped him learn the word pairs. Such Ss often complained that the words didn't go together or said "I concentrated", "I tried to remember." This category also included reports of "I tried to use my photographic memory", "I tried to think how the words looked on the card."

If an S mentioned a strategy for only one word pair, such as a helpful letter combination or association, he was assigned to no strategy.

If more than one strategy was mentioned, the one used for most of the word pairs was assigned for that report (passive association, however, by definition, never involved more than half of the word pairs).

APPENDIX G

CATEGORIES OF STRATEGIES REPORTED FOR PRACTICAL MEMORY TESTS

A survey of Ss' reports of strategies used for the practical memory tests indicated some common strategies (repetition, association to the S's own experience, and no strategy) and also some strategies specific to particular tests. For each test, the relevant strategies were defined before categorizing individual reports. The number of Ss reporting each strategy on the final testing is indicated in parentheses before the definition presented below.

Personal Narrative

Repetition (1): The S reported repeating the facts to himself or aloud.

Personal Association (5): The S related one or more of the facts presented to a similar experience in his own life (e.g., "I visited Washington once", "I had a friend from Rhode Island").

Categorizing (2): The S identified a common theme among the facts (e.g., "It was all about your family", "All places where you lived or where you're going to live").

No Strategy (32): The S could identify no technique he used to help him learn or remember the facts.

Grocery List

Repetition (4): The S reported repeating the items to himself or aloud.

Personal Association (5): The S related the items on the list to hiw own shopping habits, categorizing the items as ones he had or didn't have, ones he liked or disliked.

Categorizing (6): The S combined the items into categories (e.g., Oriental food), menus (e.g., lunch of fish chowder and cole slaw), or common pairs (e.g., rice and salt, fish and shoyu).

Visual Mediation (3): The S reported trying to picture the items in his mind, to visualize where they would be on his shelves.

Counting (2): The S reported counting or knowing how many items he had to remember.

Word Features (3): The S reported attending to characteristics of the words themselves (e.g., initial letters, the length of the words).

No Strategy (17): The S could ientify no technique that had helped him to learn or remember the items.

Names and Faces

Names

Repetition (3): The S reported repeating the names to himself or aloud.

APPENDIX G (cont.)

Personal Association (2): The S reported that knowing people with the same names as some of the faces helped him to remember.

Visual Mediation (1): The S reported picturing the spelling of the names.

No Strategy (34): The S could identify no technique that helped to learn or remember the names. Recognition of the ethnic background of faces and names was not considered a strategy.

Occupations

Repetition (3): The S reported repeating the occupations to himself or aloud.

Visual Mediation (3): The S reported visualizing the person doing that kind of work. This was a true strategy to be differentiated from the passive approach of stereotyping.

Stereotyping (11): The S reported that some of the people matched expectations for appearance of someone in that occupation (e.g., "The hairdresser looks like she's used to taking care of herself").

No Strategy (23): The S could identify no technique that had helped him to learn or remember the items.

The categorization of strategies relied on the S's own

APPENDIX G (cont.)

report and disregarded the E's observations; for example, some Ss were observed to be repeating the names of the faces but were not considered to be using repetition unless they reported having done so.

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