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Greenberg, Cheryl

A CRITICAL REVIEW OF RESEARCH ON MEMORY INTERVENTIONS FOR THE ELDERLY

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A CRITICAL REVIEW OF RESEARCH ON MEMORY INTERVENTIONS FOR THE ELDERLY

by

Cheryl Greenberg

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ABSTRACT

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As the number of older adults engaged in learning increases, it is incumbent upon educators and psychologists to examine both age-related changes in learning and methods of remediating deficits in learning processes. Researchers have looked at deficits in the memory performance of older persons and at interventions meant to minimize or remediate memory changes. However, until this dissertation, no comprehensive review of the intervention literature had been conducted.

Manipulation of organizational techniques, the quality of the memory items, the modality of encoding and retrieval, mediation, orienting instructions, pacing, practice, and affective factors have been shown, in laboratory tests, to be effective interventions. Training programs have likewise been effective. However, the relative power and efficiency of individual interventions has not been assessed. It does appear that the most persistent aids to improvement of memory performance are practice and affective support. In addition, there is a need to examine the needs of the older adult in

his natural environment. While interventions have been useful in the laboratory, little research has dealt with changes in memory function and the effectiveness of interventions with real-life tasks.

Until ecologically valid studies have been conducted, it is suggested that attempts be made to alter the learning environment by application of laboratory findings to the real-world task.

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Limitations of the Study

All intervention studies reviewed in this dissertation employed experimental research designs and were reported in published articles or papers presented at professional meetings. While research on memory performance has been performed using infirm samples, with the exception of only two studies (Catino, Taub, & Borkowski, 1977; Hulicka & Grossman, 1967), the research reviewed here studied only healthy, community dwelling subjects. All samples included elderly persons. Most studies explicity sought to assess the value of interventions. In some instances, such as the examination of the quality of memory items and mediators, the researchers explored memory processing changes without attempting to improve or maintain memory performance. These studies were reviewed, nonetheless, because the implications of the study findings were essential to understanding potential, if not tested, memory interventions.

CHAPTER I

INTRODUCTION

The population of aging persons in the United States is increasing significantly. Concurrently, the numbers of older adults who are involved in formal and informal educational pursuits is increasing. While memory, the ability to acquire, store, and retrieve information, declines as one ages, interventions to compensate for the decline have not been adequately researched. No comprehensive review of research on interventions has been published. The relative effectiveness of interventive techniques has not been evaluated. Little attention has been paid to individual differences in memory function and to the ability to remember real-life tasks. It is the intent of this dissertation, then, to review the research on interventions for memory performance of the elderly, to critique that research, and to suggest implications of research findings for real-life activities. Only by understanding memory function and the need for intervention can educators and cognitive psychologists be of help to elderly individuals as they continue to learn across the life span.

ELDERLY LEARNERS

In 1980, 11.3% of the population of the United States

was 65 years of age or older. By 2020, the proportion of elderly in the population is expected to increase to about 17% (Cowgill, 1983). Who these older adults are, how they function, in what ways their functioning can be maximized and the quality of their lives improved are significant questions for the last part of this century.

The myths of aging suggest that elderly persons are lonely, withdrawn, inactive, infirm, and mentally incompetent. The facts of aging indicate that the elderly continue to be socially active and alert in patterns similar to those of their middle years (Havighurst, 1961; Palmore, 1968). While society may expect elderly persons to disengage, to withdraw from active participation in social, recreational, and job roles, the elderly appear to be most satisfied when they remain active (Havens, 1968; Havighurst, Neugarten, & Tobin, 1968). Moreover, though by 65 years of age most people suffer from at least one chronic illness (Smith, 1983), 83% of these individuals carry out, independently, the important responsibilities of their lives (Kimmel, 1980). Some decline in intelligence, memory, problem solving, and creativity is indicated by research findings, but in natural, everyday activities, older people continue to be capable and productive (Salthouse, 1982). The elderly, in large numbers, continue to learn as they meet the demands of new jobs and retirement and as they continue to participate in formal and informal educational processes.

Many older adults continue to work. While the proportion of people over 65 still in the work force has declined significantly in recent years, 22% of elderly men and 8.3% of elderly women were still working in 1975 (Siegel, 1976). Women are in the job field in increasing numbers, many returning to the work force after years of child-rearing (Schaie & Willis, 1978; Sinicropi, 1983). Individuals are working in multiple occupations over the course of their lives (Schaie & Willis, 1978). Technological changes and the rapid expansion of the information industry are responsible for occupational obsolescence and, hence, job changes (Cross, 1979; Naisbitt, 1984; Schaie & Willis, 1978). There is a tendency for people, as they age, to move out of fast-paced, complex jobs into less demanding jobs (Salthouse, 1982). For many of the older persons who continue to work, then, adaptation to changing jobs and on-going learning are required.

For the majority of older persons who retire, adaptation and learning are also required. The complexity of the technological and information society has an impact on these people. Ninety percent of the work force participates in Old Age and Survivors Insurance of the Social Security Act (Kutza, 1981). Two-thirds of health care costs of the elderly are paid by Medicare and Medicaid (Kutza & Zweibel, 1982). Dealing with the regulations of Federal programs, with private insurance, rent contracts, even a trip to the

now computerized library, demand learning and adaptation on the part of the aging person.

Finally, with earlier retirement and longer life expectancy, leisure itself makes demands on the elderly person. New hobbies, volunteer positions, and part-time jobs require learning and adaptation. As Cross (1979) points out, leisure activities today tend to be complex and thoroughly learned behaviors rather than casual time-fillers. Cross goes on to point out that participation in learning for adult leisure increased 75% between 1969 and 1975, with elderly persons constituting a significant proportion of the participants.

The higher the level of education attained, the more likely it is that people will continue to pursue education (Peterson, 1983). Until recently, completion of high school and postsecondary education were the province of relatively few persons. Today, the median number of years of school completed by persons under 65 is more than 12 years (Peterson, 1983). By 1985, 61% of persons over 65 will have completed high school (Knox, 1977). It is reasonable to expect, then, that an increasingly large number of adults will be involved in educational experiences. Already, in the short period between 1969 and 1975, participation in adult education by persons over 55 years of age increased by 55.2% (National Center for Education Statistics, 1978).

Education for the acquisition of leisure skills is only

one of the reasons elderly persons participate in formal classes. Often, classes provide information for coping with normal aging changes (Hiemstra, 1972). Classes may provide the opportunity to explore an intellectual or academic question, for either practical reasons or for the joy of learning itself. Finally, classes may provide, as the prime goal of the participant, a social opportunity, one in which personal interaction and emotional support are available (Bolton, 1983; Peterson, 1983). Whatever the goal of the course and the motivation of the student, the cognitive abilities of the individual will influence the success of his or her experience.

Education takes many forms. In addition to participation in formal classes, elderly persons are actively involved in informal learning. In his very broad definition of "learning projects," Tough (1977) includes any activity which is sustained for a total of at least seven hours and is directed to the acquisition of new skills or information. Tough finds that 98% of all adults, regardless of age, participate in at least one learning project each year. Hiemstra (1975) writes that people over 55 years of age participate in 3.3 learning projects a year.

As the elderly population increases in number, as these people adjust to their jobs and leisure, cognitive psychologists and educators are called on to understand the ways in which adjustments are made. As already noted, much

of the adaptation to new roles requires either formal or informal learning. Do age-related changes impede continued learning? Are techniques and technologies available to maximize learning and minimize the effects of age-related decline? Are gerontologists asking the questions which will result in better understanding of learning changes and effective interventions? These areas bear exploration.

Learning is a complex construct. When studying learning, one attends to perception and attention, intelligence, memory, problem solving, and creativity. In addition to the cognitive processes involved, social norms and affective factors must be considered (Sherwood, 1975). Biological changes affect all aspects of intellectual, sociological, and emotional function. The breadth of factors which exert an influence on learning, then, is enormous. While it is possible to examine the field _in toto_, the focus of this dissertation is memory, an aspect of cognition which is implicit in all learning, regardless of educational goals (Botwinick, 1970).

MEMORY

During the last two decades, a large body of research has accumulated which indicates that memory, as measured by laboratory tasks, exhibits age-related decline (Perlmutter, 1980). However, the locus of change and the cause of decline remain uncertain. Indeed, the neurophysiological components of memory, the interrelationships of aspects of memory, and

the adequacy of the research itself are problematic. A body of findings exists, but theory is still absent (Agruso, 1978). In this section, models of memory function and loci of memory change will be briefly reviewed.

Agruso (1978) describes two models of memory processing. In the information processing model, an individual takes in stimuli, which are then stored for a limited time in short term memory. Short term memory has a rapid decay period and a limited capacity, probably seven items held simultaneously (Birren, Woods, & Williams, 1980). The stored items are then either forgotten or transferred to long term memory. Long term memory has a virtually limitless capacity, utilizing ten to twelve billion neurons and the almost infinite interconnections among the neurons (Agruso, 1978).

In the second model of memory processing, memory is described in terms of a continuum of levels of processing (Agruso, 1978; Cermak, 1980; Craik & Lockhart, 1972). At the first level, the physical properties of a stimulus are processed. At the next level, discrete qualities of the stimulus are recognized. Finally, at the deepest level, the stimulus is organized according to meaningful properties. As this level is reached, the stimulus receives more attention and interpretation, with the greatest durability of memory evidenced at the deepest level of processing. Unlike the information processing model, the levels of this model are not presumed to be of invariant order. Deep processing may

occur prior to shallow processing, or a variety of levels may occur simultaneously (Cermak, 1980; Hultsch & Pentz, 1980).

Research on memory across the life span indicates decline in performance as an individual ages (Hartley, Harker, & Walsh, 1980). However, the reason for decline and the location of that decline within the memory process have remained subjects of controversy.

Studying short term memory, Inglis, Ankus, and Sykes (1975) reported a U-shaped curve of scores on a dichotic listening task for subjects 5 to 70 years of age. They found an increase in accurate responses, based on items in short term memory, for subjects from 5 to 10 years of age. A leveling off of scores occurred until 30 years, with a persistent decline from 30 years to 70 years.

Wetherick (1975), in examining short term memory of familiar and unfamiliar items (English and Hebrew letters), found that for an age X familiarity criterion, all ages handled familiar material efficiently, with only a small amount of slowing by older subjects. With unfamiliar material, however, older people performed significantly more poorly than younger people. Wetherick attributed score differences to age-related limits on short term memory for unfamiliar items.

Craik (1977) and Hartley, et al., (1980) reported that contradictory research exists. They noted that many studies show little or no age-related decrease in short term memory

capacity, except when cognitive reorganization of memory items or division of attention is demanded.

Inglis, et al. (1975) hypothesized that short term memory affects overall learning; that is, short term memory affects evolution and endurance of trace in long term memory as well as retrieval from storage. However, most research on long term memory has tended to look separately at acquisition, storage, and retrieval as sources of decline in long term memory.

There is little evidence that storage of items in long term memory exhibits age-related decrement (Hartley, et al. 1980). However, changes in encoding do affect subsequent retrieval (Arenberg, 1980; Smith, 1980). Hartley, et al. (1980) noted that older and younger adults may organize information differently. In testing recall of prose passages, Smith, Rebok, Smith, Hall, & Alvin (1983) attributed age-related score differences to qualitative changes in organization with age. Given interwoven stories, older subjects were less able to reestablish the organization of individual stories and thus to recall the elements of those stories. Meyer and Rice (1981), however, concluded that decline in prose recall was due to differences in the subjects' educational experiences, noting that individuals currently engaged in schooling would be more sensitive to the organization of reading passages.

Friedman (1975) hypothesized that degree of organization

for memory is a developmental issue. Healthy subjects 20 to 34 years old and 60 to 81 years old learned randomized letters beyond their short term memory capacity. The older group performed less well than the younger group and displayed less organization. Smith (1980) tested subjects using 60-word lists. Again, the older the group of subjects, the less organization for encoding was found.

In addition to age-related deficits in organization of to-be-remembered items, decline in visual mediation for encoding has been found. Hulicka and Rust (1964) and Hulicka and Weiss (1965) found that elderly persons did not spontaneously use mediational devices. Hulicka and Grossman (1967) and Treat and Reese (1976) reported less spontaneous use of visualization among older subjects than among younger subjects. Hulicka and Grossman (1967) found that older subjects were more likely to use verbal mediation than visual mediation.

Finally, the depth of processing (qualitative analysis) and the degree of elaboration (extensiveness of reworking new information and of interrelating new and old memory items) affect memory performance (Craik & Simon, 1980). The more deeply and extensively an individual processes to-be-remembered items, the more distinctive and potentially accessible is the memory trace. Optimal performance is achieved when encoding techniques are reinstated for retrieval. However, Smith (1980) and Craik and Simon (1980)

reviewed research which indicated that older people do not process information as deeply or as elaborately as do younger persons. For tasks which require deeper processing, older persons show more decrement than for tasks which require only shallow processing (Craik & Simon, 1980).

Long term memory deficit may occurs in retrieval as well as in acquisition. Noting that recall, rather than recognition, depends on retrieval strategies, Schonfield and Robertson (1975) found that recognition scores by age showed little decline, while recall scores by age showed a steady decline. The findings of this study, perhaps biased by the high IQs of subjects, were based on single item tasks. The researchers expected even lower recall scores if serial tasks were demanded. Hartley, et al. (1980), speaking to the same topic, however, suggested that recall deficit may be the result of encoding organization which was inappropriate for the task.

Speed of processing has also been studied as a source of memory decrement. Salthouse (1982) considered age-related slowing to be the most important source of all cogntive decline. Birren, et al. (1980) reviewed research which indicated slowing in peripheral and central processing, as shown by slower escape from masking effects for older persons. They reviewed research which points to shortened memory of iconic images, slowing in the rate of scanning of short term memory, and slowing in retrieval from long term

memory. Birren, et al. noted that, while some research attempts to separate motor speed and cognitive memory, other studies show significant correlation of these factors.

Arenberg (1965) found that when cohort scores were compared for speed, each group did better on slow-paced trials. However, on fast, slow, and self-paced tests, older subjects scored less well than younger subjects. Older people required longer rehearsal time between inspection and response. With longer rehearsal, there was greater opportunity for items to enter long term memory and less opportunity for interference from adjacent tasks. Scores for older people improved with slowing of pace, but did not achieve the level of young peoples' scores.

Hartley, et al. (1980) noted that slower processing speed may not indicate storage and retrieval of less information. Rather it may indicate concurrent demands, reflective of an age-related deficit in ability to divide attention while procesing. Lachman and Lachman (1980) found that older people had larger stores of memory items, the result of accumulation of information during the life span. This larger store may suggest the need for increased time to sift through information in order to retrieve the appropriate information. However, Lachman and Lachman found that older people retrieved information as efficiently as did younger people. Fozard (1980), speaking to this issue, suggested that slowing in retrieval of very well-learned information is

only partially the result of changes in memory search; more importantly, this slowing is the result of lengthening of reaction time, that is, the time needed to respond to stimuli.

In reviewing memory change with age, Fozard (1980) broadened the categories of memory to include sensory memory (a fast decay perception of environmental stimuli), working memory (memory of rules and plans for task attainment), and tertiary memory (memory of very well-learned, well-practiced items). Primary and secondary memory are similar to those of the levels of processing model, with the caveat that tertiary memory involves better-learned items than does secondary memory.

Fozard observed that sensory, secondary, and working memory exhibit decrement with age. Primary and tertiary memory do not. Increased slowing with age, on the other hand, is evident in all memory processing. The perceptual motor component, or time required for perception and response, increases for all memory categories. Decision making, or memory search, is slowest with secondary memory and shows less slowing with primary and tertiary memory. Fozard noted, however, that time varies significantly for an individual, dependent on task difficulty, and among members of an elderly cohort.

Memory performance is effected not only by changes in cognitive processing, but also by affective factors.

Decreased interest in attending and practice, decreased motivation to perform on experimental tasks (Hulicka, 1975), fear of failure, anxiety, and depression are related to memory decline (Richardson & Pratt, 1981; Wass & Olejnik, 1983). Arenberg (1975) found that error patterns were different for different cohorts, with older subjects making more omission than commission errors, and young subjects making more commission than omission errors. The age-related increase in omission errors may be largely due to fear of giving incorrect responses.

It is evident, then, from this brief review of memory processes, that laboratory findings indicate changes in memory performance as one ages. It is equally evident that the locus and mechanism of change has not been established; rather, research findings are in conflict over the etiology of change. Moreover, several researchers (Charness, 1981a, 1981b; Hartley, et al., 1980; Wass & Olejnik, 1983) suggest that laboratory results may not be relevant to the daily lives of older adults. They note that, particularly when the older person engages in activities which are well-practiced and familiar, he or she may experience no significant impact of memory decline on real life activities. Clearly, additional research is needed both in the laboratory and in natural settings. Nonetheless, with attention to what is known about age-related memory changes, a great deal of research has been conducted which has, as its goal, the

maintenance memory performance or the remediation of memory decline. It is this research on interventions which will be addressed in the following section.

DEFINITION OF TERMS

For the purpose of this dissertation, the following definitions of terms will be used:

Aids. Devices or techniques which facilitate memory performance.

Community dwelling. Living independently; not institutionalized.

Cues. Verbal or visual signals which aid memory performance.

Ecological Validity. Accuracy of findings when applied to natural settings or to naturally occurring tasks.

Encoding. Putting information into memory in a form suitable for storage and retrieval; input process of memory.

Imagery. Mental pictures or representations of items to be remembered.

Interacting Image. Visual representations in which two or more items to be remembered are interrelated or involved in the same activity. For example, if the words bird and fly are to be remembered, the interacting image might be a mental picture of a bird flying through the sky.

Intervention. Activities and techniques which may alter the course of a behavior or cognitive process. Interventions reported in this paper are intended to maintain

or improve memory performance.

Learning. The acquisition of knowledge or skills.

Maximizing Potential. Causing an individual to perform with the greatest effectiveness or efficiency of which he or she is capable.

Mediators. Links between memory items; devices which facilitates memorizing and retrieving information.

Memory. The mental process of encoding, storing, and retrieving information about events, experiences, persons, places, and items.

Methodology. Research techniques and assumptions involved in gathering data, analyzing that data, and arriving at conclusions.

Mnemonics. Verbal or visual techniques for improving memory.

Perception. Organization of information acquired through the senses.

Retrieval. Process by which information is secured from storage; output process of memory.

Storage. Maintenance of memory items.

Verbal Mediation. The use of semantic elements, such as letters, words or phrases, in order to form connections between items to be memorized.

CHAPTER II

INTERVENTIONS

In order to test the possibility of avoiding age-related memory changes or of remediating changes when they do occur, a number of interventions have been tested. In some cases, the studies have looked at techniques for improving various aspects of cognitive processing. In other cases, the quality of the stimulus items themselves have been manipulated. In order to provide the reader with an organizational scheme, studies which deal primarily with internal memory processes (organization, mediation, and orienting instructions) will be reviewed first. Studies which focus on manipulations which are more external to memory processing (quality of the task and intervention, modality, pace, practice, affective factors, and training programs) will be reviewed second. This organizational scheme is somewhat arbitrary; the studies could be clustered in other ways. Nonetheless, this structure is a useful approach to understanding memory interventons.

In this section, research on interventions will be reviewed in sufficient detail to reflect both the content, as well as the strengths and weaknesses of the studies. The Discussion section, which follows the reviews, will address overall problems with the body of research, implications of

the existing studies for learners, and directions for future research.

ORGANIZATION

Craik (1977), in reviewing research concerning short and long term memory, reports that there is little evidence that short term memory performance declines as one ages. However, long term memory does show age-related deficit. One of the primary reasons for this change, he reports, is the lessened ability of older people to organize information effectively for later retrieval.

Hultsch (1971) examined the performance of subjects in a memory task which required that the subjects either sort words into categories of their own design (Sorting condition) or merely look at the words without categorizing them (Nonsorting condition). Hultsch hypothesized that older subjects' scores would be significantly lower than younger subjects' scores under the Nonsorting condition. Further, Hultsch hypothesized that the opportunity to sort would result in a smaller score difference between old and young subjects.

The sample consisted of 60 community dwelling females (mean ages = 24.0, 45.6, and 64.2). The sample was a superior group in terms of verbal abilities and educational level. All groups were closely matched on a multiple-choice vocabulary test. Mean years of education were 16.0 for the 20-29 year olds, 15.0 for the 40-49 year olds, and 16.35 for the 60-69

year olds. Occupational status was not described.

The youngest group outperformed other age groups under all instructional conditions. In the Nonsorting condition, the youngest group outperformed both the 40-year olds and the 60-year olds, though there was no significant difference between the two older groups. Under the Sorting condition, the youngest group recalled significantly more words than the oldest group, with no significant difference between the 40-year olds and either the younger or older groups. For all groups, however, performance was better under Sorting than Nonsorting conditions. The differences between scores for the two conditions was greater for the two older groups than for the youngest group. The actual organizational activity was not significantly different among sorting groups. All groups used approximately the same amount of time and numbers of trials to form categories, and all formed the same number of categories with similar content and size.

The sample was a superior group in terms of verbal ability and educational attainment. For this sample it appears that all age groups were able to organize items to be memorized, and all age groups performed better in tasks which provided the opportunity to organize. The oldest group exhibited the greatest score differences between sorting and nonsorting conditions.

The study did not examine effects of organization on less able subjects. It did not clarify the discrepancy

between the apparent ability to organize during encoding and the findings of age-related differences in performance after organizing. The study did show that under nonsorting conditions, decrement in performance relative to the youngest group was apparent as early as the 40's.

In a later study, Hultsch (1975) young subjects (mean age = 20.24) and elderly subjects (mean age = 70.25 years) learned 40 words to recall. The control group was instructed to learn the words. The experimental groups were provided with labels identifying the 10 categories into which the words could be grouped.

As in Hultsch's 1971 study, young subjects recalled more words than did older subjects. Older subjects benefited more than the young from the experimenter-provided organizational cues. While the older groups did not seem to organize spontaneously, they were able to do so with instructions and aids.

In the two studies mentioned above, older age groups were found to benefit from the provision of instructions to organize as well as the provision of specific organizational techniques or aids. In still another study by Hultsch (1974), the researcher assessed the effect of practice on organization for memory performance. He found that organization for the task increased over successive trials without explicit instructions and training. This finding of spontaneous organization among elderly groups is in conflict

with much of the research (Craik, 1968; Hulicka & Grossman, 1967; Hultsch, 1969, 1971).

In this study, Hultsch used 114 female subjects (mean ages = 19.62, 45.50, 54.50, 65.17, 74.22) who exhibited superior verbal ability and educational level. The groups were not matched for educational level, as the 40 and 50 year olds had mean educational attainments of 16.28 and 16.11 years of education respectively, while the 20, 60 and 70 year olds had 13.76, 14.17, and 14.11 years of education respectively.

Subjects were given two lists of words to learn. They were tested individually a total of 10 times. Subjects were not instructed to use organization nor were they provided with organizational aids. Nonetheless, all subjects exhibited increased organization from List I to List II. (This result will be discussed in detail later when rehearsal is addressed.) In Hultsch's (1971, 1975) studies reviewed above, the performance of the elderly improved with instructions to organize and with techniques for doing so. Hultsch's 1974 study found improvement with only practice. This latter finding raises the question about the relative effectiveness of training the elderly and merely providing experience.

MEDIATORS--IMAGERY

Among the most frequently studied interventions for memory function is the use of mediators. Hulicka and Grossman (1967) noted that studies from the early 1960's (Hulicka & Rust, 1964; Hulicka & Weiss, 1965) indicated that elderly persons did not spontaneously use mediational devices. Researchers have attempted to increase or improve the use of mediators, hypothesizing that accurate and appropriate use would benefit memory performance.

Hulicka and Grossman (1967), in a much cited paired-associate learning study, tested the hypotheses that older people would form associative links between memory items when instructed to do so, and that performance would be better for subject-generated associations than for experimenter-provided associations. It was the researchers' assumption that when the experimenter provided the mediator, learning the new associative device added a second task to that of learning the words of the paired-associate task. In addition, the experimenters' mediator might interfer with associations between the words which were already in the subject's repetoire.

Seventy-two elderly persons (mean age = 74.1) and 72 young persons (mean age = 16.1) participated in the study. The younger persons were high school students; the elderly group were members of senior citizen centers or residents of homes for the aged. Persons with uncorrected sensory

deficits were excluded. The age groups were matched for educational level. No other description of the sample was reported. In order to maintain the motivation of subjects, they were paid for correct recall responses.

Young and elderly subjects were assigned to one of four conditions dependent on their performance on recall scores for a trial list. The No Special Instructions group was exposed to a list of pairs of words. On the second presentation, they were given the first word of the pair and asked to recall the second word. The Self-Image Instructions group was told to form an image which would connect the two words in the pair. The Experimenter-Image group was given a word or phrase which attempted to connect the pair and instructed to form a mental image of a scene suggested by the phrase. The Verbal Instructions group was provided with the linking word or phrase, but not with instructions to form an image.

Three lists of paired-associates were presented orally. Responses also appear to have been oral. Each list consisted of 10 pairs for the older group and 20 pairs for the younger group. The different list lengths were used because the researchers expected that ten pairs would be difficult for older subjects but would result in a ceiling effect for younger subjects. Both input and recall occurred at fixed rates. Subjects were tested individually.

Despite the longer list of pairs, the younger group

performed significantly better than the older group. For both the younger and the older groups, there were significant differences between No Instruction and Self-Image conditions, and smaller but still significant differences between No Instruction and Experimenter-Image conditions. Verbal Instructions resulted in improved scores for the elderly group but not for young group.

Hulicka and Grossman questioned subjects about their use of mediators. When given no instructions to mediate, the young reported that they spontaneously formed associations almost twice as often as the elderly. The elderly subjects who were instructed to mediate did so twice as often as old subjects in the No Instruction condition. Instructions to use mediators, then, increased formation of associative links significantly. The older subjects who did use mediation used verbal links more frequently than the young, and imagery less frequently than the young. The older subjects used self-generated imagery less often than the young and experimenter-provided imagery about the same amount.

Hulicka and Grossman concluded that older persons could improve their recall of paired-associates when they were reminded to mediate. They performed best when associations were self-generated. Experimenter-provided links were not only used less frequently, but often described by older subjects as too bizarre to be helpful.

Results of comparisons between young and old subjects

were subject to several caveats. The researchers noted that their study did not deal with the causes of differences, which may have been based on different educational experiences or on developmental changes. Hulicka and Grossman imply that, if the etiology of score decline is educational experiences, it is possible that training with mediators could be very effective in improving the performance of older people. Developmental decline would, perhaps, not be as remediable. Hulicka and Grossman did not discuss the possible effects of paying subjects for correct responses. Leech and Witte (1971) found, in a study reviewed later in this dissertation, reinforcement resulted in improved memory performance for their subjects. Hulicka and Grossman's findings, then, may have been the result of not only mediation but also reinforcement. Finally, Hulicka and Grossman did not report data on the educational level of the sample. In fact, they provided little information descriptive of the sample. Because of this lack of data, it is difficult to assess not only their causal inferences, but also the generalizability of their findings to other populations.

Hulicka and Grossman studied paired-associate learning in a fixed pace condition. While the findings indicated improvement in memory when mediation was used, it was not clear that these findings would generalize to real-life tasks and natural pacing of tasks.

Treat and Reese (1976) also tested the relative effects of no-imagery, experimenter-devised imagery, and subject-devised imagery. The results of their experiment were similar to those of Hulicka and Grossman (1967). In addition, Treat and Reese manipulated the pace of the task, finding that older persons more effectively used imagery when the pace of the task was slowed.

For Treat and Reese's study, the sample was composed of 18 males and 36 females in each of two age groups. The younger group were 25 to 35 years (mean age = 29.58); the older group were 60 years or older (mean age = 69.5). The groups were matched for educational, occupational and intellectual level, the latter measured by the verbal meaning section of the SRA Primary Mental Abilities Test.

Subjects were randomly assigned to experimental conditions for learning paired-associate lists. In the No-Imagery condition, standard paired-associate learning instructions were given. In the Experimenter-Provided Imagery conditions, subjects were told of an interacting mediator for the pair of words and instructed to form an image involving that interaction. In the Subject-Generated Imagery condition, subjects were instructed to form an interacting image for the two words in the pair. In addition to the instructional variations, conditions were varied as to pacing of the task. The anticipation time (time between presentation of stimulus and response by the subject), the

presentation time (time when both stimuli and response items are presented), and the interpair interval (time when pairs are not presented) were manipulated.

Treat and Reese found that, as with the Hulicka and Grossman study (1967), the performance of older subjects was facilitated by instructions to use imagery. Longer intervals resulted in improved performance for the older group. Instructions to use imagery were not effective at fast paces. When the intervals were longer, however, self-generated and experimenter-generated imagery resulted in better performances than those of the no-imagery groups, with no significant differences between imagery conditions. For young subjects, instructions to use either self-generated or experimenter-generated imagery were more effective than no-imagery instructions when the anticipation intervals were short. Again, there were no significant differences between imagery conditions. When pacing is not considered, the older group performed significantly better under self-generated imagery conditions than they did under no-imagery or experimenter-provided imagery instructions, findings similar to those of Hulicka and Grossman (1967).

Young and older subjects performed equally well with self-generated imagery when the anticipation interval was long. However, young subjects outperformed the older subjects when images were presented by the experimenter. Treat and Reese speculated that this variation in

effectiveness of imagery for the older subjects was the result of age-related increases in rigidity. The researchers suggested that, with increased age, subjects were less likely to adopt imagery developed by another person, but that they would use their own imagery. It appeared, however, that the older subjects required the longer intervals in order to devise or use even their own images.

While the design of Treat and Reese's study was complex, the results did indicate that, at least when the pace of learning is sufficiently slow and with some tasks, the memory performance of older subjects can be facilitated by instructions to mediate visually. Whether imagery would be helpful when instructions to mediate were not explicit, and when the pace and content of the task involved real-life situations was not clear from this study.

Treat (1977) studied the effect of focused attention and elaboration on paired-associate learning. As with the Treat and Reese study (1976), the learning task involved remembering pairs of concrete items. For Treat's study, subjects were asked to remember words or pictures. In order to assess the effect of varying amounts of elaboration or mental processing of information, both simple and interacting imagery were used. Attention was focused on the learning task, in the experimental condition, by asking subjects to describe the words or pictures, or by asking them to form images in which the words or pictures interacted. In control

conditions, the experimenter described the words, pictures, and interactions in order to minimize the subjects' attention to the memory items. The mode of response was not described.

Thirty-two males and 32 females were randomly assigned to the experimental and control groups. Subjects were 25 to 35 years of age or 60 years or older. No other description of the sample was reported.

Overall, the young subjects outperformed the older subjects. For all male subjects and for older female subjects, focusing of attention and elaboration resulted in improved scores for most paired-associate tasks. Treat concluded that the older persons did not spontaneously mediate, but that their performance improved when they were encouraged to use mnemonic devices. The researcher noted that mnemonic devices served to increase the active processing on the part of the subject, the activity resulting in deeper, more elaborate processing of to-be-remembered items. Training and practice in the use of mnemonics, Treat stated, would help compensate for age-related memory decline.

Treat, Poon, and Fozard (1981) also tested the effect of imagery on paired-associate learning of concrete nouns. In this study, however, the researchers examined the long term effects of instructions to use mediators. They investigated whether, given instructions to use imagery on one trial, subjects would continue to mediate on subsequent trials. They also questioned whether, given experience with a memory task,

subjects would spontaneously use mediators.

Subjects included 50 younger persons (mean age = 19.4) and 45 older persons (mean age = 69.91), who were college students or members of senior groups. The younger group had a mean of 14.43 years of education; the older group, 13.29 years. No other data were reported.

Subjects were randomly assigned to experimental conditions. The control group received only standard paired-associate instructions. Experimental groups were given instructions, during the first and second sessions, to use self-generated imagery, experimenter-generated imagery, or a combination of self-generated and experimenter-generated imagery. In the third session, all groups received standard instructions. The paired-associates were presented at a fixed rate. The researchers reported that response time was self-paced, although after 10 seconds of no response, the next paired-associate was presented. The mode of response was not described. Subjects were tested individually.

Overall, the younger group scored better than the older group. The older subjects did use imagery when instructed to do so, and for tests immediately following instructions to mediate, groups which used experimenter-generated imagery or a combination of experimenter-generated and self-generated imagery performed with no significant age differences. When self-generated imagery instructions were used for both trials 1 and 2, there was no significant age difference for any list

of the three sessions.

Between sessions, there were two-week intervals. Apparently, during those intervals the older subjects forgot the instructions to mediate or the mediational techniques themselves. The first trial after the break, before instructions were repeated, resulted in significant declines in the overall performance for the older group and modest but not significant declines for the young.

The control group was given only standard paired-associate instructions. Over the course of the three sessions, scores of the older control group improved. By the end of the third session, the older control and experimental groups scored equally well. Treat, et al. concluded that the older control group had generated their own mnemonic strategies, thus improving their performance without experimenter intervention.

Treat, et al. found that older people benefited from instructions to mediate. They found, like Hulicka and Grossman (1967) and Treat and Reese (1976), that self-generated imagery resulted in better performance than did experimenter-generated imagery. However, they also found that, given sufficient time, the older group was able to generate and use mediation without explicit instructions to do so. The latter findings call into question the validity of studies which are conducted within narrow time constraints. While age-related learning deficits are often found in these

studies and experimental interventions result in performance improvement, it is not clear that intervention is necessary. As implied by the improved performance of the control group in the Treat, et al. (1981) study, it is possible that the important variable is time for the older group to become familiar with the task and the laboratory setting or opportunity to practice.

Fullerton (1983) studied the use of imagery in memory of syllogistic reasoning problems, problems which contain three sentences with interrelated information. The relationship of items in one sentence and items in a second sentence can be deduced logically, by rearranging the internal information and, for some problems, by making use of previously acquired knowledge. For example:

> A wren is larger than a XET.
> A LAJ is larger than a JID.
> A JID is larger than a hawk. (Fullerton, pg.328)

Using this syllogism, subjects might be asked whether a LAJ is larger than a hawk. Subjects were tested on their memory of the relationships stated in the syllogism, deduction of relationships which were inherent in the syllogism, and inferences about relationships through integration of information presented in the syllogism with knowledge the subject had prior to the experiment. Only the memory aspects of this study will be discussed here.

Fullerton hypothesized that, if the ability to use

imagery declines with age, instructions to mediate would be more beneficial for younger subjects than for older subjects. On the other hand, if older people have the ability to use imagery but do not do so spontaneously, instructions may narrow the performance differences between the age groups. If spontaneous mediation is less likely for spatial than nonspatial tasks, instructions to mediate should differentially improve spatial task performance.

Fullerton recruited 40 females and 1 male (age range = 20 to 39) for the younger group and 41 females and 6 males for the older group (age range = 60 to 80). Most subjects had attended college. No other data descriptive of the sample or of attempts to match the groups were reported.

Overall, the performance of the older group on memory tasks was significantly poorer than that of the young group. Young persons performed better with sentence presentation. Older persons performed better with paragraph presentation, that is, with contextual cues. Imagery instruction improved the performance of both groups for spatial relations presented in paragraph presentation. Imagery instructions did not facilitate performance for spatial relations in sentence presentation or for any nonspatial tasks. Fullerton concluded that older persons were able to use imagery, with some tasks, when instructed to do so. Fullerton's hypotheses that imagery would facilitate performance, particularly for tasks involving spatial relationships, were only modestly

supported. The young continued to outperform the old significantly on memory tasks. Indeed. for spatial tasks in paragragh presentation, the use of imagery resulted in greater differences between the age groups than did non-imagery conditions. Fullerton did not assess the significance of this increased discrepancy between the groups. Fullerton did conclude that the overall performance advantage for the younger subjects may have indicated that task was difficult for the older subjects because of their lack of familiarity with syllogistic reasoning problems, exercises common in school settings. The use of nonsense syllables in the problems may have been difficult for the older subjects, as well.

MEDIATION--METHOD OF LOCI FOR IMAGINAL MEDIATION

Instructions to use imagery as a mediational device are often fairly general: The subject is told to form a mental representation of the item to be learned or to form a picture of two or more items interacting with each other. Often, the subjects are provided with experimenter-devised simple or interacting images. In other studies, however, subjects are taught specific, sometimes elaborate, mediational techniques, such as the method of loci and face-name mnemonics. The following studies examine the usefulness of these techniques as interventions.

In a much cited study, Robertson-Tchabo, Hausman, and

Arenberg (1976) researched the effectiveness of loci mnemonics, a method which requires the individual to form images involving both the new, to-be-remembered item and a familiar location. By recalling the location and the image, the new information is also recalled. Robertson-Tchabo, et al. contended that, with unfamiliar mnemonics, the learner had multiple tasks with which to deal. The mnemonic had to be learned along with the memory items. In the Robertson-Tchabo, et al. study, locations in the subjects' homes served as the mnemonics, hence were familiar and required no new learning.

Subjects were one male and four females (mean age = 69.3). Mean WAIS vocabulary score was 62.8. No other data concerning the subjects were reported.

On the first day, subjects performed two word-recall exercises. They were then instructed to identify 16 familiar locations in their homes, in the sequence in which the locations would be met on a walk around the homes. On the second day, subjects were to rehearse the locations in sequence and to associate, with each location, a high-imagery word. Subjects described the association. On the third and fourth days, the same procedure was followed with a new list of words each day. On the final day, subjects were given instructions to use the mnemonic which they had been practicing. They did not rehearse the mnemonic and did not receive explicit instructions to form and describe

associations. Again, they used a list of words which had not been used in other sessions.

Robertson-Tchabo, et al. found that subjects performed significantly better on Days 2, 3, and 4 than on Day 1. However, without instructions to use the loci mnemonic on the last day, scores declined. Performance on the fifth day was better than on the first day, but significantly inferior to that of Day 4.

In a second experiment, Robertson-Tchabo, et al. tested the effect of more explicit instructions to apply the loci mnemonic to new learning. For this study, 30 subjects were assigned to one of two experimental groups or to the control group. Random assignment was not reported. Experimental Group 1 consisted of two males and eight females (mean age = 70.63). Experimental Group 2 consisted of four males and six females (mean age = 71.74). The control group consisted of three males and seven women (mean age = 70.70). All groups were matched for WAIS vocabulary subtest scores. No other data concerning the sample were reported.

The experimental groups practiced recall, identified 16 home locations, and were instructed to associate lists of words with the locations, in the same 4-day sequence of sessions as seen in the preceding study. On Day 5, Group 1 received weak instructions to use the mnemonic which they had learned. They were not given explicit instructions to form associations between the location and the new words. Group 2

was given clearer instructions to use the mnemonic. They were told to form associations and to describe those associations. Neither group rehearsed the locations. On Days 1 through 4, the control group practiced recall, identified home locations, and rehearsed trips to those locations. However, they were not given instructions to form or describe associations on any of the days of the study. On Day 5, they did not rehearse the loci mnemonic.

Both experimental groups performed significantly better on Days 2, 3, and 4 than they had on Day 1. There were no significant differences between the two groups in the amount of score improvement. While the performance of the control group was better on Days 2, 3, and 4 than on Day 1 (significance was not reported), the experimental groups improved significantly more than the control group. All groups declined from Day 4 to Day 5. However, all groups performed better on Day 5 than on Day 1. There was no significant difference in gain between the two experimental groups. Both experimental groups gained significantly more than did the control group.

Robertson-Tchabo, et al. concluded that the loci mnemonic, by increasing organization of information at the time of encoding, was effective in aiding recall for elderly subjects. The method was maximally effective because it involved familiar, overlearned mnemonic devices which were selected by the subject rather than by the experimenter. The

researchers suggested that the decline in scores between the fourth and fifth days was due to insufficient instruction to apply the mnemonic to new situations, that is, insufficient attention to transfer of training and insufficient practice with the mnemonic. It was not clear that the loci mnemonic would be effective in the real world. Without generalizability to new tasks, the mnemonic would be effective only under the supervision of a trainer.

The researchers tested only lists of high-imagery words. It would be useful to test the effectiveness of the loci mnemonic with other memory tasks, for example, with abstract words. In addition, it would be informative to investigate the limitations of associating new memory items with the same mnemonics. It would seem that interference would impede the effectiveness of the device if the same locations were used repeatedly as mnemonics for lists of to-be-remembered items.

The composition of the samples was not well reported. While the sample of the first study was small, the questions and findings were replicated in the second study with a somewhat larger sample. However, it would be useful to test the effectiveness of the method of loci with larger, better defined, and diverse samples in order to assess the generalizability of findings.

Rose and Yesavage (1983) noted that Robertson-Tchabo, et al. (1976) had not studied the relative effectiveness of the method of loci mnemonics for various age groups. Rose

and Yesavage, therefore, conducted a study in which the sample consisted of 16 younger subjects (mean age = 27.8), 25 middle-aged subjects (mean age = 53.3), and 26 older subjects (mean age = 61.4). The age range for the sample was 21 to 67 years. Forty-three of the subjects were male, 24 were female. All held middle management jobs and volunteered for the study with the expectation of self-improvement. Most subjects reported average or better health.

Subjects participated in three training session of 2 1/2 hours each. They took fixed-pace, written tests in groups at the beginning and at the end of the training course. Memory items consisted of lists of 12 concrete and 6 abstract nouns. On the posttest, subjects were instructed to use the method of loci mnemonic in order to recall the nouns in the order in which they had been learned. Unlike Robertson-Tchabo, et al. (1976), Rose and Yesavage also asked the subjects to rate the image associations on the basis of pleasantness or unpleasantness.

All groups improved significantly from pretest to posttest. However, the youngest group showed the greatest gain and the oldest group, the least gain. On both pretest and posttest, scores varied inversely with age. In fact, there were greater differences between the groups on posttest than on pretest.

Rose and Yesavage concluded that the mnemonic was effective in improving the memory performance of all

subjects. They had expected that the judgment concerning pleasantness would facilitate performance more than the use of the mnemonic alone, in that the judgment involved additional elaboration of memory items. Such semantic elaboration would enhance encoding and retrieval. However, as posttesting resulted in greater age differences than those found on pretesting, Rose and Yesavage suggested that the judgment requirement may have increased the difficulty of the task for the older subjects. They explained that the score differences supported the concept that there exists an age-related deficit in the ability to engage in semantic processing. They noted, also, that the pretest-posttest increase in differences may have been due to the inability of older persons to utilize visual mediation. They cautioned, however, that the research is in conflict on this point. As reviewed above, Hulicka and Grossman (1967) found that both older and younger subjects benefited from the use of visual mediators.

Rose and Yesavage found that the method of loci was a useful intervention for old and young subjects. However, their sample was relatively young, occupationally advantaged, and motivated. It would be instructive to replicate their study with other populations. Moreover, the researchers did not study delayed recall, though Robertson-Tchabo, et al. (1976) found little carry-over effect. Again, it would be useful to examine duration of effects and transfer of

training, particularly with the addition of the judgment task.

In another study concerning the method of loci mnemonic, Yesavage and Rose (1983) tested the effect of preceding mnemonic training with concentration training. The researchers expected that the facilitation afforded by the mnemonic would be increased by prior concentration training. The researchers also expected that the order of training would be important; that is, concentration training would be less facilitative when it followed mnemonic training than when it preceded mnemonic training.

The sample consisted of 12 male and 23 female subjects (mean age = 68.7; age range = 58-85), most of whom had graduated from high school (97%) and college (54%). Subjects were screened for depression and organic brain disease by administration of the Hamilton Rating Scale for Depression, the Geriatric Depression Scale, the Research Diagnostic Criteria, and the Folstein Mini-Mental Dementia Screening Test. The subjects were then assigned to one of two experimental conditions: Concentration training followed by mnemonic training (CT-MT), and mnemonic training followed by concentration training (MT-CT). The two groups were similar in terms of age, educational background, and gender.

Subjects participated in eight sessions, once a week, for 1 1/2 hours each, during which they learned and practiced concentration and method of loci skills. Five other sessions

were held for orientation, testing, and debriefing. At each of three testing sessions, subjects were asked to memorize and recall in writing, at a fixed pace, 18 common nouns. Subjects were given 5 to 10 minutes of distracting tasks and then retested on the list of nouns in order to assess delayed recall. Transfer of training was tested by means of paired-associate and reading comprehension tasks. Finally, subjects rated themselves on perceptions of cognitive abilities and performance, using a measure which included self-report of memory problems.

Both groups improved on all measures from the first to the third testing sessions. However, the CT-MT group showed significantly more improvement on immediate and delayed recall of lists and on the paired-associate task. On the reading comprehension task, the difference in improvement between the CT-MT and MT-CT groups was only marginally significant. Groups performed equally well on recalling word lists in the order of presentation, though improvements in this area did not appear until mnemonic training had taken place. Despite overall performance improvements, there was very little correlation between subjects' self-assessments and objective measures. This lack of correlation between subjective and objective measures is in keeping with the findings of Richardson and Pratt, (1981), Schaffer and Poon, (1982), Scogin, Storandt, and Lott (1985), Zarit, Cole, and Guider (1981), and Zarit, Gallagher, and Kramer (1981).

Yesavage and Rose concluded that the pairing of mnemonic training with other types of cognitive training enhances memory performance. Moreover, the researchers felt that the order of training, in this case concentration training preceding method of loci training, was important. Yesavage and Rose did not, however, use a control group which learned only the mnemonic device. It would have been useful to know whether the MT-CT group performed better than a group which had received no concentration training. It would similarly be useful to compare the performances of all groups with a fourth group which received only concentration training.

MEDIATION--FACE-NAME MNEMONICS AS IMAGINAL MEDIATION

Another imagery technique is called a face-name mnemonic. Yesavage, Rose, and Bower (1983) taught the use of this mnemonic by instructing the subject to identify a prominent feature of the individual's face. The subject then transformed an individual's name into an image. The name-image was superimposed on the prominent feature. In order to recall the name, the subject identified the prominent feature, recalled the image associated with the feature, and transformed the image back into the name. For example, if the subject were trying to remember the name Doggett, he might observe that the individual had very large ears. He would transform Doggett into dog, and picture a dog on the individual's ears. To recall the name, he would look at Mr.

Doggett's large ears, recall the image of the dog, and transform dog into Doggett.

McCarty (1980) found that this face-name mnemonic was useful for young subjects. Yesavage, et al. (1983), with a sample of older persons, further elaborated the technique by requiring subjects to form judgments regarding the pleasantness or unpleasantness of the face-name associations. Yesavage, et al. hypothesized that this additional step would increase elaboration of the memory items at the time of encoding and thereby increase the probability of accurate recall.

Subjects were 60 retired, middle-level managers (mean age = 65.6) who volunteered for a course on memory improvement. Seventy-five percent were male. Thirty-three percent had completed primary school; 33% had completed high school; 33% had attended college. Fifty-three subjects reported good or excellent health. None reported poor health. The subjects were assigned to groups which were matched for age, gender, educational level, and health.

During the first two sessions, all subjects were taught to identify prominent facial features and to transform names into concrete images. Subjects were shown slides of equal numbers of males and females who were dressed in nondistinctive manners. A common name, written on a piece of paper, was displayed with each slide and read aloud by the experimenter. Presentation was at a fixed rate.

After completing training on the mnemonic, the sample was assigned to one of three groups. The control group was given no further training. The Image group was taught to form an association between the prominent feature and the name-transformation image. The Image and Judgment group was taught to form the association and also to make a judgment about the pleasantness of the image association.

On Day 2, subjects were shown a different set of slides and given accompanying names both orally and in writing. For each slide, they were told what prominent facial features and name transformations were appropriate. The Image group was also provided with an experimenter-devised association between the facial feature and the name transformation image. The Image and Judgment group received the association as well as a judgment as to pleasantness.

On Day 3, subjects were exposed to a third set of slides and names. Experimental groups were told to identify, for themselves, the prominent facial features, name transformational images, and associations. The Image and Judgment group was told to rate the association.

Recall tests, in which only the slides were presented, were administered after each study trial. For experimenter-mnemonic and self-mnemonic trials, tests were repeated after 48 hours. For delayed recall of the experimenter-provided mnemonic, two additional tests were used, one in which the prominent facial feature was given as a cue and one in which

the association was repeated as a cue. All tests were conducted at a fixed pace. Responses were written.

For the no-mnemonic condition of Day 1, there were no significant differences among groups. For all tests of experimenter-provided mnemonics, scores for the Image and Judgment group were significantly higher than those of the Image group. Both experimental groups outperformed the control group. For self-generated mnemonics, the experimental groups outperformed the control group on immediate recall tests. The experimental groups did not differ significantly from each other. On delayed recall, however, the Image and Judgment group performed significantly better than the Image group, while the Image and control groups received similar scores.

Yesavage, et al. (1983) concluded that the use of imagery and semantic judgments increased the elaboration process during encoding, hence improving face-name recall. They suggested that further elaboration would improve recall of the mnemonic. The researchers noted that the opportunity to rehearse was not a factor in the superior performance of the Image and Judgment group since the semantic judgment task provided only minimal additional practice with the memory items. Yesavage, et al. explained that the body of research did not support the conclusion that performance is enhanced by rehearsal. However, the latter explanation is in conflict with much of the research on practice interventions reviewed

later in this dissertation (DeLeon, 1974; Taub, 1966, 1973; Taub & Long, 1972; Treat, et al., 1981).

Mean scores for the self-generated mnemonics were superior to those of experimenter-provided mnemonics. Statistical analyses of these data were not reported. It would be useful to test the significance of this difference, since the data seemed to suggest, as Hulicka and Grossman (1967), Treat, et al. (1981), and Treat and Reese (1976) found, that elderly subjects perform better with mediators which they devise for themselves. However, a practice effect may be responsible for the superiority of self-generated mediators. Yesavage, et al. did not vary the order of experimental conditions; all subjects used experimenter-provided mnemonics on Day 2 and self-generated mnemonics on Day 3.

When cues were provided, recall was better than for all other conditions. For example, the Image and Judgment group recalled 89.7% of names when cued with the image association, as opposed to 31.6% for presentation of the slide only. The improvement in scores under cued conditions suggests that the mnemonic alone facilitated but did not maximize recall. The discrepancy may indicate that subjects only partially learned or utilized the mnemonic device. The face-name mnemonic, like the method of loci, is a complex mediational device. It was, perhaps, difficult to acquire under the time constraints of this study. Robertson-Tchabo, et al. (1976) found that

the method of loci was not used without explicit instructions to do so. In the Yesavage, et al. study, also, subjects may have required continued guidance from the researchers in order to use the face-name mnemonic most effectively. Alternatively, as Robertson-Tchabo, et al. (1976) and Yesavage, et al. (1983) suggested, additional training in the mnemonic may have been required in order to insure its effective use. Whether such a device would be effective in real-life settings, without the direction of trainers, requires research.

Groups were matched for sex, educational level and health. The sample represented a cross-section of educational backgrounds. As all subjects were retired middle managers, findings were generalizable only to populations with similar occupational levels. No comparisons were made to other age groups.

In a second study, Yesavage and Rose (1984) repeated their 1983 research on the face-name mnemonic, this time with young, middle-aged, and elderly adults. As with the 1983 study, subjects were middle managers who volunteered for a course on memory improvement. Groups were composed of 16 young persons (mean age = 27.75), 25 middle-aged persons (mean age = 53.32), and 26 elderly persons (mean age = 61.35). No further description of the sample was reported.

During the first session, general instructions about the experiment were provided and a baseline test for recall was

administered. The face-name mnemonic was then taught, with instruction being completed on the second day. Subjects were not instructed to form semantic judgments as to pleasantness of the association. As with the 1983 study, faces were presented via slides, with names presented in writing and read aloud by the experimenter. Subjects wrote their recall responses.

No control group was utilized in this study. Self-generated and experimenter-generated mnemonics were tested, though the order of conditions was not described. No significant differences between the conditions was found.

Yesavage and Rose reported a strong age effect. The youngest group performed better than the older groups. The middle-aged group outperformed the oldest group. All groups improved significantly with the use of the mnemonic. There was no significant difference between groups in the amount of improvement.

The researchers concluded that face-name mnemonics facilitated recall for all age groups. While the mechanism for such facilitation was not understood, they suggested that the mnemonic might be useful in cognitive training programs for the elderly.

In still another study, Yesavage (1983) examined the effect of training subjects in general visualization techniques before teaching them the face-name mnemonic. The researcher hypothesized that such visualization training

would maximize the effectiveness of the mnemonic.

For this study, the sample consisted of 50 members of senior centers (mean age = 78), 80% of whom were women. Assignment to experimental groups was random, with the groups being matched on initial recall scores, age, sex, education, and health status.

The training consisted of six bi-weekly sessions of 1 1/2 hours. After an orientation session, the Imagery group practiced a variety of visualization exercises, such as studying a picture in order to recall as much detail as possible. This aspect of the training took place during the second and third sessions, and at home. During the same period, the control group learned techniques for dealing with attitudes and stereotypes concerning aging. The fourth and fifth session were used for teaching the face-name mnemonic described in studies by Yesavage, et al. (1983) and Yesavage and Rose (1984), reviewed above. Posttesting took place during the final session. Tests consisted of 12 face-name pairs which were studied at a fixed pace and recalled in writing, again at a fixed pace.

Both groups were tested after the visualization or attitude training of the second and third sessions. The Visualization group scored better than the control group, but differences were not significant at that point. Only after mnemonic training, that is, at the end of the training period, were the mean group scores significantly different.

Yesavage concluded that general visualization training was not particularly facilitative by itself. However, paired with a specific mnemonic device, visualization training improved the effectiveness of that device.

MEDIATION--VERBAL

Arenberg (1977), Cermak (1980), Craik (1977), and Winograd and Simon (1980) reviewed research which indicated an age-related deficiency in the use of imagery. They suggested that verbal mediators are used more often and more efficiently by the elderly. Hulicka and Grossman (1967), in a study described above, found that when older subjects reported spontaneous use of mediators, these mediators were often verbal rather than imaginal.

Clarkson-Smith and Halpern (1983) tested the use of verbal mediators to facilitate spatial memory. In a mental rotation task, somewhat ambiguous figures were presented with verbal labels which were increasingly descriptive and familiar. The researchers expected that the older groups would make more errors and perform more slowly than the young. They hypothesized, however, that all subjects, regardless of age, would benefit from labels which described the picture, with the amount of improvement being correlated with the amount of information provided by the label.

To test their hypotheses, Clarkson-Smith and Halpern used a sample of 16 college students (mean age = 21.3), 16

middle-aged (mean age = 54.7), and 16 older (mean age = 74.2). The middle-aged and older subjects were recruited from organizations or by friends. All subjects were female. They reported being in good health. The three groups were roughly equivalent in educational level, although the older groups were better educated than is typical of their cohorts. The middle-aged group had a mean of 16.9 years of education; the oldest group, 15.3 years.

Slides of four pictures were shown at six angles of rotation. The mirror images of the six angles were also presented. One of four labeling conditions was assigned to each picture presentation: a meaningful name which indicated the direction of orientation of the pictured object, a meaningful name with no indication of directionality, a nonsense name with no indication of directionality, and no name. Subjects controlled the pace of the presentation of the slides. Subjects were exposed to pretraining in which the subjects were shown the pictures and their accompanying labels, and instructed to attend to these labels. The subjects were then asked, on two trials, to identify whether the picture was being shown in the standard orientation or as the mirror image of the standard. Subjects responded by pressing an appropriate button rather than by writing or speaking.

Clarkson-Smith and Halpern found, as hypothesized, that the younger groups made fewer errors than the oldest group.

The amount of information conveyed by the label correlated with error scores. The oldest group made twice as many errors in the No Name and Nonsense Name conditions than on the Meaningful Name and Meaningful Name with Directionality conditions. For the middle-aged and younger groups, the differences between numbers of errors for the naming conditions were progressively smaller. However, differences in performance between labeling conditions were significant only for the old group. There were no significant differences between groups in the numbers of errors made for the Meaningful Name with Directionality label. For other conditions, the young and middle-aged groups performed significantly better than the oldest group. When subjects were tested for recognition of an unrotated picture, the two older groups performed similarly and significantly more slowly than the youngest group. When the pictures were shown at angles of rotation, reaction time was significantly slower for the oldest group than for the middle-aged group, with no significant differences between the two younger groups. For all groups, reaction time increased as the angle of rotation increased.

Clarkson-Smith and Halpern concluded that verbal mediation was particularly beneficial to the oldest group of subjects. It is interesting to note, however, that when questioned about the strategies they had used to identify rotated pictures, some of the subjects reported mental

rotation. This response seemed to indicate visual rather than verbal mediation.

The researchers noted that their sample was composed of females with high levels of education and health status. They also indicated that the sample was advantaged socioeconomically, though they did not provide SES data. The researchers cautioned that their findings could not be generalized to women who were representative of a different population or to men. They expected that research with samples from different populations would replicate their findings.

The research dealt entirely with spatial memory. The mental rotation task is a very specific one, one found almost exclusively in the laboratory. Clarkson-Smith and Halpern noted that there are tasks in the real world which are similar, for example, becoming oriented in a new geographical environment. Whether real world tasks are similar enough to the mental rotation task to permit generalizability of laboratory results to natural settings must be explored. In addition, whether verbal mediation is helpful for memory tasks other than spatial ones must be researched.

ORIENTING INSTRUCTIONS

Craik (1977), in discussing the levels of processing model of memory, attributed age-related declines in secondary memory to inadequate processing of memory items. The

following four studies examined the hypothesis that older persons have the capacity to process deeply, but require instructions or training in order to do so. Specifically, the studies examined the effects of orienting instructions, that is the provision of cues or questions meant to encourage or direct subjects to elaborate or rework new information, to integrate it with information they already have, in short, to encode the information with sufficiently deep processing that retention improves.

Mason (1979) used, for her study, a sample of 498 healthy, active adults assigned to three age groups (age ranges = 20-39, 40-59, and 60-80). No other data descriptive of the sample were reported. The task for these groups was to learn 60 common nouns at a fixed pace. Subjects from each age group were equally assigned to either a standard instructions condition (control), that is, instructions to learn the words, or to one of three orienting instruction conditions. In the orienting conditions, subjects were asked questions about either the typescript of the words, rhymes, or category membership. Half of the subjects were tested on recall and half on recognition, both tests being self-paced and written.

Overall, the younger the age group, the better the performance. For the recognition tests, instructions affected performance for the sample taken as a whole, with the best performance being found with category orientation,

the second best performance with standard instructions. Only with category instructions were age differences significant, the youngest subjects outperforming the oldest subjects. For the recall test, there were no overall significant differences between category and standard orienting instructions. However, scores for both conditions were significantly superior to rhyme and case conditions for the young and middle-aged groups. There were no significant differences among conditions for the oldest group. The young and middle-aged groups significantly outperformed the oldest group under category and standard instructions.

Mason concluded that category orienting instructions resulted in the best overall performance, reflective of the deeper processing required by categorization. However, unlike Hultsch (1971), Mason found that instructions to categorize did not significantly improve the performance of older persons. As noted above, for the oldest group there were no significant differences between category and standard instructions for recognition tests and no significant differences among any instructions for recall tests. Mason concluded that older persons were not able to process deeply, even with orienting interventions.

The reasons for the discrepancies between Mason's findings and those of Hultsch (1971) are not clear. Mason did not describe her sample. Learning occurred at fixed intervals and responses were written. Common nouns were used

as memory items, but there was no report that these words were evaluated for relative familiarity or meaningfulness to the various age groups. The large age range of the oldest group may have obscured effects for some of the younger members of that group. Any of these factors may have led to lower effects of the intervention found in Mason's study. On the other hand, Mason's sample was larger than that of any other study described in this review. It would be expected that, with such a large number of subjects, effects of the intervention would be found if they existed.

Rankin and Hyland (1983) also studied the effects of orienting instructions on recognition and recall of words. For their study, subjects were told to learn the words (control) or were asked questions which oriented the subjects to rhymes or meaning. Like Mason (1979), Rankin and Hyland hypothesized that if older people have the ability to deeply process but do not do so, instructions which encourage deep processing would result in improved performance. Noting the meaning of words would involve semantic processing (that is deeper processing) than would attention to the phonological quality (rhyme) of the words to be remembered.

The sample for Rankin and Hyland's study was made up of 18 undergraduates (mean age = 18.44), 18 middle-aged alumni (mean age = 47.11), and 18 older alumni (mean age = 69.55). There were significant differences among age groups on measures of educational level, the differences favoring the

alumni groups. There were no differences in self-assessment of health. No other description of the sample was reported.

Subjects were shown 48 words at fixed intervals, followed by instructions to learn the words or by questions as to whether the word rhymed with or had the same meaning as another word. The subjects were then given a self-paced, written recall test and a fixed-pace, forced-choice recognition test.

For recognition tests, there were no significant overall differences among age groups. The type of orienting task did produce significant differences, however, with better performances for meaning and learning instructions than for the rhyming orientation. The difference between meaning and ryhming conditions was significant. On recall tests, performance scores declined with age. Instructions to learn the word resulted in signficantly better performance than did rhyme or meaning orienting instructions. Only in the learning instructions condition was there a significant age difference, with the youngest group performing best.

Rankin and Hyland found only minimal effects for orienting instructions as interventive techniques. Recognition performance was similar for all age groups, with the semantic task producing the best results. There were significant differences among age groups on recall tests, however orienting tasks did not produce significant improvement in performance. They concluded that the semantic

task increased elaboration for all groups on recognition tests, but even with this aid, older people could not retrieve the information well when required to recall memory items.

Surber, Kowalski, and Peña-Páez (1984) studied the effect of instructions on memory of prose passages. As in Mason (1979) and Rankin and Hyland's (1983) studies, Surber, et al. hypothesized that instructions to increase semantic processing of memory items would result in deeper, hence more enduring, memory. Recall would thereby be improved. For this study, the researchers choose to ask the subjects to solve a problem based on the information in the reading passage.

Subjects were 30 undergraduates (age range = 18-20) and 30 members of senior citizen groups (age range = 64-79). Approximately equal numbers of males and females participated. There were no significant differences between age groups on an Educational Testing Service measure of vocabulary. The elderly group reported reading approximately twice as many pages per week as did the younger group. Health status, occupational level, and socioeconomic level were not reported.

Subjects were asked to read a 1563 word passage concerning commercial fishing. Prior to reading, half of the subjects were told to read in preparation for a test (no description of the test was reported). The other half were asked to think of themselves as members of a marine

commission who would subsequently present their views on ecological problems to commercial fishermen. The time allowed for reading was fixed at the length of time required by the first 15 older subjects. Recall test were self-paced.

Surber, et al. found that the younger subjects recalled significantly more information than did the older subjects. When information was divided into levels of importance, there was no difference between age groups for amount of least important information recalled. The largest difference was for the amount of most important information recalled. This finding is in keeping with that of Meyer and Rice (1981), who found that younger people seemed to be more sensitive to a hierarchy of the importance of information, and were therefore more likely to remember major ideas than older subjects.

While Surber, et al. found age-related differences, they did not find significant effects for the instructional intervention for the sample as a whole or for the individual age groups. The researchers concluded that the problem solving task may have been difficult to keep in mind while reading, particularly given the length of the passage of this study. They speculated that study strategies were more effective than the experimenter-provided elaboration technique, in which case subjects who were currently students would have an advantage with the prose memory task.

It is interesting to note that, in this study, the older

subjects were advantaged relative to other members of their cohort and to the younger subjects in the study, on measures of daily reading. Nonetheless, their performance on memory of reading passages was not as good as that of the younger cohort. The researchers did not assess the effect of the form of the written material, although it was double-spaced but apparently not large-size type. They did not assess familiarity or meaningfulness of the material to the two age groups, nor did they assess whether either group was fatigued by reading the long passage. They did attend to pacing factors. It would be interesting to replicate this study with other passages, as well as with presentations which attend to possible visual problems of the elderly. For this study, however, no improvement in recall was seen as a result of techniques meant to increase semantic processing of memory items.

West and Boatwright (1983) hypothesized that memory performance would be maximized when both input and output utilized the same modality. They expected that older individuals, since they do not process semantic information as deeply as younger people, would perform better on the acoustic tests. However, they also expected that guidance during semantic processing, that is, suggesting techniques for processing, would result in improvement of performance for the older group.

The sample consisted of 64 younger adults (mean age =

26.1), 64 middle-aged adults (mean age = 49.0), and 64 older adults (mean age = 69.7). Subjects were college students, acquaintances of those students, members of an adult club, or residents in an apartment for older persons. The sample was 50% male, 50% female. The three groups had similar levels of education (young--12.5 years; middle-aged--13.6 years; and old--12.5 years). No other data about SES, ability, or health were described.

Subjects were given lists of words to read. Acoustic pairs on the list consisted of words which rhymed (eg. spoon and moon). Semantic pairs consisted of words with meaningful relationships (eg. star and moon). Guidance or orientation meant to improve encoding and retrieval was provided by the experimenter asking questions. Subjects were asked to recall either a word which rhymed with one in the question or which was semantically related to a word in the question. Subjects wrote their responses. Recognition was assessed by means of a forced-choice written test. Both recognition and recall tests were self-paced.

Half of the subjects were randomly assigned to the acoustic encoding condition. Half were assigned to the semantic encoding condition. Of these subgroups, half were randomly assigned to the recognition test and half to the recall test.

West and Boatwright found that, for the recognition test, performance was significantly higher for semantic

encoding than for acoustic encoding. In contrast, to the research hypothesis, there were no significant differences among age groups on measures of semantic versus acoustic encoding. For the recall test, the younger and middle-aged groups outperformed the oldest group. The younger group outperformed the oldest group when semantic encoding was followed by an acoustic test, and when acoustic encoding was followed by either the acoustic or semantic test. Only when semantic encoding was followed by a semantic test were the performances of the youngest and oldest groups similar. Both semantic encoding and semantic testing, when analyzed separately, correlated with the highest performances scores for the sample as a whole. The combination of semantic encoding followed by semantic testing yielded better scores than did any other encoding/retrieval combination.

West and Boatwright noted that findings of superior scores associated with semantic processing conflict with other research outcomes. Mason (1979), for instance, found that for recall older people did as well on acoustic tasks as on semantic processing tasks. West and Boatwright attributed their findings to long encoding and retrieval times, and to the close match of encoding and retrieval strategies. They concluded that elderly persons could successfully use semantic processing when carefully guided to do so. The researchers provided close and consistent matches between encoding and retrieval cues, as well as test

questions which specifically asked for acoustically or semantically processed memory items.

All subjects performed within the same time limitations and were required to respond to tests in writing. It may be that, given more time and other modes of responding, the differences between scores of the young and old groups would have been smaller. On the other hand, the memory items and the encoding/retrieval matching of this study were laboratory-specific. It is not clear that elderly persons would perform well on semantic tasks in natural settings in which tasks and behaviors are not carefully guided.

In the fifth study concerning orienting instructions, the emphasis was somewhat different than than that of the preceeding four experiments. In this study, McFarland, Warren, and Crockard (1985) examined the difference in memory for items provided by the experimenter and those generated by the subject. The researchers hypothesized that memory performance would improve when subjects were involved in the development of the to-be-remembered items. For each of 20 words, subjects were provided with a card on which were written a cue word, instructions to form a rhyme or find a synonym, and either the first letter of the word which was to be remembered or the word itself. During study, subjects said the cue and the target word aloud. Recall tests were oral. The experiment was repeated for three lists of words. Subjects also participated in a recognition test 48 hours

after the end of the study/recall trials.

Subjects for the recall study consisted of 14 female and 2 male students (mean age = 19.63; educational level = 12 to 14 years) and 13 female and 3 male member of a church (mean age = 69.0; educational level = 8 to 15 years). The sample for the recognition experiment was comprised of 12 female and 4 male students (mean age = 19.13; educational level = 12 to 13 years) and 10 female and 6 male church members (mean age = 70.93; educational level = 4 to 15 years). All subjects reported good health and no perceptual impairment.

Overall, the young subjects outperformed the older subjects, and both groups improved their performance over the course of the three study/test trials. There was no difference between rhyming and synonym conditions, but there was a significant advantage for self-generated over experimenter-provided words for both groups. Differences between self-generated and experimenter-provided conditions were apparent for the younger group on the first trial. Differences did not show up for the older group until the second and third trials.

McFarland, et al. interpreted the relatively late improvement of the older subjects to be evidence that older subjects required experience with the task before they could benefit from self-generation of the memory words. The researchers did not make note of the educational differences between the age groups, differences which may have influenced

the research findings. The younger groups reported narrow educational ranges of 12 to 13 years and 12 to 14 years of schooling. The upper limit of the range for the older groups was 15 years; however, the lower limits were eight years for the recognition experiment and four years for the recall experiment. The short educational experience for some of the older subjects might be expected to reduce the ease with which they performed on the memory tasks. The differences between the groups in terms of the lower limits of the educational ranges would be expected to influence how well the groups performed relative to each other.

McFarland, et al. concluded that involvement in the generation of the task, that is, in generation of the to-be-remembered items, increased performance scores on that task. The researchers did not explain the reasons for such improvement. Task performance may improve because of noncognitive factors, such as increased motivation, reduced anxiety, increased familiarity and comfort with the task. All of these factors may be implicit in a task which is generated by the subjects and over which they have some control. Indeed, experimental manipulation of noncognitive factors has been associated with improved memory performance by Leech and Witte (1971), Ross (1968), and Yesavage, Rose, and Spiegel (1982). Noncognitive effects are implicit in many of the training interventions studies reviewed later (Richardson and Pratt, 1981; Shaffer and Poon, 1982; Zarit,

Cole, and Guider, 1981; Zarit, Gallagher, and Kramer, 1981). In addition to noncognitive effects, a practice effect appears evident here, with scores for both age groups improving over time. Such an effect would be in keeping with the findings of DeLeon (1974), Hultsch, 1974), Taub (1966, 1973), Taub and Long (1972), Treat, et al. (1981), Zarit, Cole, and Guider (1981) and Zarit, Gallagher, and Kramer (1981). The effects of rhyme and synonym instructions were equivalent. However, the self-generations of the target words may have involved deeper semantic processing or greater activity on the part of the subjects, hence better memory trace.

McFarland, et al. (1985) noted that studies which utilize self-generated, rather than experimenter-provided, to-be-remembered items would be better gauges of memory changes. They explained that the involvement of the elderly in task development would result in more familiar, meaningful, recently practiced tasks, thus better measures of memory performance. As an intervention meant to maintain or improve memory performance, however, self-generation of task would seldom be useful. One can rarely control the items which he or she must memorize; rather the tasks are usually imposed by the realities and requirements of the individual's environment. It is conceivable that some tasks can be manipulated by the subject in ways which are more comfortable and familiar: Planning to buy familiar brand names for a

grocery list, using self-generated cues for geographic locations, and such. Research into ways in which older persons can be involved in the development or adaptation of tasks would be useful.

In yet another study involving orienting instructions, Kausler and Hakami (1983b) examined the effects of incidental versus intentional memory of conversations. With incidental instructions, subjects were told only that they would be discussing personal and current event topics. With intentional instructions, the subjects were told that they would take part in discussions, and also told that they would be asked to name the discussion topics or remember the content of those conversations. The researchers did not expect to find differences between the conditions, as memory for conversations seems to occur incidentally in the real world.

Subjects for the study included 13 male and 11 female undergraduates (mean age = 19.2) and 8 male and 16 female older adults (mean age = 68.0). All subjects reported good health and seemed to be free of hearing impairment. Young subjects had a mean educational level of 13.54 years and a mean WAIS Vocabulary subtest score of 19.96. Older subjects had a mean educational level of 16.12 years and a mean WAIS Vocabulary subtest score of 31.54. The differences on both measures were significant, favoring the older subjects. The researchers did not report whether the WAIS scores were raw

or standardized scores.

Subjects spent about three minutes discussing each of 12 topics, with the experimenter guiding the conversation by means of prescribed questions. A 30-second rest period was provided between each conversation. After all topics were discussed, subjects recalled the topics orally at their own pace. A recognition test was then administered in which subjects read 72 questions and identified whether or not the questions had been asked during the conversation. This test response was oral and self-paced.

Kausler and Hakami found that the younger subjects outperformed the older subjects, but there was no significant difference between incidental and intentional instructions for either group. Half of the topics were personal, half impersonal. It was expected that discussion about oneself would result in more distinctive, hence more easily retrieved, memory traces. However, there was no difference between scores for personal and impersonal topics.

Kausler and Hakami (1983a) also studied the effects of intentional and incidental instructions on memory for activities. As with their study of memory for conversation (1983b), the researchers did not expect to find performance differences due to instructions. They explained that, as memory for activities occurs incidentally in the real world, instructions to remember would do little to improve performance in this sphere. Participation in an activity

contributes to deep processing under incidental conditions, such that incidental memory performance and intentional memory performance are similar.

The sample consisted of 6 male and 18 female undergraduates (mean age = 18.5) and 7 male and 17 female older subjects (mean age = 65.7). The younger adults had a mean educational level of 13.7 years and a mean WAIS Vocabulary subtest score of 19.38. The means for the older adults were 16.21 and 32.29 respectively. Differences between the groups on measures of educational level and vocabulary ability were significantly different, favoring the older adults. The researchers did not note whether vocabulary scores were raw or standardized. All subjects reported good health and were free of uncorrected perceptual difficulties.

Both groups participated in 12 tasks, which were designed to range over a continuum from minimally to maximally cognitively demanding. The tasks included perceptual-motor activities, verbal learning activities, semantic memory activities, and problem-solving activities, with the latter being most demanding. The order of tasks was varied among subjects. Subjects in the incidental condition were told that they were participating in a study of the skills involved in the tasks. Subjects in the intentional condition were told about the task study and also that they would be asked to recall the activities in which they

participated. The series of tasks required less than an hour to complete, including rest periods between tasks. Subjects orally recalled the activities.

Overall, the younger subjects outperformed the older subjects. The younger subjects performed significantly better than the older subjects on all tasks, except those which involved problem-solving. Kausler and Hakami concluded that, for the older subjects, but not for the younger subjects, the more cognitively demanding tasks resulted in more enduring memory traces, hence better recall of those tasks.

Intentional and incidental instructions produced no significant differences in performance for either group. The researchers presumed that participation in the activities, regardless of instructions, resulted in adequate encoding. Differences in performance, then, were a result, not of encoding deficit, but of apparent retrieval deficit on the part of the older subjects.

In the final study of this section, Simon, Dixon, Nowak, and Hultsch (1982) did find an effect for intentional instructions. The researchers varied both semantic processing and intentionality of memory for recall of prose passages, hypothesizing that both deep processing under incidental conditions and intentionality would produce better recall than would shallow processing under incidental conditions. They further hypothesized that, regardless of

memory conditions, the younger subjects would outperform the older subjects.

The sample consisted of 180 females, equally assigned to three age groups (mean ages = 23.1, 44.17, and 66.83). Subjects were students or members of organizations such as churches and senior centers. Most subjects reported moderately good or better health, vision, and hearing. The three age groups did not differ in terms of educational level (mean educational level = approximately 12 years for each group). The groups did differ significantly on measures of vocabulary scores, the difference favoring the oldest group.

Subjects were randomly assigned to one of four experimental conditions: For the three incidental conditions, the subjects were told to attend to syntactical errors, to rate the style of the story, or to describe advice they would give to the characters in the prose passage. The syntax task involved shallow processing; the other tasks, deep processing. For the intentional condition, subjects were told they would be asked to remember the story. Subjects read a 500 word story, printed in large type, and wrote what they recalled of the passage.

As expected, the youngest group recalled significantly more of the propositions, or content, of the passage than did either the middle-aged or older group. For the youngest group there were no differences in performance with intentional, stylistic, or advisory instructions. All three

conditions were significantly better than the syntactic instructions. For the middle-aged and older subjects, recall was significantly better with intentional instructions than with the other three conditions, the latter not differing from each other. The younger subjects performed better on deep processing tasks than the middle-aged and older groups. With shallow processing and intentional instructions, there were no significant age differences.

The finding that the youngest group performed better with instructions for deep processing or intentional memory than for syntactic, or shallow processing, instructions is in keeping with depth of processing models of memory. That instructions to increase depth of processing did not improve memory performance of older subjects is in accord with the findings of Mason (1979), Rankin and Hyland (1983), and Surber, et al. (1984). Simon, et al. noted that all subjects had completed their tasks according to instructions, and all had rated the passage as readable and interesting. The researchers concluded, therefore, that either encoding had been less well elaborated than that of the young, or that encoding had been sufficient, but that processing for retrieval had been inadequate or inappropriate. Simon, et al. found, however, better performance with intentional than incidental instructions, though Kausler and Hakami (1983a, 1983b) found no such effect. In the Kausler and Hakami studies, the older subjects were educationally advantaged

relative to their own cohort and to the younger subjects of the studies. They were also better educated than the subjects in the Simon, et al. (1982) study. If intentionality instructions were effective, the more educationally experienced subjects of Kausler and Hakami's studies would be more likely to improve performance than would the sample used by Simon, et al. The discrepancy in results may be a result of the study tasks, however. As Kausler and Hakami noted, memory for activities and conversations seems to occur incidentally. This may not be the case for memory of prose, in which case intentional memory instructions may be facilitative. It would be useful to examine several dissimilar tasks within the same study in order to assess further the value of intentional and incidental instructions.

QUALITY OF MEMORY ITEMS AND INTERVENTION DEVICES

In addition to organization of memory items at the time of encoding and retrieval, the quality of the to-be-remembered items affects memory performance. Meaningfulness, familiarity, and concreteness of items have been investigated, particularly with young subjects. The following seven reviews look at studies which assessed the effects of item quality on the performance of old as well as young subjects.

Paivio (1969) found that concreteness facilitated paired-associate learning for young subjects. Rowe and

Schnore (1971) conducted a study to ascertain whether the same effect could be found for older people. For their study, Rowe and Schnore assigned 48 female subjects to three age group (mean ages = 18.4, 50.4 and 72.8). Groups were matched for verbal ability but not educational background. All subjects were active, alert, and free from auditory and visual deficit. The researchers did not report the measures they had used to assess verbal ability, activity level, or alertness.

The subjects were given lists of pairs of concrete or abstract words. After practice on the memory task, they were asked to recall words on a self-paced schedule. For recall of concrete pairs of words, the youngest group performed better than the middle-aged group, but the difference was not significant. The middle-aged group performed significantly better than did the oldest group. For abstract pairs of words, the younger the group, the higher the performance scores, differences being significant. All groups performed better on the concrete task than on the abstract one, with the oldest group showing the greatest difference between concrete and abstract tasks. The older groups made significantly more errors of omission than commission. The youngest group did so only on the concrete task.

Subsequent to the recall test, subjects were asked to describe the memory strategy which they had used. It was

expected that imagery would be more likely with concrete words, since these words by definition lend themself to visual representations. Abstract words were expected to be associated more often with verbal mediators. Moreover, it was expected, based on previous research (Hulicka & Grossman, 1967), that younger persons would use imagery more often than older people, and that the older subjects would have a differential tendency to use verbal mediation.

As expected, subjects reported that imagery was used more frequently for concrete words and verbal mediation was used more frequently for abstract words. However, the youngest group reported that they used mediation devices more frequently for abstract words, while the middle-aged and oldest group used mediation more frequently for concrete lists. Overall, the young reported more use of mediators than did the oldest group.

The researchers examined the relationship between scores and type of mediation reported. They found that imagery and verbal mediators were essentially similar in their effectiveness in facilitating memory of concrete items. However, they noted that the imaginal component may have been present even when verbal mediation was reported.

While the types of mediators were equally effective, Rowe and Schnore found a differential use of visual and verbal mediation by age groups, as measured by subjects' reports of memory strategies. The research findings suggest

that increasing the concreteness of memory tasks may facilitate memory performance for older persons.

Mason and Smith (1977) reported two studies of the effectiveness of providing mnemonic aids for subjects. They varied both word lists to be remembered and the memory devices in terms of concreteness and abstractness. It was their hypothesis that by providing instructions and techniques for use of mnemonic devices, memory scores would improve, with the greatest increase being for the oldest group. They also hypothesized that concreteness of either the memory aid or the to-be-remembered lists would facilitate the performance of all subjects, with the youngest subjects showing the greatest gain since they more readily utilized imagery as a mediator.

Seventy-two alumni of Georgia Institute of Technology were assigned to age groups (age ranges = 20-39, 40-59, and 60-80). Alumni status was presumed to match for SES and educational level. Subjects were given the Digit Span and Vocabulary subtests of the WAIS. There were no significant differences among the groups on initial testing.

Each age group was subdivided into two groups, one of which learned a concrete peg-word (rhyming) mnemonic with relatively high imagery words. The other subgroup learned an abstract peg-word rhyme with low imagery words. Each group then learned four lists of words, two of which were rated high on a scale of concreteness, two of which were low on the

concreteness scale.

When compared with scores of a control group of 24 subjects who received no mnemonic aids, scores for experimental conditions were superior. The concreteness-abstractness of the mnemonic device did not have a significant effect on performance. However, for all groups, performance was better on concrete lists than on abstract lists. Rowe and Schnore (1971) found that differences between scores on abstract and concrete memory items increased with age. Mason and Smith (1977), in contrast, found that the middle-aged subjects showed the largest difference and the oldest group, the smallest difference. Overall, the older the group, the fewer words recalled.

Mason and Smith had hypothesized that the concreteness-abstractness of the mnemonic device would affect performance. They explained the absence of such an effect by suggesting that subjects may have created concrete images when presented with the abstract mnemonic device. The researchers further expected that the oldest group would not perform as well as younger subjects on concrete lists of memory items because of an age-related decline in the use of imagery mediation. Findings of the study supported this hypothesis.

In a second study, Mason and Smith reexamined the performance of three age groups relative to the concreteness-abstractness of word lists. In addition, they examined two instructional conditions: standard free recall instructions

and instructions to use imagery for the memory task.

Three-hundred fifty-eight subjects were assigned to age groups (age ranges= 20-39, 40-59, 60-80). Subjects were healthy and active; no further description of the sample was provided. Assignment to experimental conditions was random.

For the total sample, recall of concrete items was superior to recall of abstract lists. Performance was better with instructions to use imagery than with standard instructions. However, when data were analyzed in terms of age groups, only the performance of the middle-aged group was facilitated by the imagery instructions.

Mason and Smith concluded that the youngest group performed very well in either instructional condition. The oldest group was less able or willing to use imagery and was not aided by instructions to do so. This is not to say that the elderly did not use imagery spontaneously; they recalled significantly more concrete than abstract words. However, compared to the standard instruction group, there was no evidence that experimenter-provided instructions to use imagery facilitated performance.

Catino, Taub, and Borkowski (1977) tested the effects of familiar and novel mediational devices which had, at the same time, concrete and abstract qualities. The results were different from those of Mason and Smith (1977). Catino, et al. provided subjects with Chinese-shaped visual symbols and

verbal labels as mediators with "low prior association stimuli," that is stimuli which were relatively unfamiliar to the subjects. For "high prior association stimuli," they provided pictures and labels of a pig, dog, gun, and wagon. Recall was tested by means of pressing a response key which would turn on a light if the response was correct.

The sample for this study consisted of 40 preschool children (mean age = 4.3), 40 first grade children (mean age = 7.3) and 40 elderly adults (mean age = 72.6). Selection of the children was random within three schools. The elderly persons were alert, ambulatory residents of two progressive-care nursing homes. The mean educational level of the adults was 11.2 years. No other attempts to randomize or match samples were described.

Catino, et al. found that, for mediation utilizing low prior association stimuli, performance of the older persons and preschoolers did not differ significantly. The first graders did much better than the other groups. However, with high prior association stimuli, the preschoolers committed significantly more errors than both the first graders and the elderly groups, with the latter groups performing similarly.

Intragroup comparisons for mediational devices showed significant differences for the elderly between performances using the high and low association mediational devices. There was no such significant difference for either of the younger groups. Neither repetition of the task nor the

provision of verbal labels for the stimuli influenced performance for any group.

Catino, et al. concluded that a developmental trend was evident. The preschoolers did not have the cognitive maturity to use mediational techniques. The first graders were able to use both high and low association mediation. The elderly persons benefited from use of mediational devices when they were nonsymbolic and familiar.

The researchers had proposed studying high prior and low prior association stimuli. The implication is that these stimuli represent familiar and novel items used as mediators. However, their choice of items was confounded by a concrete-abstract quality. While they did not acknowledge this confound explicitly, their own conclusions were that the symbolic as well as the novel nature of mediators influenced the performance of elderly persons.

Most cross-sectional research on memory interventions utilize adult groups in addition to an elderly group. While Catino, et al. concluded that a developmental trend is evident in the use of mediators, the absence of other adult groups left questions about the course of such development over the life span.

Assessment of memory performance in the Catino et al. study was based on motor responses. As motor performance and reaction time declines during adulthood (Birren, Woods, & Williams, 1980; Stern, Oster, & Newport, 1980; Fozard, 1980),

one may question the validity of the between groups differences found. It should be noted, however, that the 7-9 year old child has been found to react more slowly than older adults, the peak of speeded behavior being seen at age 20, with a persistent subsequent decline (Stern, et al., 1980).

The memory task itself was not described adequately. What was clear from the research report was that the more familiar, more concrete, memory aids facilitated performance for the elderly group in this study.

Thomas, Waugh, and Fozard (1978) studied the effects of familiarity on recognition of a list of memorized letters. Subjects learned a list of "familiar letters" (a,b,c,d,e,f) and "unfamiliar letters" (p,g,k,t,r,i). They were then shown a series of letters and asked to respond as to whether the letters were in the memorized lists. Tests were self-paced and oral.

The subjects for the study were 65 males who were assigned to 5 age groups: 31-35, 36-45, 46-55, 56-65, and 65+ years. All were participants in a longitudinal study on aging. No additional data concerning the subjects were reported.

In contrast to the findings of Catino, et al. (1977), Thomas, et al. reported that there were no significant differences among the age groups in numbers of errors made, though there was a trend toward increased errors in the unfamiliar conditions. When latencies, that is, time to

respond, were compared, time increased significantly with increased age, greater differences being seen in the unfamiliar condition than in the familiar condition. Thomas, et al. also noted that variability among subjects increased with age, with the fastest times being similar for older and younger subjects, but the longer times being more extreme in the case of the older subjects.

Poon and Fozard (1978) also studied the effects of familiarity on latency. Instead of letters, they used four sets of pictures: Unique dated items which were used 50-70 years ago (e.g. hand pump, spittoon), unique contemporary items (e.g. monorail, computer card), common dated objects (e.g. baby carriage as it looked in 1919), and common contemporary items (e.g. baby carriage as it looked in 1974). The researchers hypothesized that the more familiar the object, the shorter the time required to retrieve names of that item from long term memory. The unique contemporary items would be more familiar to the young group, the unique dated items would be more familiar to the old group, and the common items would be equally familiar to both groups.

The sample consisted of 30 college students (mean age = 20), 29 middle-aged men (mean age = 50), and 24 older men (mean age = 65). No other data concerning the sample were reported.

Subjects were shown slides of each of the items. They named the items orally, at self-paced rates. Poon and Fozard

found that the oldest and youngest groups performed more accurately and faster when the items were more familiar to them. For unique dated items, the oldest group recalled the most names at the fastest paces. For the unique contemporary items, the youngest group scored best. For common dated items, the older subjects performed somewhat better than the young, but there were no age-related differences on common contemporary items. Speed and accuracy of response for the middle-aged group tended to fall between those of the young and old groups.

Poon and Fozard also studied the effects of perceptual-motor slowing on memory performance. They presented a written word before each picture presentation, and measured the amount of time between perception of the picture and oral identification of the picture. No search of long term memory was necessary, as the correct label had been provided. On these trials, the researchers found that the older the subjects, the longer the latency. When scores on these labeled trials were subtracted from scores on the non-labeled trials described above, there were no age-related differences in response time. The researchers concluded that familiarity and slowing of perceptual-motor responses, not processing ability and speed of retrieval, were implicated in apparent age-related memory differences.

In a similar study, Hanley-Dunn and McIntosh (1984) looked at the effect of meaningfulness. They expected that

the young would outperform the elderly, particularly on lists which were more meaningful to the young or nonmeaningful to both groups, with the elderly performing better than the young only on items meaningful to their cohort. Instead, the researchers found that, overall, the elderly recalled as well or better than the younger subjects.

The younger group consisted of 56 undergraduates (mean age = 20.3, mean education = 12.9 years). The older group was made up of 56 subjects (mean age = 71.9; mean education = 11.9 years). No data were reported regarding SES, verbal ability, or impairment of function.

Three lists were created, comprised of names of well-known politicians, pre-1945 Big Band musicians, and contemporary singers. A fourth list was composed of nonmeaningful common names. Each list was labeled as to category. Subjects were randomly assigned to list conditions. The younger subjects were tested in large groups; older subjects were tested individually or in small groups.

The older subjects performed better on lists of politicians' names and Big Band musicians' names. They performed less well than the young group on names which were more meaningful to the latter, i.e. names of contemporary singers. Both groups performed equally well on the nonmeaningful list.

Despite the equal or better performance of the older

group relative to the younger group on three lists, the elderly subjects reported lower self-assessments of performance than younger subjects. For politicians and nonmeaningul names, self-ratings were the same for both groups. For the two groups of musicians, however, the older group had significantly lower self-assessmenta.

Hanley-Dunn and McIntosh did not address the possible effect of providing organization of memory items, in the form of categorized lists, and memory cues, in the form of labels for the four lists. Moreover, the researchers did not address the possible effects of the differential testing conditions, that is the large group testing for the younger subjects versus the small group or individual testing for the older subjects. It is conceivable that the older group benefited from the differential treatment possible in small group settings, including reduction of anxiety and personal attention to questions.

Hanley-Dunn and McIntosh concluded that the elderly, given a task with real-life validity, showed no encoding or retrieval deficit. The variable tested, while called meaningfulness, involved the familiarity of the memory item to the individual. Poon and Fozard's (1978) findings were similar. Only with items more familiar to the young did the old group not perform as well or better than the young group. Catino et al. (1977) also found that memory performance for familiar stimuli showed little deficit. However, for

nonfamiliar tasks, Catino et al. found considerable deficit. Thomas, et al. (1978) found more effect of familiarity on speed than on errors.

The discrepancies in findings may be due to different research designs. It is possible that, in the studies by Catino, et al. (1977) and by Thomas, et al. (1978), the more laboratory-specific nature of the test items (Chinese figures, dog, cat, wagon and gun; letters of the alphabet) were more threatening or less motivating than were the real life memory items (names of persons or known items) in Hanley-Dunn and McIntosh's (1984) and Poon and Fozard's (1978) studies. Catino et al. (1977), Thomas, et al. (1978), and Poon and Fozard (1978) did not describe attempts to put the subjects at ease. Hanley-Dunn and McIntosh reduced task anxiety by instructing subjects that order of recall and spelling were unimportant to the test and that results would not reflect on intelligence of the subjects. Such noncognitive support may have aided performance in the Hanley-Dunn and McIntosh study. (See the sections on affective interventions and training for a further discussion of this matter). In addition, the requirement of motor responses, which are slower and less effective as an individual ages (Birren, et al., 1980) may have impeded performance in Catino et al.'s (1977) study. Poon and Fozard (1978) and Thomas, et al. (1978) required oral responses; Hanley-Dunn and McIntosh (1984), written responses. In sum,

the differences in test items and the testing situation may have resulted in better performance for the subjects in the studies by Hanley-Dunn and McIntosh and by Poon and Fozard. Nonetheless, in all four studies, significant effects on memory performance were seen with increased familiarity of the task.

MODALITY

Research findings are in conflict concerning the relative benefit of auditory versus visual encoding and retrieval. However, some manipulations of input and output modalities have proven to benefit the memory performance of the elderly.

Taub (1975) studied the relative effectiveness of auditory and visual presentation of materials for the memory performance of young and old subjects. He hypothesized that, rather than modalities being differentially effective with various age groups, the effectiveness of the modality was influenced by the task. He expected that when material was presented along with the opportunity to review, as with prose passages, the visual mode would lead to superior performance. However, for tasks which involved sequences of unrelated items, as with digit spans, the auditory mode would be superior.

In order to test his hypotheses, Taub used a sample of

66 females asigned to three age groups (mean age, 23.5, 51.5, and 69.8). Mean scores on the Vocabulary subtest of the WAIS for the young, middle-aged, and old groups were 11.8, 11.7, and 12.3 respectively. Mean years of education were 13.6, 13.1, and 12.6. The groups, then, were similar on IQ and educational measures. Subjects were, for the most part, secretaries, volunteer workers, or housewives. No other data descriptive of the sample was reported.

The memory items consisted of six short prose passages, some of which were recipes, and digit spans from 3-10 digits in length. The Visual groups read the passages and digits, the passage task being self-paced. The Auditory group heard the passages and the digits read slowly. Subjects were asked to recall orally the passages and digit spans they had memorized.

Taub found that, both for the prose passages and the digit spans, the level of performance was age-related, declining with increasing age. He also found, as expected, that visual presentation resulted in superior prose performance, while auditory presentation was better for the digit spans. Neither modality benefited any age group more than another. There were no effects for the pace of the tasks, indicating that all subjects had sufficient time to perform.

Taub and Kline (1976) also studied the relative effectiveness of auditory and visual encoding modalities. In

the first experiment, they tested retrieval of memory items from prose. The researchers hypothesized that visual presentation of memory items was most effective when subjects had the opportunity to review.

A sample of 89 females and 7 males (mean age = 70.7; mean education = 10.4 years) was divided into four groups, matched for age and educational level. No other data descriptive of the sample were reported. One group heard four prose passages; the second group read, but did not review; the third group read and reviewed within time restraints; the fourth group read and reviewed as long as they liked. Subjects recalled the prose passages orally.

Taub and Kline reported that, overall, there were no recall differences when presentations were auditory or visual without review. Recall scores were similar for the two review conditions and higher than those of the no-review conditions.

Taub and Kline then tested memory of lists of digits. In this case the presentation was by means of (1) auditory sequential lists, (2) visual sequential lists, (3) visual sequential presentation with different left-right placements, such that the placements provided spatial cues, and (4) simultaneous visual presentation, which allowed review within the time constraints.

Using the same subjects as in the first experiment, the researchers found that auditory presentation resulted in

scores which were better than those for the visual sequential list, equal to those of presentation with spatial cues, and inferior to those of the presentation which allowed for review.

In a third experiment, using a somewhat larger sample of subjects, Taub and Kline looked at digit span memory only for simultaneous visual presentation (review condition) and auditory presentation. Again, given the opportunity to review, subjects performed better in the visual condition.

The researchers concluded that whether auditory and visual modalities were effective in maximizing memory performance of digits or prose was dependent on the conditions under which learning took place. When presentation was sequential, the auditory modality resulted in superior performance. When spatial cues were available, the modalities were equally effective. With opportunity to review, the visual modality was preferable.

Taub and Kline noted that the pace of presentation did not effect performance. There were no experimenter-paced versus self-paced differences. The researchers observed that the experimenter-paced conditions may have been sufficiently long to allow maximum performance in that condition.

While the prose and digit memory tasks were performed under laboratory conditions, study results may be generalizable to real-life situations. Taub and Kline noted that, under natural conditions, persons would often have the

opportunity to review. Given that possibility, they suggested that visual presentations be considered in intervention programs.

Dixon, Simon, Nowak, and Hultsch (1982) also studied the relative effectiveness of listening and reading for recall of prose passages. The researchers noted that older people tend not to review information. They hypothesized, therefore, that the opportunity to review would be of less benefit to older subjects than to younger subjects. Reading, which naturally provided more opportunity for review, would be correlated with greater age differences in performance than would listening.

The sample was composed of 30 young subjects (age range = 18 to 32), 30 middle-aged subjects (age range = 34 to 56), and 30 older subjects (age range = 60-81). Ninety-one percent of the sample was female. Groups were matched for educational level and vocabulary test scores. Subjects rated themselves as being in good health, with adequate sensory and psychomotor capacities to perform the research tasks.

Abstracts of five newpapers articles were either read to subjects at a natural pace or were read by subjects at their own pace. The subjects wrote what they recalled of the articles, with both exact recall or recall of the substance of the information being counted as correct.

Overall, the middle-aged group and the oldest group did not differ significantly in the amount of information they

recalled. The youngest group outperformed both of the older groups. When tested immediately after hearing or reading the articles, the youngest and middle-aged group recalled more propositions (ideas or concepts, bits of information) after reading than after listening. There was no effect of reading versus listening for the oldest group. However, when retested one week later, the two younger groups performed equally well regardless of input modality. At this testing, the oldest group performed better when they had heard rather than read the articles.

Dixon et al., unlike Taub and Kline (1976), found that reading with opportunity to review did not benefit the oldest group of subjects. They concluded that the articles were comprehensible to this group and that the group had had sufficient time to read. However, the older persons apparently did not take advantage of the opportunity to review.

The researchers noted that when recalled propositions were analyzed, the youngest group remembered more main ideas than did the two older groups. Dixon et al. concluded that the older subjects were less able to identify the hierarchical structure of the information contained in the articles. They could not, therefore, take advantage of the intrinsic organization of the prose as a memory aid.

The articles dealt with recent, mostly major, world events. The possibility of differential familiarity and

meaningfulness to the various age groups was not tested, but may have affected research outcomes (Catino, et al., 1977; Hanley-Dunn & McIntosh, 1984; Poon & Fozard, 1978; Thomas, et al., 1978).

For the taped version of the articles, a female voice was used. As older persons have greater difficulty hearing high pitches (Botwinick, 1984), this choice of voice may have decreased their performance on the listening task. Similarly, there was no report that age-related difficulties with reading standard size print or writing responses were addressed. Subjects were asked to rate their sensory abilities relative to others their own age. This question did not address the issue of changes relative to other age groups.

Arenberg (1968) studied visual imput augmented by both passive and active auditory imput. He hypothesized that the combined imput modalities would result in better short term recall than would visual imput alone. Moreover, he hypothesized that activity on the part of the subject would result in the best performance.

Subjects were recruited from an employment service. None had education beyond high school. Two groups were formed, 48 elderly males ranging in age from 60 to 80 years (mean age = 67.1) and 30 young males ranging in age from 17 to 22 (mean age = 20.0). No other data descriptive of the sample were reported.

Subjects were exposed to four digits in three input conditions: Visual Alone, Passive Auditory in which the experimentor said the digit aloud while the subject looked at it, and Active Auditory in which the subject said the digit as he looked at it. Conditions were presented in one of six possible orders. Subjects were randomly assigned to order. The rate of presentation was fixed. Responses were written.

Findings supported Arenberg's hypotheses. Overall, recall was better for augmented conditions than for the visual modality alone. Active auditory accompaniment to visual presentation resulted in better recall than did passive auditory accompaniment. Intragroup analyses showed that differences between the visual-alone condition and the auditory augmentation conditions were greater for the elderly group than for the younger group. The differences between passive and active auditory imput were similar for the older and younger groups. Arenberg concluded that the presentation of memory items via two modalities benefited all subjects, with greater benefit to the older subjects. The addition of activity to the task further enhanced performance. While the activity increased the complexity of the task, this confound was more than compensated by the benefit of the active involvement. The reason, or mechanism, for recall improvement with activity was not explored.

In Arenberg's (1968) study just reviewed, the effects of auditory augmentation on memory of verbal material were

examined. In 1977 Arenberg studied the effects of auditory augmentation on memory of nonverbal material, in this instance, memory of geometric figures. Arenberg hypothesized that, while the older subjects would not perform as well as the younger subjects, the older subjects would benefit more from auditory augmentation than would the young. Arenberg further hypothesized that subjects exposed to auditory augmentation, regardless of age, would improve over the course of the study more than subjects who did not have this aid.

The subjects for this study consisted of 68 male high school students (mean age = 18) and 136 males (mean age = 65.5) who were seeking employment, largely as blue-collar workers. The younger group had a mean score of 38.1 on the Vocabulary subtest of the WAIS. The older group had a mean score of 41.5.

The subjects were randomly assigned to experimental or control groups. All subjects were shown two series of nine geometric designs at a fixed pace. Only the experimental groups heard taped descriptions of the designs. All subjects were then asked to draw the designs which they had seen. Response time was self-paced.

Arenberg's hypotheses were supported. Not only did experimental groups perform better than control groups, but the older subjects showed more improvement from Series 1 to Series 2 than did the young experimental group. Arenberg

noted that the relative lack of improvement for the young subjects may have been the result of a ceiling effect for them. Arenberg concluded that auditory augmentation facilitated not only the short term memory, verbal task of his 1968 experiment, but also the long term memory, nonverbal task of this 1977 study. The effect, the researcher explained, was the result of increased encoding elaboration and rehearsal, neither of which the elderly tend to do well spontaneously. It is interesting to note that despite the fact that stimuli were presented without adaptation for the normal visual impairment of the elderly and despite the motor performance requirement for response, the older subjects outperformed the younger subjects.

Taub and Kline (1978) studied the effect of auditory augmentation on memory for prose. Augmentation was performed by the subject rather than the researcher. In this study, unlike those of Arenberg, no effect for augmentation was found.

The subjects for the study were 36 females. The younger group (mean age = 27.6) had a mean of 12.4 years of education and were housewives. The older group (mean age = 67.2), active members of a senior center, had a mean educational level of 12.9 years. The groups did not differ significantly on measures of educational level or scores on the Vocabulary subtest of the WAIS.

Subjects read three short paragraphs four times in one

of three conditions: Silent reading with review, silent reading without review, and reading aloud without review. Recall was oral. In this study, the young and old improved their performances over the course of the trials, with the younger subjects improving more than the older ones. However, while all subjects showed a trend toward improvement over the course of the four trials in the reading aloud, or augmentation, condition, the improvement in scores was not significant. When the overall scores were analyzed, the review condition resulted in significantly better scores than either the reading aloud or reading silently without review conditions. In short, opportunity to review was more beneficial in the learning of prose material than was the augmented condition.

It is not clear why augmentation resulted in improved subject performance in Arenberg's (1968, 1977) studies, but not in Taub and Kline's (1978) study. It might be expected that multimodality encoding (for instance, reading and speaking) would result in conflicting, distracting, simultaneous tasks. This was clearly not the case in Arenberg's studies. Alternatively, however, the design and tasks of the research studies may account for the differences. It is noteworthy that in Arenberg's studies, no opportunity for review was provided. In Taub and Kline's study, however, it was review which was most effective in improving scores. Moreover, as Taub and Kline noted, visual

presentation may be most effective for memory tasks which provide the opportunity for review, such as the prose reading task. This is in keeping with the findings of Taub (1975) and Taub and Kline (1976) in their studies reviewed above. The Arenberg studies, however, involved sequential tasks (digit span memory) and nonverbal tasks (recall of geometric designs).

PACING

Birren, et al. (1980), in reviewing slowing with age, concluded that changes in the central nervous system result in reduced behavioral speed. Among the functions affected are encoding and retrieval of memory items. Researchers have hypothesized that older people require more time to encode and/or retrieve information. A variety of experimenter-paced and self-paced schedules have been tested as interventions in the memory process.

Canestrari (1963) tested the effect of pacing on paired-associate learning. He hypothesized that age-related deficits for this task, found in earlier studies, were largely a result of fixed-rate, experimenter-controlled pacing. He tested subjects' learning under a self-paced condition and two different experimenter-paced conditions, with the expectation of smaller apparent deficit with slowing and increased flexibility of pacing.

The sample was composed of 30 younger men (mean age =

23.9) and 30 older men (mean age = 65.4). Subjects were obtained from an employment agency. The subjects were presumed to be in good health, motivated, and of similar socio-economic and educational levels due to their common source of recruitment. Subjects were administered the Vocabulary subtest of the WAIS. While no scores were reported, Canestrari noted that the groups were comparable on this measure.

Three equivalent lists of paired-associates, consisting of words, were compiled. Subjects were presented one list at 1 1/2-second intervals between pairs, a second list at 3-second intervals, and a third list on a self-paced schedule. For all pacing conditions, the younger group committed significantly fewer errors than did the older group. For both groups, there were significantly fewer errors for the longer interval than for the shorter interval, with the fewest errors being committed in the self-paced condition. When the two groups were compared in each pacing condition, the smallest score difference between groups was found for the self-paced condition. The older group used more time in the self-paced condition than did the younger group.

Data were also analyzed in terms of errors of commission and errors of omission. The older group committed more errors of commission than did the younger group. However, there were no significant interactions between errors of

commission and pace of learning. Errors of omission declined as more time was available for the task.

Canestrari noted that the facilitating effect of longer intervals and, particularly, of the self-paced condition indicated that the older group had the capacity to improve performance on paired-associate tasks, but that they required more time to do so. Subjects apparently used the longer time for response more than for study since they were more likely to stop the presentation of pairs during response than during learning. Moreover, omission rather than commission errors were reduced with longer intervals, which, according to Canestrari, indicated slowing of response rather than learning deficit. It is also possible that the longer intervals provided the opportunity for the older subjects to gain confidence in their responses. As Botwinick (1984) notes, older persons tend to be cautious in responding, omitting responses rather than risking inaccuracy.

Canestrari did not describe the educational level, socio-economic status and WAIS scores of this sample. It would be useful to know more about the population represented by the sample in order to assess the limits of generalizability of the findings. It would also be instructive to study samples representative of dissimilar populations, again to assess generalizability. Finally, slowing is an age-related factor which affects multiple behaviors (Birren, et al., 1980). Lengthening of task time

or self-pacing may or may not improve performance for memory tasks other than paired-associate learning.

Arenberg (1965), like Canestrari, studied the effects of different pacing conditions on paired-associate learning. Arenberg expected that younger subjects would outperform older subjects, and that the performance differences would decrease as the time available for the task increased. It was Arenberg's hypothesis that subjects would benefit from increased opportunity to respond. However, he suspected that adequate response time would not account for, or compensate for, all deficit in memory performance. In short, subjects would perform better on slow-paced trials than fast-paced trials, but self-paced trials would not result in great additional improvement.

Sixty-four participants in a longitudinal study were selected for this cross-sectional study. The subjects were males (age ranges = 29-40 and 63-77), all of whom were working in or retired from academic, scientific, technical, or administrative jobs. The 32 younger subjects had attended college. Most held a degree. More than half of the elderly subjects had an advanced degree. The two age groups had similar raw scores on the Vocabulary subtest of the WAIS, the means ranging from 63.7 to 66.6.

Each paired-associate consisted of a two-consonant, meaningless stimulus matched with a familiar two-syllable adjective. Both the presentation rate, when the pair was

presented, and the interim interval, when no items were shown, were constant throughout the study. The anticipation interval, when only the two-consonant stimulus was exposed and the subject was to produce the paired word, was either fast-paced or slow- paced. Subjects responded orally on individually administered tests.

As expected, in both pacing conditions the young outperformed the old subjects. For the young group, the mean number of errors was similar under both the fast- and slow-paced conditions. However, the older group made approximately half as many errors with slow pacing as with fast pacing.

Arenberg concluded that slowing of the response pace facilitated the performance of the older group. However, it was not clear whether a learning or response deficit was being manipulated since all intervals had been fixed by the experimenter. In order to eliminate the possibility that subjects had had insufficient time to respond, a second study was conducted in which Arenberg included a self-paced response condition. If the self-paced condition resulted in large score improvements, it could be concluded that subjects had learned the material but required longer retrieval time. If the self-paced condition did not result in such improvement, a learning deficit was implied.

For the second study, the sample was comprised of 64 unemployed men who ranged in age from 18-21 and 60-77 years.

Most had at least a sixth-grade education. The two age groups had similar WAIS Vocabulary subtest scores (four group means for raw scores for the four experimental groups = 41.1 to 44.9). No other data concerning the subjects or matching of the groups was reported.

A simpler version of the two-consonant/familiar word paired-associate list was devised for this less well educated sample. Self-paced anticipation intervals were alternated with experimenter-fixed slow-paced intervals for half of the younger and half of the older subjects. Self-paced trials were alternated with fast-paced trials for the other subjects.

As with the previous study, the younger group performed similarly in fast- and slow-paced conditions. The older group made approximately half as many errors in the slow-paced condition as in the fast-paced one. Errors declined significantly in the self-paced condition. Unlike Canestrari's (1963) findings, however, self-pacing did not result in the fewest errors. The pattern of errors under self-paced conditions was similar to that of the paced conditions with which it was paired. Self-pacing matched with fast-pacing, then, resulted in more errors than either slow-pacing or self-pacing matched with slow-pacing. Arenberg concluded that increased opportunity to respond did not eliminate age-related deficit. Rather, he noted, interference of adjacent tasks, inadequate memory search

strategies, or need for more rehearsal were implicated in the deficit.

The discrepancy between Canestrari and Arenberg's findings are not easily explained. The samples for both studies appeared to be similar, though little data descriptive of the samples was reported. For both Canestrari's study and Arenberg's second study, samples were recruited from employment services, so were, according to Canestrari's assumptions, healthy and motivated. The age ranges of the two samples were similar. In Canestrari's study, subjects had the opportunity to increase acquisition time as well as response time, though the researcher indicated that subjects were more likely to exercise the latter option. In Arenberg's study, only response time was self-paced. Given this difference, it is possible that Canestrari's subjects took advantage of more time to learn the paired-associate, as well as the unlimited response time, and were therefore aided by the self-paced condition.

It is interesting to note that, for all three studies, including Arenberg's first study with a sample of well-educated, high socio-economic status subjects, increased response time did not eliminate age-related deficit in paired-associate learning but did improve the performance of older subjects.

In a later study, Canestrari (1968) interpreted Arenberg's findings as indications that, during the interval

between presentations of paired-associates, some of the items learned were subject to an "erasure phenomenon" (pg. 170). To evaluate this hypothesis, Canestrari conducted a study in which the interval between presentations of pairs, that is, the interim interval, was varied. Paired-associates, consisting of two words, were presented at fixed rates and response time was self-paced.

The sample for this study consisted of 152 subjects ranging in age from 30-69. Subjects were clerks, housekeepers, or veterans who were receiving outpatient care. The sample was divided into groups by decade. The groups were similar in terms of socio-economic status and educational level. No other description of the sample was reported.

For the 40- and 60-year-old groups, shorter interim intervals resulted in poorer performance. Performance of the 30- and 50-year-old subjects was not effected by the length of the interval. Canestrari concluded that for the 60-year-olds, and possibly for the 40-year-olds, the shortened interval resulted in erasure of some of the learned information. Interference, he said, was not a factor, since there was an increase in omission errors but not intrusion errors (errors resulting from mismatching of stimuli and responses).

While Canestrari interpreted the data as indicating a developmental trend, beginning perhaps as early as the 40's,

the discrepancy of 50-year-olds' not displaying erasure effects leaves his findings inconclusive. Given the possibility of interim interval effects on learning, however, research on pacing should include this variable.

Taub (1966) examined the effects of speed of interim intervals and presentation of stimuli with free recall of digit spans rather than with paired-associate learning. Instead of the usual sequences of numbers, Taub presented nine letters of the alphabet in random order. Pacing was subject to four conditions: The letters were presented at one- or two-second intervals (interim intervals). For each interval pace, actual exposure to the letter was either 0.25 seconds or 0.75 seconds (presentation intervals). At the end of the presentation of each nine letter series, subjects recalled orally as many of the letters as possible. Canestrari (1968) concluded that shorter intervals resulted in more loss of information. Taub hypothesized that if the decay of information hypothesis was accurate, the one-second interval would result in fewer errors than the two-second interval, as less time would be available for loss of information. On the other hand, if older subjects react more slowly than younger people, their performance would be improved by the longer (0.75) exposure to the stimuli.

Younger subjects (mean age = 25.8) were employees of medical facilities. Older subjects (mean age = 69.7) were members of senior citizen clubs. Eight males and 32 females

comprised each age group. Scores on the Vocabulary subtest of the WAIS were not significantly different for the two age groups. No data concerning health, educational level, or socio-economic status were reported.

Analysis of correct responses indicated that younger subjects performed better than did older subjects. The researcher found that older people made significantly more commission errors than their younger counterparts, except when repeating responses they had already made. The scores of both groups improved at longer interim intervals. There was no significant difference in the amount of improvement for the two groups. The presentation rate, however, did not result in significant score differences.

Taub concluded that slowing of the interim interval resulted in better rather than worse recall performance. There was no evidence, he noted, that information decayed in this experiment. Errors of commission, such as recalling the same response for several stimuli, indicated that memorized items were in storage, but that the older person was less likely to accurately retrieve those items. While the presentation rate did not produce differences in performance, it was not clear whether scheduling the amount of exposure was irrelevant or the shorter exposure time was sufficiently long for learning.

Taub's conclusions on this digit span test were similar to those of Canestrari's (1968) research on paired-

associates. Slowing of the speed of interim intervals resulted in improved performance. The conclusions about the etiology of deficit have varied, Taub citing interference, Canestrari (1968) citing erasure. Taub did not find an effect for slowing the pace of presentation as had Canestrari (1963) and Arenberg (1965). In Taub's study the older subjects did not improve more than the younger subjects. These differences may be due to a ceiling effect in Taub's study, that is, sufficient time for all subjects to learn in all conditions. It may be a result of qualitative differences between paired-associate and digit span learning; the two types of memory exercises were not compared.

Several additional studies have looked at the effects of pacing along with a second variable. Two of these studies sought to assess the effects on recall of both pacing and affective factors. In the first, Taub (1967) hypothesized that, not only would older people perform better at slower anticipation and presentation intervals, but performance would also improve when older people were required to respond. The researcher explained that, as elderly persons were more reluctant than younger persons to risk error, they often omitted responses. The requirement to respond and encouragement to do so, would reduce the number of omission errors.

To test his hypotheses, Taub selected 8 males and 32 females (mean age = 26.1) who were employees in medical

facilities. Eight males and 32 females (mean age = 69.7) were members of senior citizens clubs. There were no significant differences between the groups for scores on the Vocabulary subtest of the WAIS. No other description of the sample was reported.

Subjects were given a paired-associate learning task in which three-letter syllables were paired. The stimulus and stimulus-response pairs were presented at fixed rates of either 4 or 8 seconds for learning and recall. Groups assigned to the two pacing conditions were further subdivided into instruction and no instruction conditions. In the Required Response condition, subjects were told that they were required to respond to the stimuli, even if the response was a guess. In the No Response condition the task was merely explained, with no instructions to respond. Subjects were tested individually. Mode of response was not described.

Taub found that, overall, younger subjects made fewer errors than did the older subjects. For both groups, numbers of errors were significantly lower at the slower pace of presentation. At the slower pace, there was no significant difference between age groups in numbers of omission errors. For the older group, commission errors for each pacing condition remained fairly constant over the ten trials of the study. However, omission errors decreased significantly at the second trial for the fast rate and at the fifth trial for

the slow rate. For the remainder of the trials, numbers of omission and commission errors were similar. Numbers of commission errors did not increase as the omission errors decreased, indicating that the subjects were not merely comfortable responding but that they had learned the paired-associates. Young subjects made more commission than omission errors on all trials. Instructions to respond did not affect numbers of errors committed for either age group.

Taub concluded that providing subjects with slower encoding and response paces and with the opportunity to rehearse over the course of the experiment led to improved scores on the paired-associate task. Further research would be needed, Taub noted, to assess the relative effects of rehearsal and task pace in compensating for memory deficit.

In a study reviewed above, Canestrari (1963) also found that slowing of task pace reduced omission errors. Canestrari explained that performance improved when older subjects had longer response intervals to compensate for age-related slowing. Neither Canestrari nor Taub (1967) discussed the possibility that longer intervals may have reduced the pressure to perform, hence the anxiety inherent in the testing situation.

In a second study which looked at both pace of task and affective factors, Leech and Witte (1971) examined the performance of subjects on a paired-associate learning task which varied the rate of presentation and provided tokens as

incentives. Using three-letter syllables as paired-associates, as had Taub (1967), all subjects were reinforced for correct responses. Half of the subjects also received a token for each commission error. Subjects responded orally.

Twelve males and 16 females (mean age = 69) were selected for this study. All had at least a high school education and were in good health. No other description of this sample was reported.

Leech and Witte did not discuss the main effect of slow and fast paces of presentation on the performance of the subjects, that is, the effect of pace irrespective of incentive conditions. They did report, however, that the incentive conditions resulted in fewer omission errors and more rapid learning as measured by numbers of trials to criterion. The performances of both the slow-paced incentive group and the fast-paced incentive group were not significantly different. Leech and Witte concluded that reinforcement reduced omission errors and improved overall performance. They noted, moreover, that pacing effects may have been seen had the stimuli been presented differently. Because the pairs were shown for several seconds, removed, then shown again, the researchers conjectured that the subjects may have been distracted and therefore may not have performed as well as under continual exposure to the stimuli.

It is interesting to note that Taub (1967) and Leech and Witte (1971) used essentially the same task for their

studies. Taub found no effect for his noncognitive intervention, the requirement to respond. However, Leech and Witte, using reinforcement, did find a noncognitive facilitation for older subjects. Unfortunately, Leech and Witte did not include young subjects in their study, making it more difficult to compare the two studies. In addition, the absence of the young group makes it impossible to assess performance improvement relative to younger subjects. It would be interesting to know whether the scores of the older subjects approached those of younger subjects under incentive conditions.

Taub (1967) and Leech and Witte (1971) examined the effect of both pacing and affective interventions. In a third study which looked at pacing along with another independent variable, Treat and Reese (1976) tested the effects of both imagery and pacing on memory performance. The researchers, as discussed earlier in this review, investigated Experimenter-Provided Imagery, Self-Generated Imagery, and No Imagery conditions. Anticipation and presentation intervals were 2 or 6 seconds. Treat and Reese found that, for the sample taken as a whole, there was no significant difference in performance between conditions which manipulated the anticipation interval (stimulus presented alone; subject may respond) or the presentation interval (stimulus and response presented together). Looking only at anticipation intervals, Treat and Reese found that

the pace was significant, for the younger group, only in No-Imagery conditions. For the older group, the longer interval did not improve performance in the No-Imagery condition, but did improve scores under both of the Imagery conditions. The researchers concluded that imagery alone was sufficient to facilitate performance for the young. Only in the absence of such an aid was slowing of the task pace necessary. The elderly, on the other hand, appeared to be unable to efficiently utilize imagery without additional processing time.

Craik and Rabinowitz (1985), studied variations in pacing combined with orienting instructions, that is, instructions which encouraged semantic processing. Unlike Arenberg (1965), Canestrari (1963, 1968), Taub (1966, 1967), and Treat and Reese (1976), Craik and Rabinowitz hypothesized that age-related differences in recall would be greater at slow rather than fast paces. The researchers explained that young persons are more likely to process information spontaneously and elaborately than are older persons. Given longer encoding opportunities, then, young subjects would evolve more enduring memory trace. Older subjects would not be able to take as much advantage of the slow pace. The researchers further hypothesized that orienting instructions would aid both young and old subjects under fast-paced conditions, when the opportunity for developing self-generated encoding schemes was minimized. In

slow-paced conditions, however, young subjects would perform better without orienting instructions, that is, when they were free to develop their own strategies. Older persons would be disadvantaged in slow-paced conditions when they did not receive the help of orienting instructions. In sum, Craik and Rabinowitz expected to see the smallest age differences in performance at fast paces with orienting instructions. They expected the largest differences to be at slow paces under free learning conditions.

The sample for this study was comprised of 37 female and 11 male students (mean age = 20, age range = 18-29) and 34 female and 14 male members of senior citizen centers (mean age = 68, age range = 60-86). The older subjects reported good health. On measures of vocabulary skills (Mill Hill Vocabulary Test), older adults significantly outperformed younger persons. No other description of this sample was reported.

Half of each age group was assigned to the Learn condition, in which they were told to memorize and recall lists of concrete nouns. The other half of the sample was also encouraged to learn the words, but in addition, they were presented with an orienting question during each list of words, the question meant to direct the semantic processing of the words. For example, the subjects were asked the question, "Taller than a man?" and were to respond "yes" or "no" as each word on the list was presented. All subjects

learned four lists of words at each of three presentation rates. Presentation of the lists and responses to semantic orienting questions was accomplished via a microcomputer. Recall tests followed each list learning activity, and were individually administered. Responses were oral. Recognition tests were written.

Overall, on recall tests, the younger group outperformed the older group, and performance for both groups was better at slow than at fast paces. There were no significant differences between learning and orienting instructions. When the pace was slowed, the older group's performance improved equally with learning and semantic orienting tasks. Young subjects also benefited by slowing of the pace, however they showed greater benefit with learning instructions. As hypothesized, the greatest age differences were for slow paces with learning instructions.

Findings for the recognition test were similar to those of the recall tests. Overall, the younger outperformed the old, and performances for both groups was better at slow paces than at fast paces. Both groups improved in instructional and orienting conditions as the pace slowed. Unlike recall findings, the amount of age difference was similar for both instructional conditions. Older subjects performed better with semantic instructions than with learning instructions. There were no such differences for the younger subjects.

Craik and Rabinowitz concluded that their findings did not support the hypothesis that age-related slowing is the major factor in memory performance changes. They noted that slowing of the task pace had benefited both age groups equally in all cases except recall with orienting instructions, and in that case, the young had benefited more than the old. The researchers noted that in order to support the slowing hypothesis, slower paces would have had to benefit the older subjects differentially. The study indicated age-related processing deficit. The smallest difference between the two age groups was found for recognition tests under orienting conditions. That is, when the older persons were aided in both encoding and retrieval, their performance was most like that of younger persons.

While Craik and Rabinowitz disputed the hypothesis that slowing is the major factor involved in memory deficit, nonetheless their findings are in accord with those of the other studies reviewed in this section. Slowing of the task improved the performance of older persons. Craik and Rabinowitz suggested that other interventions are useful and perhaps more important than are pacing reductions alone.

PRACTICE

Several studies reviewed earlier found, incidentally, that the opportunity to practice resulted in improved performance for older subjects. Taub (1966), in his

examination of the effects of rate of presentation and requirement to respond on memory of digit spans, noted that numbers of omission errors declined over the course of the ten trials. Taub attributed this improvement to opportunity to rehearse the task and thereby to learn more thoroughly. Treat, et al. (1981) found that instructions to use imagery facilitated memory of paired-associates, though continual reminders were necessary. Subjects given experience and practice with the task generated their own strategies for remembering the material. By the third session, the control group, who had been given no instructions to use mnemonics, performed as well as the experimental groups. The following studies focus on practice as an intervention for the maintenance or improvement of memory performance of the elderly.

Taub and Long (1972) examined the effect of repeated trials on memory of digit spans. They expected that practice would reduce anxiety and improve strategies for recalling lists of numbers. They hypothesized that, as older people exhibit greater test anxiety than younger people, older subjects would improve more than their younger counterparts over the course of the experiment.

Groups were composed of 12 females and 2 males (mean age = 25.2) and 9 females and 3 males (mean age = 70.6). The younger group were housewives, clerk-secretaries, technical aides, teachers' aides, nurses aides, or animal caregivers.

They had a mean educational level of 13.1 years. The older subjects were members of a senior citizens club who were currently retired or keeping house. Seven had worked in secretarial or clerical jobs. Their mean educational level was 10.8 years. All subjects had been selected on the basis of meeting a minimal digit span ability (four digits for the older subjects, nine for the younger subjects). Statistical matching of the groups was not reported.

The tasks involved remembering digit spans consisting of the numbers 1 to 9. For the first task, increasingly long series were presented until the subjects could no longer recall accurately. For the second task, series varied in length from four to eight digits on different trials, and subjects performed on all trials regardless of accuracy. Presentation of the stimuli was at a fixed rate, but intertrial intervals were controlled by the subjects. Response was oral. Subjects were evaluated on the basis of three criteria: maximum digit span accurately recalled without error, number of trials correct, and numbers of digits correctly recalled.

The younger subjects outperformed the older subjects on length of digit span remembered. The younger subjects improved significantly over the course of the trials, while the older subjects showed a trend toward improvement which was not significant. For numbers of correct trials, the younger outperformed the older subjects, but both groups

improved as the study went on. Both groups significantly improved their performance on numbers of digits correctly recalled, on Task Two, as a function of successive sessions. The length of the series significantly affected the performance of both groups for numbers of correct trials, but only the older group for numbers of correct digits. The younger subjects reached their peak of improvement earlier than did older subjects.

Performance of older subjects was studied, again, after a six-month interval. The results were consistent with those of the last session before the interval.

Taub and Long concluded that, while practice did not seem to improve the performance of older subjects in terms of the length of digit span remembered, it did result in improvements in consistency (numbers of accurate trials) and accuracy (numbers of correct digits). Moreover, the improvement persisted even after a six-month hiatus. The researchers speculated that improvement was the result of development of organizational strategies more like those used by younger persons.

The initial screening for participants may have eliminated persons for whom low motivation, high anxiety, or sensory deficits made digit span learning particularly difficult. Persons not accepted as subjects, that is, persons with lower starting scores, may have shown more improvement than did the more capable subjects who were selected for

participation in the study. Taub and Long refute this argument, saying that analysis of the data indicated that the tasks allowed adequate room for improvement, except for some younger subjects for whom a ceiling effect was seen.

Taub (1973) conducted a follow up study which addressed some of the concerns of the previous study. Subjects were not screened for minimal digit spans. Rather, they were matched for scores on the Vocabulary subtest of the WAIS. Longer digit spans were included in order to avoid the ceiling effect seen with younger groups. Written responses were utilized, providing visual feedback cues which were not available with the oral responses of the previous study. In addition, Taub included in this study instructions for organizing the digits into groups of three or four, and rehearsing these groups. As grouping is more naturally used by young people than old, Taub hypothesized that this technique would be of greater aid to the older than the younger group.

Subjects were 16 younger females (mean age = 26.0) and 16 older females (mean age = 70.3). The younger subjects were housewives, secretaries, clerks, or assistants. Sixty percent of the older subjects had histories of work experiences similar to those of the younger subjects. The young had a mean educational level of 12.7 years; the old, 10.8 years.

The tasks were similar to those of the previous study.

Task One assessed the maximum length that could be recalled without error. Task Two assessed the number of correctly recalled digits. Numbers of correct trials were not analyzed. For sessions two through four, half of the subjects were given instructions to rehearse; half were told to group digits, if the span were sufficiently long to do so, and rehearse those groups. For Task Two, written examples of this grouping technique were given to subjects. Subjects were tested individually. Presentation was at a fixed rate and written. Responses were oral for Task One and written for Task Two.

Overall, the younger subjects performed significantly better than the older subjects, though performance improved with practice for both groups. Younger and older subjects improved similarly for the first task, that is, maximum length of digit span recalled. Both groups improved significantly in numbers of digits correctly recalled over the course of the experiment, though the difference in gain scores for younger and older were greater as the length of digit span increased. For the longest spans, as the capacity of both younger and older subjects was exceeded, differences decreased, again. Instructions to rehearse groups of numbers had no effect on performance.

Taub concluded that, even with the inclusion of written responses, different subject selection procedures, and greater possible range of digit spans, younger persons

outperformed older persons. The older group did show improvement with practice. However, the younger group showed more improvement despite provisions to reduce anxiety and increase organizational encoding, provisions which were expected to disproportionately aid older subjects. Taub further noted that improvement may have been greater had more sessions been included in the study or had other tasks been tested, such that coding, chunking, or organization were intrinsic to those tasks.

Hultsch (1974) also studied the effects of both practice and organization on recall. He hypothesized that older persons suffered a deficit in cognitive processes due to lack of exposure to school-like learning tasks. He investigated the possiblility that, given the opportunity to practice a task, persons of all ages could improve their performances.

Hultsch used a sample which consisted of 114 females divided into five groups (mean ages = 19.62, 45.5, 54.5, 65.17, and 74.22). All groups had 18 members except the youngest group which had 42 members. The youngest group were university students. Subjects were above average on the Advanced Vocabulary Test from the Kit of Reference Tests for Cognitive Factors, though the youngest group scored significantly lower than the other groups, with the four older groups being equivalent. The sample was also above average for educational level. The 40- and 50-year-old groups had more education than the 20-, 60- and 70-year-old

groups.

For each of the blocks of trials, subjects learned two lists of 30 words which were of mixed quality in regard to meaningfulness, concreteness, frequency of occurrence, and imagery. Rates of presentation and interim intervals were fixed by the experimenter. Recall was self-paced, though opportunity to recall was terminated after 1.5 minutes if there was no response. Presentation of words and responses were written. Subjects were tested individually.

Performance improved as practice increased. Less organization was exhibited as the age of the groups increased. Hultsch measured the similarity of organization of encoding and retrieval. The 20-year-old group scored significantly higher on this measure than the 70-year-old group, but not significantly higher than any other group. The similarity of organization of retrieval on two consecutive trials was also measured. On this measure, the 20-year-olds significantly outperformed all other groups. Overall, however, the organization exhibited by the groups improved as their recall scores improved.

Hultsch interpreted the older groups' uneven improvement on recall scores from List One to List Two to be evidence of negative transfer of learning and interference in the earlier stages of learning. This interpretation is subject to question. It is not clear why such a phenomenon would occur nor why it would correct itself over the course of the

experiment. Indeed, there is some evidence that older persons tend to persist in their responses even in the face of direct evidence that their responses are incorrect (Kay, 1959). Further, research has shown that anxiety (Richardson & Pratt, 1981; Ross, 1968; Wass & Olejnik, 1983) and fear of failure (Botwinck, 1984) tend to inhibit the performance of older people. If subjects were given feedback as to the lack of accuracy of their performance in the early part of the study, one would expect that performance would remain stable or decline further, or indeed, that the subjects would drop out of the study. No information concerning feedback was reported.

The superior ability and educational level of the subjects limit the generalizability of the findings to other populations. Moreover, one would wonder whether, given these areas of superiority, Hultsch's assumption that the older groups had little opportunity, during daily activities, to practice learning strategies is accurate. Certainly, there is evidence that the higher the educational level of an individual, the more likely he or she is to continue to learn (Cross, 1979). For this superior sample, then, word learning may not have been a dissonant or unfamiliar experience; the use of words as the task component may have minimized finding of recall deficit and decreased the amount of room for improvement.

It is not clear why groups were of unequal sizes. In

replicating this study, it would be helpful to use equal size groups, males, and other memory tasks in order both to reassess Hultsch's findings and to extend the potential for generalizability.

DeLeon (1974) tested the effects of practice and training in the use of both repetition and mediators for paired-asociate tasks. He observed that, while training had been shown to improve memory performance of the elderly on memory tasks, generalization of this training to subsequent similar and dissimilar tasks had not been researched. In order to assess the long-range effects of training, DeLeon tested 40 elderly persons, aged 60-86 years, on five consecutive days. Subjects were matched for initial performance on paired-associate tasks.

On the first day of the study, subjects were tested on recall of real-life memory tasks: a personal narrative, a grocery list, and names and occupations of photographed persons. On the next three days, the subjects learned paired-associates under one of five conditions: training and practice with a repetition strategy, training and practice with a mediation strategy, practice without specific strategy training, social attention with no concurrent training or practice, and no treatment. On the fifth day, subjects were again tested on practical memory tasks. During the first and final sessions, subjects were asked to report what strategies they had used for remembering.

DeLeon found that all groups improved in paired-associate performance over the course of the sessions, indicating a practice effect. There were no significant differences between groups. Tests for transfer of training to new tasks, however, indicated little generalization by the groups trained in paired-associates or mediation. The repetition group, however, appeared to generalize their training, as they maintained their improved performance on new tasks. Moreover, the repetition group reported having developed their own mediators. When scores were analyzed in terms of subjects who had developed mediators and those who had not, the self-generators of strategies improved consistently over the course of the study but the non-generators displayed an uneven pattern of rises and declines in numbers of errors.

The sample for this study was composed of only older subjects. It would be useful to compare their performances with those of younger subjects. It is particularly helpful that DeLeon included several strategies as well as practical tasks in his study. The usual isolation of individual components of memory tasks, such as the rate of presentation, as well as the use of laboratory specific tasks, such as paired-associate learning, make it difficult to assess the importance of research findings in the daily lives of elderly persons. It would be interesting to extend DeLeon's study to research which examines the effects of training and practice

on other real life tasks.

Kausler, Lichty, and Hakami (1984) studied the effects of rehearsal on both recall and frequency judgments. For this study, subjects were not instructed or trained in practice strategies. Rather, Kausler, et al. varied the amount of information subjects had about the tests. The Incidental group was told that they would be shown four-digit numbers, with distractor words interspersed, and that they would be tested on immediate recall of the numbers. The Intentional group was told about the numbers, distractors, and short-term memory tests. They were also told that they would subsequently receive a frequency judgment test in which they would report the number of times they had seen distractor words. The Semi-Intentional group was told about the number learning and recall test. They were also told that they would be tested on the distractors, but the exact nature of the distractor test was not revealed. The researchers assumed that under the Intentional and Semi-Intentional conditions, subjects were more likely to rehearse the distractors and less likely, therefore, to perform well on recall of numbers than they would be under the Incidental conditions. The reseachers noted that frequency judgment, according to some of the available research, suffers less decrement than does recall. If this is accurate, little improvement in frequency judgment would be seen regardless of amount of rehearsal.

The young group was composed of 13 males and 23 females (mean age = 20.46) who had a mean educational level of 13.81 years. The old group was composed of 9 males and 27 females (mean age = 71.89), with a mean educational level of 16.58 years. The difference in educational level was statistically signficant. The Vocabulary subtest of the WAIS was administered at the end of the study. Scores were significantly different, favoring the older group. All subjects reported good health and no uncorrected perceptual deficits.

After a practice session, subjects were shown 27 numbers composed of four digits. Thirty-six words were used as distractor items between presentations of numbers. The words were repeated with varying frequencies. Presentation was at a fixed rate. Subjects recalled numbers immediately. For the test of frequency judgment, subjects were shown pairs of distractor words and asked to identify which word of each pair had been seen more frequently. Frequency judgment tests were self-paced.

Younger subjects recalled significantly more of the numbers than did older persons. Scores for all subjects indicated that recall was significantly better for the Incidental condition than for the Intentional and Semi-Intentional conditions. That is, subjects who were instructed that they would be tested on the distractor words tended to rehearse the words. The result was poorer recall

of the numbers. The younger subjects scored better on frequency judgment tests than did the older subjects. However, the difference was, according to the researchers, not large, the older subjects' scores being 8% below those of the younger subjects. Kausler, et al. interpreted this finding as support for the hypothesis that frequency judgment suffered less deficit than did some other types of memory tasks.

Kausler, et al. repeated their study, this time making the distractors more difficult in order to avoid the ceiling effect which may have occurred for the younger subjects in the first experiment. For this study, the younger group consisted of 8 males and 16 females (mean age = 19.19). The older group consisted of 8 and 16 females (mean age = 69.9). The sample was comparable to that of the preceding study in terms of health, education, and residency.

The researchers found, as in the previous study, that younger subjects outperformed older subjects on the recall test. Elderly subjects performed significantly better in the Incidental memory condition than in the Intentional condition. However, in this study, the Incidental/Intentional difference was not seen for the younger subjects. The frequency judgment test resulted in findings similar to those of the first study, the difference between younger and older being 9% rather than 8%.

Kausler, et al.'s study is particularly interesting in

this set of reviews in that it measured not only a recall task, which the researchers classify as effortful learning, but also frequency judgment, which results from automatic processing. The study did not, however, directly measure rehearsal. There was not repeated exposure to a given task, instructions to practice, nor reports by subjects of reworking of the to-be-remembered items. The researchers presumed that this reworking was being done by the subjects.

AFFECTIVE FACTORS

In two studies reviewed above, researchers manipulated not only the structure of the memory task, specifically, task pace, but also noncognitive factors. Taub (1967) examined the effects of instructions requiring a response for two paces of paired-associate learning. Subjects performed better at the slower pace. However, the noncognitive variable, the requirement to respond, did not result in significantly improved memory performance. Leech and Witte (1971) provided incentives for paired-associate learning at two paces. In this case, the pace of the task did not influence performance, but reinforcement did. In the two studies reviewed next, the researchers examined the effects of manipulating noncognitive or affective factors unaccompanied by another intervention.

Ross (1968) observed that older persons tend to be more anxious and insecure in learning situations than do younger

people. Ross hypothesized that supportive and challenging instructions would reduce anxiety, increase motivation, and hence, result in improved performance.

The sample for Ross' study consisted of 60 younger males (age range = 18-26) who were members of social or recreational clubs and were currently employed. The 60 older subjects (age range = 65-75) were retired from their jobs, but were active in day centers. Subjects were free of severe auditory or visual limitations, and had no history of diabetes, alcoholism, strokes or central nervous system disease. Subjects were given the Gallup Thorndike Vocabulary Test. All subjects received scores which fell between the 25th and 75th percentiles. There were no significant differences between groups on the vocabulary test, self-assessment of anxiety, or socioeconomic status. There was a significant difference in educational level; however, educational level did not correlate with performance and therefore did not affect the findings of the study.

All subjects were tested individually on two lists of paired-associates comprised of common words. The pairs were written on white paper with black ink in letters which were 1/2 inch high. The task pace was fixed at a relatively slow rate (a 5-second anticipation interval and 5-second interim interval). The pace of the task and the particular visual presentation of the words may have compensated for age-related sensory deficit not screened out in the subject

selection process. The subjects were randomly assigned to one of three conditions: 1/3 received standard paired-associate instructions; 1/3 received standard instructions along with supportive instructions; 1/3 received standard instructions along with challenging instructions. Subjects learned and were tested on the paired-associates, given a distracting task, and then learned and were tested on the same list. After 1/2 hour, this procedure was repeated for a second list of less common word pairs. Each study session was complete when the subjects had correctly recalled the list two times. If the subject did not successfully reach this criterion within 30 trials, he was eliminated from the study. At the end of the study session, subjects were asked to assess their own anxiety level.

Ross found that, for the initial learning of the pairs, the older subjects performed worst with challenging instructions and best when given supportive instructions. Differences among all three instructional conditions were significant. While the younger subjects outperformed the older subjects under all instructional conditions, the differences between the age groups was smallest for the supportive instruction condition. For the relearning trials, while the young again outperformed the older subjects, there were no significant differences among the instructional conditions. All subjects performed better with common words than with uncommon words

Ross interpreted the findings of her study as evidence that challenging instructions, instructions which indicated that the subject's performance would be evaluated relative to that of other subjects, increased insecurity and stress, and thereby depressed performance. Supportive instructions, on the other hand, resulted in the best performance of the older person on initial learning. Two caveats are in order, however. First, the terms challenging and supportive are subjective in nature. Challenging instructions in this study not only encouraged subjects to do their best, but included the implicit threat that they could be unfavorably compared to their peers. Supportive instructions solicited the help of the subjects by claiming to need imput from them about the characteristics of the words in the paired-associate lists. The instructions were not explicitly suportive of the subjects in the sense of expressing encouragement or confidence in their performance. It is not clear, then, that Ross measured the effects of challenging and supportive instructions in the more common uses of those words.

In addition to some lack of clarity about the variables being manipulated, there is also some question about the reason for the results of the study. It was not clear why the relearning task was not affected by the instructional conditions. Ross speculated that familarity with the task may have resulted in lowered anxiety levels and less need for instructional interventions. Unfortunately, Ross did not

assess anxiety levels until the end of the study, therefore the relationship between initial levels of anxiety and instructional interventions cannot be assessed. As Ross noted, persons with high levels of anxiety tend to perform more poorly than persons with low levels of anxiety. While Ross was able to point to improvement in learning scores in relationship to the type of instructions the subjects heard, her data would not allow her to correlate the effects of instructions with pretest anxiety levels.

As with other interventions reviewed (Robertson-Tchabo, et al., 1976; Treat, et al., 1981) Ross found a short term effect of the intervention which did not persist over time. Only 1/2 hour after the initial learning, the effect of the intervention was not evident. One may question whether the intervention was necessary or effective. It may be that practice with the task, that is exposure to the task and increased familiarity with it, in itself improved the performance of the older person.

Ross is among the few researchers discussed in this review who attended, in their procedural design, to the differential sensory needs of the older person. She undoubtedly eliminated some sources of bias by slowing the pace of the task and by providing visual stimuli which had high color contrast and large size letters. The task itself used common words, thus minimizing the effects of educational differences seen with some tasks, such as paired-asociate

tasks which utilize nonsense syllables. There were, however, several elements of the design open to question. Subjects were allowed to try 30 times to reach the two correct trial criterion. While Ross did not report the mean number of trials to criterion, the design did allow for the potential of a long, very tiring task. This may have differentially affected the performance of the young and old subjects. In addition, the all male sample and the requirement that subjects be free of diseases which are fairly common among older subjects limited the generalizability of the findings. It would be instructive to replicate this research with other samples.

Yesavage, Rose, and Spiegel (1982) also studied techniques to reduce anxiety among subjects. Rather than manipulating instructional (hence external) factors, Yesavage, et al. trained subjects in relaxation techniques. Based on their own pilot studies, the researchers expected that relaxation would lead to improved memory performance among persons who were highly anxious, that is, experiencing anxiety which interfered with performance. For persons with low levels of anxiety the researchers expected stability or decline in performance. Some anxiety is necessary for an individual to be motivated to perform well.

The sample for this study was comprised of 26 members of senior centers (mean age = 69.3; age range = 59-85). Forty percent of the sample was male. Subjects were screened for

serious depressive disease. No other description of the sample was reported.

During the first two sessions, a physical relaxation technique was taught to the subjects. They practiced the technique during the one-week interval between sessions. During the third session, subjects were asked to learn and recall 18 common nouns. The subjects then practiced the relaxation technique, followed by a memory exercise with a different 18 word list. The task pace was fixed. The fourth session was not described.

Overall, there was no significant difference between recall scores which preceded or followed the relaxation exercise. However, there were significant correlations between performance score improvement and initial levels of anxiety. Subjects with high initial levels of anxiety improved on recall scores which followed relaxation. Subjects with low initial levels of anxiety experienced declines in performance which were greater than the gains of the high anxious subjects. Yesavage, et al. interpreted this finding as evidence that minimal levels of anxiety or arousal were necessary for performance. Relaxation which lowered already minimal levels impeded performance. When anxiety levels were high, the intervention was facilitative.

It would be instructive to replicate this study with a sample which included younger subjects. Not only would an expanded sample make comparisons to other studies possible,

but it would shed light on the possibility of age-related effects of relaxation interventions.

TRAINING PROGRAM

The research reviewed thus far is largely the result of laboratory attempts to identify interventive techniques which might maintain or improve the memory performance of elderly persons. The studies tend to look at individual memory tasks which are often laboratory-specific rather than natural, that is memory for digit spans, paired-associates, and word lists. Often, the studies examine only one intervention at a time, such as pacing or instructions to use mediation. In this section, six studies will be examined, all of which focus on training elderly persons during multiple class sessions. These studies often reflect attention to a variety of factors which affect memory impairment and provide more than one intervention in the course of the sessions. Subjects for these studies tend to present themselves for the training, that is, they are motivated not by the opportunity to participate in an experiment but because they identify in themselves a need for memory improvement.

Weston, Reever, Corby, and Zarit (1980) recruited an unreported number of subjects (age range = 52-90). The subjects were screened for senile dementia and assessed for memory complaints and depression. No other description of the sample was reported. The subjects were presented with

six daily memory tasks, including faces and names, directions, doctor's instructions, a shopping list, daily tasks, and a list of words. During the eight 1 1/2-hour sessions, one control group, the Activity Group, was taught assertion skills and physical exercises. The Wait List control group received no attention. The Didactic Instruction experimental group was taught interventive techniques appropriate to each memory task. The Inductive experimental group was encouraged to use techniques which had been helpful in the past. All subjects were asked to report the techniques which they had used.

Weston, et al. found no differences between the two control groups or between the two experimental groups, nor between the control and experimental groups. Training significantly improved performance only on the face-name task. All groups used similar numbers of techniques. In short, training in itself did not change performance, but the use of interventive techniques regardless of group membership was correlated with performance level. There was an effect for time which Weston, et al. interpreted as evidence that practice, rather than specific training, resulted in improvement of memory performance. In addition, the researchers found a correlation between memory complaints and depression, and between depression and memory performance. While Weston, et al. did not measure changes in depressive affect over the course of the study, they did suggest that

training groups may serve a supportive function for elderly persons who are concerned about their memories, thereby improving memory function.

Richardson and Pratt (1981) studied the effects of training sessions which not only taught specific memory techniques but also provided information on normal age-related memory changes. It was Richardson and Pratt's hypothesis that participation in the training sessions would improve memory performance, reduce concerns about memory, and increase life satisfaction and mood.

For their study, Richardson and Pratt recruited 1 male and 12 female subjects (mean age = 70.9, age range = 59-86), all of whom expressed concern about their memory functioning. Both educational and occupational levels were high: seven subjects had completed college, four of whom had master's degrees; nine subjects had worked as professionals, office workers or businessmen. Three subjects were still working part-time. Almost all subjects reported some illness, but none of the illnesses or medications were judged to impair memory performance. Subjects were tested before the training sessions began on measures of life satisfaction, depression, memory complaints, and general memory performance. All measures were readministered at the end of the training sessions, with the exception of the memory performance test, as pre-session scores on the latter were nearly perfect.

The subjects participated in seven weekly 2-hour

sessions. The first hour of each session involved a lecture on one aspect of memory functioning, followed by opportunity for questions and answers. In the second hour, small groups continued the discussions about the lecture topic, and learned and practiced specific memory techniques. Six daily memory tasks were studied: remembering appointments, doctor's instructions, what you were going to say, what you want to get, names, and birthdays.

Even though participants had performed nearly perfectly on pre-training memory tests, they reported improvement on memory performance on posttests. In addition, they expressed less concern about their memory, as well as a slight increase in life satisfaction and slight decrease in depression. Subjects expressed satisfaction with the training and reported that they had benefited from the sessions. Richardson and Pratt concluded that, in addition to memory improvement as a result of specific training, subjects had benefited from an increase in knowledge about normal memory changes and from the supportive nature of the training sessions.

Richardson and Pratt critiqued their study well. They noted that the small sample size was used because they were conducting only a pilot study. They further noted that their sample was relatively advantaged. Research findings would be more generalizable with a larger, more diverse sample. In addition, as the authors noted, subjects who were not

demonstrating high levels of memory performance prior to training might benefit more than this sample did. Richardson and Pratt did not report the nature of the specific techniques taught to their subjects or the relative effectiveness of those techniques. It would be instructive to examine such data, particularly in light of Weston, et al.'s (1980) conclusion that practice, rather than particular training, affected performance.

Zarit, Cole, and Guider (1981) conducted two studies in which they focused on the effects of training not only on memory performance but also on subjective complaints about memory. In the first study, half of the subjects were assigned to one of four experimental groups comprised of four to seven persons. All experimental groups performed four memory tasks: learning and recalling a grocery list, a list of unrelated items, faces and names, and a prose passage. Subjects were trained to use visualization and categorization memory techniques as appropriate to each task. The remainder of the subjects were assigned to conversation groups in which they discussed current events. While the control groups were not taught or encouraged to use memory devices, they were told that participation in the discussions would lead to improved memory function.

The sample consisted of 12 males and 32 females (mean age = 72.2; age range = 50-88), of whom 65% were community dwelling and 35% were residents in a retirement home.

Subjects with evidence of senile dementia were excluded from the study. No other description of the sample was reported.

Subjects were tested on measures of memory complaints and depression. Subjects were also tested on recall at the beginning and end of each session, and once again at the end of the four training sessions. Testing dealt with the four tasks with which the experimental groups were trained. Recognition was not tested.

For the grocery list and the list of unrelated items, the experimental groups significantly outperformed the control groups. The experimental groups showed improvement from pretest to posttest, while the scores of the discussion groups declined. In the face-name task, scores for experimental groups and control groups improved over time. The experimental groups scored better than the controls, but the difference was not significant. On the paragraph task, the control groups performed better than did the experimental groups, though, again, the differences were not significant. On three of the four tasks, then, the training group outperformed the discussion group. However, at the end of the study, both groups reported significantly reduced memory complaints. There was no significant correlation between memory complaints and depression.

Zarit, Cole, and Guider repeated their study, this time using experimental groups who received training on the four tasks and a control group who received no special attention

(Wait List). Subjects were 17 males and 37 females (mean age = 70.89; age range = 60-89). In this second study, the experimental groups improved significantly on recall of three of the four tasks both over time and as a result of the training. The control groups' score declined slightly on three of the tasks. All subjects scored well on recognition tests. The experimental groups reported fewer memory complaints, while the control groups reported increased complaints. At posttesting, there was a slight (.25) correlation between depression and memory complaints.

One task in the first experiment and three tasks in the second experiment showed a time effect. While Zarit, Cole, and Guider concluded that memory training improved performance on three of the four tasks, it also appears that exposure to the task or practice aided in the improvement. Such a practice effect would be in keeping with the findings of DeLeon (1974), Hultsch (1974), Taub (1966, 1973), Taub and Long (1972), Treat, et al. (1981), and Zarit, Gallagher, and Kramer (1981). Moreover, for the two sets of experimental groups and one set of controls, memory complaints decreased. The researchers concluded that memory training was not the sole determinant of decreases in memory complaints. Apparently, the expectation that memory would improve, as evidenced by the discussion groups of the first study, was sufficient to reduce concern and improve self-assessment of function. The researchers did not address the

lack of significant correlation between depression and memory complaint, despite the fact that such a finding is in conflict with much of the research literature (Gurland, Fleiss, Goldberg, Sharpe, Copeland, Kelleher, & Kellet, 1976; Kahn, Zarit, Hilbert, & Niederehe, 1975). Zarit, Cole, and Guider did not report data concerning the extent of depression experienced by their subjects. It is possible that the subjects in this study experienced less depression and fewer memory complaints than did subjects in other studies.

Zarit, Gallagher, and Kramer (1981) also studied the effects of memory interventions on performance and complaints. Half of the subjects were assigned to training groups in which subjects learned and practiced a variety of memory techniques, among them, categorization, visual mediation, and integration of information. The other half of the sample were assigned to growth groups in which subjects discussed and practiced personal and interpersonal skills, such as social skills, problem-solving, relaxation techniques, and self-evaluation exercises.

The sample consisted of 47 females over the age of 50 years (mean age = 63.68). All subjects were free of chronic organic brain syndrome. No other description of the sample was reported.

Subjects were tested on measures of memory complaints and depression before and at the end of the training period. In addition, memory tests were administered before and after

each session and at the end of the study. All memory tests involved recall tasks which were similar to the tasks practiced during the training sessions or similar to the topics discussed during the growth sessions. The tasks used for testing included memory of phone numbers, lists of unrelated items, faces and names, and lists of activities.

Zarit, Gallagher, and Kramer found that, overall, the training groups improved more than did the growth groups on pre-session to post-session measures. However, by the final testing, the growth groups performed as well as the training groups. Improvement was significant for categorization and visual mediation. Memory complaints and depression decreased significantly over the course of the study and were correlated with each other (.35). However, objective measures of memory improvement were not correlated with the changes in complaints, except for semantic encoding, in which case, contrary to expectations, lower performance was associated with lower levels of complaint.

The researchers concluded that memory performance improved not only as a result of specific training, but also as the result of practice, socialization, motivation, and support. Zarit, Gallagher, and Kramer noted that posttest and final test scores were very high, perhaps reflecting a ceiling effect. That is, given more difficult tests, it is possible that differences between the experimental conditions may have been evident. Nonetheless, the findings of this

study are consistent with the research which has found improvement in memory performance as the result of practice (DeLeon, 1974; Hultsch, 1974; Taub, 1966, 1973; Taub & Long, 1972; Treat, et al., 1981; Zarit, Cole & Guider, 1981) and supportive environments (Ross,1968).

As suggested by the findings of Richardson and Pratt (1981) and Zarit, Gallagher, and Kramer (1981), training appears to produce only modest changes in memory performance and memory complaints for samples taken as a whole. However, the range of improvement for individuals within samples may be great. Persons who, before training, show high levels of deficit may have greater need for intervention and more room for improvement. Shaffer and Poon (1982) tested this hypothesis in another training study. They measured initial and end of session levels of depression, memory complaint, self-esteem, memory function, health status, and verbal IQ, and analyzed the relationships between these variables and training effects.

The sample consisted of 42 female and 9 male community dwelling persons (mean age = 72.9; age range = 62-85). The sample had a mean educational level of 14.2 years and an average IQ of 110.8. No other data concerning the sample were reported.

Subjects were randomly assigned to one of three conditions: The Learning group was taught attention, concentration, and organizational skills. The Social Support

group discussed personal and memory problems and learned a relaxation technique. The Wait List group participated only on pretesting and posttesting (Sessions 1 and 6). Sessions 2 through 5 consisted of 2-hour training or support meetings. Memory tests involved recall and recognition of word lists and recall of prose passage.

The Support and Learning groups improved on all three memory tasks. The Wait List group improved only on recall of lists. There were, however, no significant differences among groups because of the great variability among scores within each group. Shaffer and Poon reanalyzed the data, dividing the sample into subjects who had scored high on initial memory task tests and subjects who had scored low. As they had hypothesized, on posttests of list recognition and recall, subjects with low baseline scores had improved more than persons with high baseline scores. On prose recall posttests, low baseline performers improved significantly. However, scores of high performers declined. Consistently good performance was correlated with high IQ scores; low performance with low IQ scores. Shaffer and Poon concluded that the correlation of performance with initial performance and ability resulted in great variability among individual scores, and that this variability obscured significant effects of training for some subjects when only mean scores were assessed.

Shaffer and Poon, as Zarit, Cole, and Guider (1981),

found no correlation between depression and memory performance. Shaffer and Poon noted, however, that the lack of correlation may have been due to the low levels of depression and high self-esteem exhibited by the sample.

Willis, Cornelius, Blow, and Baltes (1983) reviewed research which indicated that deficits in attentional processes were related to age-related declines in memory performance. In order to test the effects of training for improved attention, the researchers provided a Training group with training and practice in discrimination, selective attention, attention switching, and concentration. Practice included both laboratory-specific and real world tasks. A second group, the Social-Contact group, participated in discussions about friendships. A No-Contact group participated only in pretesting and posttesting. The Training group and Social-Contact group met for five 1-hour sessions. Posttesting was conducted one week, one month, and six months after training.

The sample consisted of 16 males and 57 females (mean age = 70.5; age range = 62-84). The mean educational level was 11.9 years. Subjects reported good health and no significant auditory or visual impairment. Groups were equivalent on measures of age, educational level, and pretest performance. No other data concerning the sample were reported.

While attention improved as the result of both

treatment and practice, memory performance showed no significant improvement. Willis, et al. explained that attention may represent only one factor involved in complex cognitive processing or, alternatively, attention may play a relatively insignificant role in performance. If either explanation is accurate, then attention training would not be sufficient to improve memory performance. It is not clear, however, why a practice effect for memory performance was not seen, at least with the earlier posttests, those closer in time to the experimental situation. Indeed, it is not clear why the expectation of improvement, described by Zarit, Cole, and Guider (1981), did not lead to at least modest gains for the Training group, nor why the opportunity to participate in a social group did not similarly produce gains (Richardson & Pratt, 1981; Ross, 1968; Weston, et al., 1980, Zarit, Gallagher, and Kramer, 1981). Willis et al. did not, apparently, include supportive instructions for their sample, perhaps minimizing the effects of affective support seen in other training research.

SUMMARY OF INTERVENTIONS

The body of research concerning interventions for memory performance of the elderly is extensive. In it, the researchers have attended to many of the age-related changes found in memory performance. In most of the studies, positive effects were found for the interventions being

tested. For studies conducted in laboratories, with a limited number of memory tasks, and with interventions most often tested one at a time, findings generally indicated that the memory performance of elderly adults can be remediated or maintained at a level more similar to that of younger persons when interventive techniques are taught or imposed. Age-related differences, however, were rarely eliminated.

Organizational deficit, one factor which Smith (1980) thinks is implicated in memory decline, was addressed in research by Hultsch (1971, 1974, 1975). Whether subjects were given instructions to organize, learning activities which required organization, or simply the opportunity to organize through repeated exposure to the task, memory performance on word lists improved. Age differences in performance, however, persisted.

Most attempts to increase or improve the use of mediators resulted in improvement of memory performance. Fullerton (1983) found that instructions to use imagery were effective for memory of spatial relations when contextual cues were present. Imagery was not effective for memory of nonspatial relations. For paired-associate learning, instructions to use imaginal mediators (Treat, 1977) and the provision of mediators without instructions to use them (Hulicka & Grossman, 1967) were effective. Hulicka and Grossman (1967), Treat, et al. (1981), and Treat and Reese (1976) found that experimenter-generated visual mediators

improved performance, but subject-generated mediators were still more effective. When specific mediational techniques were taught, such as method of loci for word list tasks (Robertson-Tchabo, 1976; Rose & Yesavage, 1983) and face-name mnemonics for name learning (Yesavage, 1983; Yesavage, et al., 1983; Yesavage & Rose, 1984), positive effects for the interventions were seen. The effectiveness of the face-name mnemonic was further enhanced when it was accompanied by a judgment concerning the pleasantness of the face-name image (Yesavage, et al., 1983) or by visualization training (Yesavage, 1983). Finally, in the only study which tested verbal mediation (Clarkson-Smith & Halpern, 1983), positive effects were found for memory of spatial locations of pictures. For all studies which used more than one age group, age-related differences were seen on posttesting, despite significant improvement in the performance of older subjects.

Attempts to increase the amount and extent of processing have largely been unsuccessful. Mason (1979) instructed subjects to attend to either the typescript, rhyming words, or category membership of the word lists to be remembered. Rankin and Hyland (1983) asked subjects to attend to rhymes and meaning for word list learning. Surber, et al. (1984) provided a problem-solving task to accompany reading of a prose passage. Kausler and Hakami (1983a, 1983b) told subjects that they would be asked to recall the conversations and activities in which they were engaged. In none of these

studies was performance improved with orienting instructions. Simon, et al. (1982) provided instructions for semantic processing (attention to syntax, style, and judgment), as well as instructions to learn for later recall. With semantic processing instructions, the older subjects recalled significantly less of the prose passage than did the youngest subjects. However, with instruction to remember, performances of older and younger subjects were similar. McFarland, et al. (1985) found that semantic orienting instructions (attention to cues, rhyming words, and syntax) resulted in improvement when subjects were actively involved in the generation of the memory task.

The quality of the memory items and interventive techniques was manipulated by Catino, et al. (1977), Hanley-Dunn and McIntosh (1984), Mason and Smith (1977), Poon and Fozard (1978), Rowe and Schnore (1969), and Thomas et al. (1978). In these studies, the memory tasks included word lists, paired-associates, letters of the alphabet, as well as pictures with labels (including real-life items and photographs of people). Mason and Smith (1977) found no effect for the use of concrete mediators in their first study. For all other tasks, the performance of the elderly was aided by increased concreteness, familiarity, or meaningfulness of either the memory item or the mediator. Age-related differences persisted, although in the study by Hanley-Dunn and McIntosh (1984), the difference favored the

older subjects.

Findings concerning manipulation of modality were often task-specific and in conflict from study to study. Taub (1975) and Taub and Kline (1976) found that for discrete memory items, such as digit spans and sequential lists of digits, auditory presentation was preferable. For tasks in which there was opportunity to use contextual cues (e.g. simultaneous presentation of digits, sequential presentation of digits with spatial placement, and prose passages), visual presentation was effective. Taub and Kline (1976, 1978) found that, for memory of prose passages, neither visual nor auditory presentations alone were as effective as visual or auditory presentation with the opportunity to review. Dixon, et al. (1982) found no difference, for older subjects, in modality of presentation for prose memory until a delayed test one week after posttesting. At that time, performance was better with auditory presentation than with visual presentation. Taub and Kline (1976, 1978), and Arenberg (1968, 1976) found a positive effect for visual presentation of digit spans and geometric figures when spatial cues or auditory presentation was also provided. In studies which used multiple age groups, age-related differences persisted, though in one study (Arenberg, 1976), the difference favored the older adults.

Despite the emphasis on slowing as a cause of cognitive decline (Birren, et al., 1980; Salthouse, 1982), research on

interventions which sought to manipulate the pace of memory tasks resulted in conflicting findings. Arenberg (1965) and Treat and Reese (1976) found that slowing the pace of anticipation intervals (time for response) improved performance on paired-associate tasks. Canestrari (1968) and Taub (1966) found that slowing the pace of interim intervals (time between presentation of memory items) resulted in better test scores for paired-associates and digit spans. Canestrari (1968), Taub (1967), and Craik and Rabinowitz (1985), using paired-associate and word list memory tasks, found that slowing the pace of presentation intervals (inspection of the stimuli) facilitated performance. Canestrari (1968) further found that self-pacing resulted in even better performance than did slow paces determined by the experimenter. However, other research testing slowing of presentation rates for paired-associate learning (Leech & Witte, 1971; Treat & Reese, 1976) and digit spans (Taub, 1966) found no improvement in performance. When slowing of the pace did aid the elderly in their performance, age-related differences were not eliminated.

Repeated exposure to the memory task and training in repetition strategies resulted in improved performance for learning of word lists (Hultsch, 1974) and paired-associates (Treat, et al., 1981). Practice resulted in improved consistency and accuracy on digit span tasks (DeLeon, 1874; Taub, 1966, 1973; Taub & Long, 1972), but the length of the

span remembered did not increase. Kausler, et al., (1984) did not find a practice effect for frequency judgments, a task they considered to be processed automatically. It appeared that effortful processing was improved by practice, but automatic processing, which suffers less decrement with age, was not aided by the opportunity to rehearse.

Several studies attempted to counteract negative influences of affective factors such as anxiety, fear of failure, and depression. Taub (1967) required a response; Ross (1968) gave challenging instructions. Neither technique improved performance. It is possible that Taub and Ross increased the elderly subjects' anxiety. Reinforcement of correct responses (Leech & Witte, 1971), supportive instructions (Ross, 1968), and relaxation training (Yesavage, et al., 1982) resulted in better performance. In the only study which included multiple age groups (Taub, 1967), performance differences persisted.

Of all the intervention studies, those concerned with training programs were most likely to deal with multiple factors and real-life tasks. Weston, et al., (1980) taught subjects interventive techniques which were appropriate to each memory task in the study. They found no effect for training, except on a face-name task. Willis, et al. (1983) provided attention training, again, with no effect. Shaffer and Poon (1982), on the other hand, found that subjects trained in attention, organization, and concentration showed

improved memory function. Zarit, Cole, & Guider (1981) found training in visualization and organization to be helpful. Zarit, Gallagher, and Kramer (1981) found improvement in performance when subjects were trained in a variety of memory techniques. Richardson and Pratt (1981) found the combination of training in techniques and information about normal age-related memory changes resulted in better performance.

It is important to note that several of the training studies attended to affective factors and practice effects as well as to training in memory techniques. In the study just mentioned, Richardson and Pratt (1981) found improvement when memory training and anxiety reduction skills were provided for the same subjects. Subjects in discussion groups concerned with personal and interpersonal skills, such as assertiveness, physical exercise (Weston, et al., 1980), relaxation, problem solving, self-evaluation (Zarit, Gallagher, & Kramer, 1981), and understanding of memory problems (Shaffer & Poon, 1982) improved as much as the training groups. Even subjects who engaged in discussions which were extraneous to their personal growth (Zarit, Cole, and Guider, 1981) improved as much or more than the training group on two of four tasks. Similarly, four studies which found a training effect also found an effect for practice (Weston, et al., 1980; Zarit, Cole, & Guider, 1981; Zarit, Gallagher, & Kramer, 1981).

In sum, attempts to improve organization of memory

items, to increase familiarity of memory items and mediators, and to teach and encourage the use of mediators have largely been effective. Manipulation of modality was effective, particularly when visual modality accompanied memory items in which contextual cues and opportunity for review were present. The verbal modality was more appropriate for discrete item learning. Multimodal approaches were useful. Slowing of the pace was effective for anticipation and interim intervals, but of uncertain value for presentation intervals. Training groups resulted in sometimes modest improvement in memory performance accompanied by better self-assessment. Practice was effective for some tasks. Affective interventions were effective dependent on the particular noncognitive approach. However, the power of practice and affective interventions is apparent when one notes the recurrence of these factors in studies which focused on other interventive techniques. Practice and noncognitive interventions were effective in training programs. Troyer, Eisdorfer, Bogdonoff, and Wilkie (1967) suggested that reduction of the pace of the task was effective not because it compensated for behavioral or cognitive slowing, but because it reduced the anxiety of the subjects. It may be that interventions which improve organizational strategies, task familiarity, and mediational techniques are largely or partially effective because they increase the subject's confidence in handling the task and familiarity over time

with the task and setting.

CHAPTER III

DISCUSSION

Research on interventions suggests a number of ways in which the older person can be helped to remember as he or she engages in daily activities. Because of a number of methodogical and design questions in the studies, the implications of research findings for real life tasks remain tentative. Problems evident in individual studies were discussed as the research was reviewed. In this section, problems which recur throughout the body of research will be discussed. Questions will be raised concerning the composition and description of samples, the internal and external validity of the findings, and the design and data analysis of research studies. The methodological problems will present caveats to the reader concerning implications of the intervention studies for the adult learner. These implications will be discussed second. Finally, future directions for research will be discussed, with an emphasis on studies which may provide information about the optimal functioning of the older person in the real world.

METHODOLOGICAL PROBLEMS

While research findings suggest educational techniques

to aid learning for the older adult, the certainty of these implications is limited by a number of research problems. Questions concerning the definition of samples, measurement techniques, and data analysis and study design will be addressed in the following section.

Definition of Samples

Perhaps the most pressing problem in the study of age-related changes in memory function, and in the study of interventions to maintain or improve function, is the definition of young, middle-aged, and elderly. The definition of these age groups, in terms of chronological age, is arbitrary. For example, Arenberg, in his 1968 study, used age groups with a mean of 20.0 and 67.1 years, and in his 1977 study, used age groups with a mean of 18 and 65.5 years. Hanley-Dunn and McIntosh (1984) employed a younger group with a mean age of 20.3 years, not greatly different than those of Arenberg; however, their older group had a mean age of 71.9 years, perhaps significantly different than the older group in the Arenberg studies. Rose and Yesavage (1983) used a younger group with a mean of 27.8 years and an older group with a mean of 61.4 years. And most strikingly, Catino, et al. (1977) compared groups with mean ages of 4.3, 7.3, and 72.6 years. Given the different definitions of age groups implicit in the various studies reviewed, it is difficult to compare the studies and to assess generalizability of the

findings.

Age groups are often described in terms of mean ages, without indication of age range. When age ranges are described, they are often so broad as to include persons in different stages of development. For example, Yesavage and Rose (1983) included in their study of older subjects persons from the ages of 58 to 85 years. In addition, as with the definition of age groups by statistical means, the definition of young, middle-aged, and old by age ranges is arbitrary. Hultsch (1971), for example, used three age groups with ranges of 20-29, 40-49, and 60-69. Mason and Smith (1977) considered groups with ranges of 20-39, 40-59, and 60-80, groups with broader ranges than those of Hultsch. Again, the comparability of studies, given the lack of consistency of age definition, is questionable.

The use of age groups is intended to provide a life span view of changes in memory and the effectiveness of interventions. However, there is often a discontinuity, a lack of investigations of certain age groups, particularly when only young and old are compared. Barr (1980) and Hughes (1980) suggest that only when all possible age groups are tested can developmental issues truly be assessed. Okun and Stock (1985) point out that age-related changes are continuous variables, such that the measurement of only extreme age groups precludes assessing the trend of change over the life span. They note, for example, that when only

young adult and older subjects are tested, differences may appear greater and more dramatic than they would had intermediate age groups been included. With more ages represented, gradual developmental change may have been seen. Conversely, without information about the mid-range ages, U-shaped effects may be missed, such that the young and old appear similar in performance. The erroneous conclusion would be reached that no change occurred over the life span. Studies which include only older subjects in their samples would clearly preclude conclusions concerning developmental trends and age-related differences in the effectiveness of interventions. The studies of Hulicka and Grossman (1967), Leech and Witte (1971), Rose and Yesavage (1983), and Yesavage, (1983) are among research reviewed in this dissertation which utilized only older persons.

The ages selected in these studies, then, affect the conclusions which can be reached about developmental issues in memory change and intervention, as well as the comparability of studies. Similarly, other demographic characteristics of the samples affect conclusions and comparisons. Representation of males and females varies among studies. West and Boatwright (1983) used a sample in which 50% of the subjects were male, 50% were female. Yesavage (1983) used a sample which was 80% male, and Ross (1968) used a sample which was all female. Not only is the comparability of studies compromised, but the ratios of males

to females do not accurately reflect the fact that 60% of persons 65 years old and older are female (Cowgill, 1983).

Educational level also varies among studies. In the Clarkson-Smith and Halpern (1983), young and old groups were matched for educational level. In the studies by Kausler and Hakami (1983a, 1983b) and Kausler, et al. (1984), the older groups had significantly more education than their younger counterparts. Surber, et al. (1984) reported that their young subjects were all undergraduates and their older subjects had 10-15 years of education. It was not clear that the groups were comparable. Groups within a study, then, were not always matched for educational level, though differences sometimes favored the old. In addition, educational levels were different among studies. Hultsch (1971, 1974,) used samples with superior educational levels. In the 1971 study, for example, the younger, middle-aged, and oldest subjects had mean educational levels of 16.00, 15.00, and 16.35 years. Catino, et al. (1977) used older subjects who had a mean educational level of 11.2 years. Arenberg (1968) used a sample in which none of the subjects had education beyond high school.

Occupational level varies among studies. In Arenberg's 1965 study, the subjects were working in (or retired from) academic, scientific, technical, or administrative jobs. Yesavage, Rose, and Bower (1983) used only retired middle-level managers. Taub and Kline (1978)

used subjects who were housewives or members of senior centers. Arenberg (1977) used high school students and unemployed blue collar workers. In short, because of the great variability among studies in terms of demographics of the sample, comparisons of studies and generalization of findings is very limited. Making conclusions and comparisons even more difficult, many of the studies, as noted in the reviews, reported little demographic data about their samples.

Variability in the definition and description of samples is complicated by cohort differences. All of the studies reviewed earlier in this dissertation are cross-sectional studies. As Hughes (1980) pointed out, developmental changes and effects of interventions, as measured by cross-sectional studies, are often contaminated by generational differences and health changes. Baltes, Cornelius, & Nesselroade (1979) and Willis and Baltes (1980) discuss three influences on life span development. Age-graded influences are normative, predictable changes which occur over time to most individuals. These are factors which are the focus of most developmental research and of all studies reviewed above. Non-normative critical life events are idiosyncratic to the individual. They are not predictable. While they may happen to many individuals, the timing, pattern, and effect of these events is individualistic. Finally, history-graded influences are those

which occur at a point or period in time. While they may affect more than one cohort, their effect on various cohorts is different given the various life stages of each cohorts when the history-graded influence occurs.

Research on memory change and interventions tends to look for age-graded influences on performance. Non-normative changes are minimized by sample selection techniques. For example, no head trauma patients were included in any of the studies reviewed above. History-graded factors impose significant influence on research outcomes, yet are often insufficiently noted by researchers. For example, Hultsch, Hertzog, and Dixon (1984) pointed out that, as older cohorts are less likely to have high educational levels than are more recent cohorts, well-educated older persons tend to be more highly selected than well-educated younger persons. Older persons with high verbal ability, on the other hand, are likely to be less highly selected than younger persons, the older subjects having more experience with vocabulary. Despite these history-graded influences, researchers of the intervention studies attempted to match younger and older groups on measures of years of education and verbal ability on the assumption that the groups are then equivalent. Arenberg (1965) and Hultsch (1971) used samples which were highly educated relative to the older cohort. History-graded influences, then, exert influence on the outcomes of research, but are often not attended to by the researchers.

Erickson (1978) noted that age-graded factors other than those related to cognitive development also influence the outcome of research. For example, declines in visual and auditory acuity (Botwinick, 1984), the lessened ability to discriminate relevant from irrelevant information in complex stimuli (Hoyer & Plude, 1980), and slowing of behavior (Birren, et al., 1980; Botwinick, 1984; Cunningham, 1980) are among the factors which account for apparent memory changes and lower levels of effectiveness of interventions for the elderly. The changes may necessitate the use of high contrast visual stimuli, low pitched auditory presentations, simplified stimuli, or attention to the pace of the task. The requirement of written responses (e.g. Arenberg, 1968; Dixon, et al., 1982; Yesavage, et al., 1983) or motor responses on a microcomputer (Craik & Rabinowitz, 1985) were disadvantageous for older subjects. Few of the studies reviewed attended to developmental changes or the necessity for adaptations of the task. (For exceptions, see Ross, 1968; Simon, et al., 1982).

Individual differences increase with age (Erickson, 1978). Willis and Baltes (1980) noted that cognitive changes are heterogeneous (individualistic), multidimensional, and multidirectional. The effectiveness of an intervention may vary from individual to individual (Poon, et al., 1980; Robertson-Tchabo; Thomas, et al., 1978; Winograd & Simon, 1980). However, little attention to individual differences

is in evidence in intervention research.

Yesavage and Sheikh (1985) noted that noncognitive factors also influence research findings. High levels of motivation may improve the effectiveness of memory interventions; high anxiety may impede improvement. Erickson (1978) noted that noncognitive factors, including low motivational level, cautiousness in unfamiliar situations, and high levels of anxiety not only interfer with the effectiveness of the interventions but also interfer with the researcher's ability to test interventions. Older persons are less likely than are younger persons to have experience with psychological testing. The unfamiliarity and the lack of apparent meaningfulness of the laboratory experiment may impede performance. Nonetheless, most of the intervention studies reviewed above took place in unfamliar laboratory settings, with unfamiliar tasks, and without the benefit of anxiety reduction techniques.

Measurement Issues

Non-normative, history-graded, and age-graded differences lead to interesting measurement questions. Cunningham (1982) suggests that, while younger and older subjects may be exposed to the same experimental conditions, tasks, and tests, research may not be measuring the same factors. As suggested above, for example, apparent age-related differences in memory performance may actually

reflect different levels of cautiousness or anxiety. Different interpretation of words, slower or faster reaction times, as well as varying amounts of experience with the task at hand and familiarity with psychological tests and experiments may affect experimental findings. Apparent age differences may reflect these extraneous variables rather than the variables being directly assessed.

The source or location of age-related decline during memory processing is often unclear (Hughes, 1980). Similarly, the mechanism by which interventions change performance is often not understood. Cunningham (1982) suggests that the study of single variables in isolation does not adequately define the etiology of change. Rather, multivariate studies are necessary in order to determine what factors are operating and with what strength (loading) for various age groups. Multivariate studies would also assess shifts in the interrelationships among factors. Petrinovich (1985) also urges multivariate studies, noting that single variable studies do not adequately assess the relative importance of that variable. For example, method of loci may, when tested alone, result in memory performance improvement for a given sample. However, when tested along with other interventions, it may be that method of loci accounts for only a small percentage of improvement, other variables being more effective. Indeed, as noted in the review of studies, interventions often seem to result in

performance improvement. Nonetheless, the effect of practice and familiarity with the testing session, factors not assessed, may have been responsible for some small or large percentage of the improvement (DeLeon, 1974; Hultsch, 1974; Taub, 1966, 1973; Taub & Long, 1972; Treat, et al., 1981; Zarit, Cole, & Guider, 1981; Zarit, Gallagher, & Kramer, 1981). Conversely, practice effects for the control groups may result in improved scores for them, less difference between control and experimental groups on posttests, and, hence, less apparent effect of the intervention being tested (Robertson-Tchabo, 1980).

While it is often difficult to assess the underlying or extraneous factors operating in the test situation, it is also difficult to define the observable, manipulated, factors. For example, several studies have sought to control the pace of learning as an interventive technique (Arenberg, 1965; Canestrari, 1963, 1968; Craik & Rabinowitz, 1985; Leech & Witte, 1971; Taub, 1966, 1967, Treat & Reese, 1976). Yet, slow or fast paces are difficult to define (Poon, et al., 1980). Indeed, examination of the pacing studies shows that various criteria for speed are used in each. In addition, the amount of time intervening before delayed recall, the length of tests, and the number of sessions all vary from study to study (Robertson-Tchabo, 1980). It is difficult to ascertain whether research findings indicate the effects of the independent variables, or the differing definition of

those variables, subjects' fatique, test-wiseness, or other extraneous variables. Such difficulties limit the internal validity, as well as the external validity of research findings.

Conclusions concerning a training effect are also difficult to ascertain. Willis (1985) notes that a finding of no training effect is often interpreted as a training failure. Before arriving at such a conclusion, Willis suggests, the researcher should ascertain whether the intervention was effective for some subgroups within the sample. Analysis of the performance of subgroups and individuals may yield information not provided by sample means.

Arenberg (1982) writes that the commonly used criterion for interventive effectiveness is the amount of change between the absolute scores at the beginning and end of an experiment. Other scientific fields, such as physiology and biochemistry, consider change as the proportion of difference between pretest and posttest scores. Consideration of a proportional criterion may be appropriate, particularly considering that persons with high initial levels of performance have the least room for improvement, hence show less improvement than persons with lower baseline scores. Looking only at rates of absolute change, an intervention may seem minimally effective. In fact, that intervention may be significantly effective for the group under consideration.

Willis, et al. (1983), on the other hand, support the concept of gain scores, noting that they reflect both the range of change and the amount of change experienced by an individual. As both Arenberg and Willis, et al. agree, the criterion for change is the subject of controversy among statisticians.

Change, in itself, may be statistically significant and yet yield little information about the practical effectiveness of a given intervention. As noted above, that intervention, when paired with others, may account for only a small percentage of the variance or source of improvement. Looked at somewhat differently, Robertson-Tchabo (1980) suggests that change may not result in success at a given task. Instead, the final level of performance must be the ultimate criterion for the effectiveness of an intervention. Conversely, the lack of change may not reflect failure on the part of the intervention. In order to avoid ceiling effects for younger groups, tasks are often too hard for the older subjects, who consequently show no improvement in performance. If the task is made sufficiently easy for the older groups, thus reducing anxiety and negative reactions to the experiment, there may be little room for improvement for the younger and perhaps the older subjects. Change, then, while a measure of interventive effect, must be assessed within the context of the study design.

Few of the studies reviewed examine the long term effect of interventions. When delayed recall was tested, the amount

of time intervening between training and testing varied from study to study. Dixon, et al. (1982) tested recall after one week; Robertson-Tchabo, et al. (1976) after one day. Overall, there was little indication of persistence of training improvement.

Generalizability of training was also rarely examined. When generalization to new tasks was assessed, the findings were usually negative. Robertson-Tchabo, et al. (1976), who found significant improvement in memory performance with the use of method of loci mnemonics, saw no transfer of training to new tasks on the day immediately following the last day of training. It is important, then, to measure not only the short term effects of interventions but also the usefulness of interventive techniques over time. It is necessary to look at the flexibility or generalizability of an intervention, and at procedures which may be helpful in ensuring persistence and generalizability (Poon, et al., 1980).

Data Analysis and Design -- Sample Size

The size of samples in the studies reviewed varied considerably. Robertson-Tchabo, et al. (1976) used only 5 subjects in their first study and 10 for each of three groups in their second study. Rowe and Schnore (1971) used 16 subjects per group; Mason and Smith (1977), 24 subjects per group. Catino, et al. (1977) and Hanley-Dunn and McIntosh

(1984) used more subjects: 40 and 56 per group, respectively. Arenberg (1977) had a much larger sample, though groups were not of equal sizes: the younger group had 68 subjects; the older group, 136 subjects. This variation in sample sizes results in problems with both the internal validity of individual studies and the comparability of studies.

Siegler and Cunningham (1982) write that small sample sizes increase the risk that findings are spurious, that they occurred by chance and are inaccurate reflections of reality. As the possibility of error increases, the opportunity decreases for replication of experimental findings by means of subsequent studies. Studies which examine multiple factors require significantly larger samples than do single factor studies. For example, Siegler and Cunningham suggest a ratio of 25 subjects for each variable for muliple regression analyses. Jaeger (1984) indicates that when a sample is comprised of 5% of the population from which it is drawn, experimental findings may be inferred to represent findings for the entire population. Glass and Stanley (1970) suggest that the sample be comprised of 1% of the population. With any of the above rules for sample size, it is clear that many of the samples used in the intervention studies were too small to avoid unreasonable error in replication or generalization of findings.

Data Analysis and Design

Ecological Validity of Research Setting

The most pressing question for the adult educator or other gerontological practitioner concerns the meaning and validity of interventive research for the older adult as he or she functions in the the real world. With few exceptions, the studies reviewed took place in the laboratory, with laboratory tasks rather than with behaviors which might be more naturally experienced in daily living. The appropriateness of the experimental setting and the generalizability of experimental results are subjects of some controversy among gerontologists.

Bahrick (1985) suggests that in the laboratory, individuals do not behave naturally. Rather, in this artificial setting, subjects are likely to behave in the ways experimenters expect and suggest. Bahrick urges that experimental questions not only be tested but also raised in natural environments. Without such an ecological approach, important variables will be missed.

Natural settings are, of course, complex and uncontrolled. It is difficult, if not impossible, to control variables and quantify findings. For these reasons, researchers tend to perform their studies in the laboratory. Mook (1985) urges that experimental questions be raised in natural settings. However, he insist that only within a laboratory can variables be sufficiently controlled to

provide confidence about experimental conclusions. Rubin (1985) insists, however, that control is not essential. Rather, observation of the natural regularity and complexity of human behavior within environments which are familiar to subjects leads to valid conclusions about human function.

As noted earlier, laboratory studies tend to look at single factors rather than at multiple, complex factors as they exist in natural settings. Single factor analyses do not yield information about the interrelationships of factors nor about the amount of impact each factor exerts (Petrinovich, 1985). Bahrick, however, (1985) contend that, given the multiplicity of factors which may impinge on behavior in natural settings, there exist insufficient methodologies for analysis of data. Correlational studies may yield information about interrelationships of factors. However, such methodologies are atheoretical and descriptive. Correlations show relationships, but not causation; thus the effectiveness of an intervention may not be concluded on the basis of such studies (Costa & Fozard, 1978).

Data Analysis and Design

Ecological Validity of Interventions and Tasks

A variety of interventions must be tested. Some interventions may be more feasible in laboratories than in the real world. For example, the pace of a task is easily controlled in the laboratory. Adjustment of pace to the

needs of the individual is more difficult in the classroom and impossible when the stimuli are presented by conventional television or radio. Some interventions, such as method of loci (Robertson-Tchabo, et al., 1976), use of imagery (Treat, et al., 1981), and supportive instructions (Ross, 1968) have been found to be effective, but generalization of the intervention to new tasks seems to require continued reminders and training by researchers. Guidance would be difficult to maintain in natural settings. Interventions may be effective in some situations and not in others (Erickson, 1978; Robertson-Tchabo, 1980). The effectiveness and feasibility of interventions in ecologically valid settings was not examined in the studies reviewed above (Yesavage & Sheikh, 1985).

Similarly, the ecological validity of the memory tasks performed in the laboratory must be questioned (Costa & Fozard, 1978; Hartley, et al. 1980). Memorization of digit spans, word lists, paired-associates, and short prose passages are easily controlled and quantified tasks (Wass & Olejnik, 1983; Yesavage & Sheikh, 1985). The syllogistic reasoning problem used by Fullerton (1983) provided interesting and multifaceted tests of the subjects' performance. However, these tasks may not represent the memory activities which individuals perform in their daily lives. The effect of interventions on memory of grocery lists, doctors' instructions, or news items, for instance, is

rarely assessed (for exceptions, see Dixon, et al., 1982; Kausler & Hakami, 1983a, 1983b; Richardson & Pratt, 1981; Weston, et al., 1980; Zarit, Cole, & Guider, 1981; Zarit, Gallagher, & Kramer, 1981); however, it is in these areas where basic research can contribute to daily function.

IMPLICATIONS FOR LEARNERS

Age-related memory changes have been well-documented in the literature. Older people exhibit less organization, slowing of behavior, and a need for extended practice and a supportive environment. These memory changes imply the need for quantitative changes in learning techniques: Learners in general require organization, reasonable pacing, practice, and positive feedback; older learners require greater attention to these factors. Some of the age-related changes, however, require qualitative changes in learning methods and materials. Older persons tend not to spontaneously mediate, to process deeply, or to perform well with abstract or unfamiliar memory items. While it would not be necessary to train and encourage younger persons to use mnemonics or to relate new learning to already known information, older learners often benefit greatly from such attention. It appears that the older learner requires not merely more of what the younger learner needs; rather the older adult also requires qualitative changes in order to

perform optimally. Moreover, the consequences for not meeting the needs of the younger and older learner are different. The younger person is likely to continue to perform, increasing the number of commission errors he or she makes. The older person is likely to withdraw from the learning situation, physically or through omission errors.

Memory intervention research suggests a number of ways in which the older learner can be helped to perform better. Given the methodological problems discussed above, these implications remain tentative; nonetheless, they represent directions suggested by basic research as it currently exists. The implications are discussed below in an organizational scheme suggested by Okun (1977).

Educational Implications of Memory Intervention Studies

Organization

1. Provide advanced organizers.
2. Present information in a highly organized fashion.
3. Explicate the organization of learning material, lectures, etc.
4. Provide organizational cues, such as category labels.
5. Train learners in organizational techniques.
6. Encourage learners to organize for both encoding and retrieval of information.

Mediation

1. Provide mediators.
2. Encourage and train learners in the use of mediators.
3. Teach specific mediational techniques, such as method of loci and face-name mnemonics.
4. Place particular emphasis on encouraging learners to use self-generated mediators.

Orienting Instructions

1. Before and during presentation of new learning materials, provide orientation which encourages deep processing. For example, pose problems to solve with new information or ask questions about the meaning of new materials.
2. Teach deep processing strategies, for example, the use of meaningful questions.
3. After initial learning, provide the opportunity for learners to use new information. For example, ask learners to relate new learning to information which they already know.

Quality of Memory Items and Mediators

1. Emphasize learning of concrete and familiar materials.
2. Use concrete and familiar examples. Point out relationships among new learning materials and examples.
3. Encourage learners to generate their own examples.

These will tend to be more familiar to the learner and at a comfortable level of abstraction.

4. Introduce novel and abstract information gradually, to allow for accommodation to the new learning material.

5. Encourage learners to find familiar aspects of new learning items.

6. Provide opportunity for practice with novel and abstract materials in order to increase familiarity.

Modality

1. Emphasize visual presentation when contextual cues and the opportunity to review are present (e.g., prose passages). Emphasize auditory presentation with disconnected pieces of information (e. g., word lists).

2. Use multimodal presentations of new information.

3. Encourage learners to review when information is presented visually.

4. Encourage learners to analyze their learning styles and the relative effectiveness for them of the presentation modalities.

Pacing

1. Adjust pacing to the special needs of the older adult.

   a. Present new information at a slow rate, with attention to the length of presentation of individual items and the time between presentation

of two or more items.

b. Provide adequate time for the learner to respond.

2. Allow the individual learner to set the pace of learning and response whenever possible.

Practice

1. Present new information two or more times, the number of repetitions depending on the needs of the learner and the complexity of the materials.

2. Provide learners with repeated opportunities to learn and retrieve new information.

3. Train in rehearsal strategies. Encourage their use.

4. Provide opportunity to apply new information in a variety of settings or with a variety of tasks.

Affective Factors

1. Reduce anxiety by minimizing instructor's evaluation of learners, presenting new information slowly, emphasizing concrete and familiar learning materials, providing adequate examples and practice.

2. Create a supportive environment by acknowledging and rewarding successes and by providing information about normal adult learning abilities.

3. Acknowledge stress of learning situation. Train learners in relaxation techniques and stress management.

RESEARCH AGENDA

Research on memory interventions has, up to this time, concentrated on performance within laboratory settings. In the previous section, the implications of these studies for elderly persons persons in natural settings were listed. However, it was noted that further study is needed in order to ascertain the appropriateness of interventions for real-life tasks. In this section, directions for future research are explored.

First, the interrelationship of factors which affect memory performance must continue to be explored in order to better understand the cause of memory decline. Given an understanding of the etiology of memory decline, researchers might then explore whether it is more useful to provide interventive techniques which remediate the weakness or to strengthen facets of memory which show little decline. For example, research indicates that older persons have greater facility with verbal mediation than with visual mediation, yet researchers are in conflict as to whether it would be of greater use to train the declining visual skills or to concentrate training on verbal abilities (Backman, 1985; Cermak, 1980; Winograd & Simon, 1980; Yesavage & Sheikh, 1985). An examination of the interrelationships and relative strengths of factors which affect and facilitate memory function, then, may indicate which interventions should receive emphasis in memory training programs, classroom

situations, and such.

As suggested earlier, memory change with age has been documented by experimental research. However, the extent of decline in memory for daily activities is not as certain (Charness, 1981a, 1981b; Poon, Fozard, & Treat, 1978). In addition, individual variation in memory performance has not been sufficiently explored. There exists a need, then, to study the individual within his environment (Costa & Fozard, 1978; Hartley, et al., 1980; Robertson-Tchabo, 1980) and to discover what particular tasks present problems in real-life situations (Crovitz, 1985; Poon & Fozard, 1980; Robertson-Tchabo, 1980). It is important to explore what environmental, personality, and health factors affect the individual's performance (Costa & Fozard, 1978; Erickson, 1978; Robertson-Tchabo, 1980). Moreover, there is a need to replicate laboratory studies with real-life tasks in natural settings in order to ascertain whether laboratory findings are ecologically valid (Costa & Fozard, 1978; Poon & Fozard, 1978, Robertson-Tchabo, 1980).

The application of single interventions to multiple tasks would yield information about the appropriate area of application of that intervention both in the laboratory and in natural settings. Similarly, as discussed earlier, multiple interventions should be tested with individual tasks in order to assess the relative value of those interventions. As noted earlier, the study of single

interventions applied to single tasks may yield significant results, yet that intervention may be less effective than other possible techniques (Petrinovich, 1985). For example, in a number of studies reviewed in this dissertation, subjects had the opportunity to practice tasks, become familiar with the testing situation, or participate in supportive environments which relieved their concerns about memory problems, while, at the same time, learning specific inventive techniques (DeLeon, 1974; Hultsch, 1974; Richardson & Pratt, 1981; Taub, 1966, 1973; Taub & Long, 1972; Treat, et al., 1981; Weston, et al., 1980; Zarit, Cole, & Guider, 1981; Zarit, Gallagher, & Kramer, 1981). It is not clear in these studies whether the intervention, itself, or practice and noncognitive factors were responsible for the greater percentage of improvement.

While many interventions have been tested with older adults, research has been extensive rather than intensive (West, 1985). In the review of studies above, nine categories of interventions were examined, with only four to twelve studies in each category. For the most part, the findings are difficult to compare and conclusions about the intervention are difficult to reach due to the diversity of sampling, measurement, and design techniques. For example, only three studies concerned with method of loci mnemonics have been conducted with older subjects (Robertson-Tchabo, et al., 1976; Rose & Yesavage, 1983; Yesavage & Rose, 1983). The

demographics of the samples were insufficiently reported to determine comparability of those sample on measures of health, socioeconomic status, occupational level, and such. Two of the studies used only elderly subjects, the age ranges of which differed from each other; the third study used young, middle-aged, and old subjects. List learning was utilized in all three studies, though the word lists were not comparable from study to study. While all three studies found positive effects for method of loci, the design of the studies were very different, hence findings cannot be considered confirmations of each other. In addition, none of the studies answered several important questions about the method of loci: Is the technique useful without constant reminders by trainers? Is the technique too complex or too dependent on visualization skills for maximum usefulness to the older adult? Is the technique generalizable to other tasks both in the laboratory and in natural settings? The method of loci studies, then, like studies concerning other interventions, require replication, with controlled changes in the dependent variables, in order to ascertain the validity of the findings in the laboratory and their application to real-life situations.

A number of interventions have not been studied at all or have been studied only with young samples. For example, personal events which occur at the time of encoding of information might be used as cues for retrieval (West, 1985).

Role-playing or simulations of conditions at the time of encoding may aid in retrieval (West, 1985). Similarly, matching of retrieval and encoding cues, which, in natural settings, would require recall of encoding conditions, might also improve memory performance (West, 1985). Training which includes application of an interventive skill to multiple tasks may result in the technique being better learned and more readily generalized to new tasks by the subject (West, 1985).

The effect of practice has been studied (DeLeon, 1974; Hultsch, 1969, 1974; Kausler, et al., 1984; Taub, 1966, 1973; Treat, 1977; Treat, et al., 1981; Weston, et al., 1980; Willis, et al., 1983; Zarit, Cole, & Guider, 1981; Zarit, Gallagher, & Kramer, 1981). However in these studies, repetition of the task generally has been limited to repeated trials within one session or to trials completed over the course of three to seven sessions. Extensive practice appears to increase knowledge about the task, organization within memory stores, and ability to attend to the task; in short, extensive practice leads to expertise which results in less memory decline than found with less well practiced memory information (Charness, 1981a, 1981b, 1985). Studies which focus on extended practice in order to achieve expertise or automaticity of memory would be useful.

Similarly, extended practice of interventions may lead to more consistent use and better generalization of

techniques (West, 1985). Robertson-Tchabo, et al. (1976) suggested that method of loci mnemonics were not generalized to new tasks because of insufficient training with the technique. Hulicka and Grossman (1967) found that self-generated mediators were more often utilized by subjects than were experimenter-generated mediators. Perhaps extended practice would increase familiarity and depth of learning of experimenter-provided techniques, thus maximizing the usefulness of those interventions.

A number of interventions have been tested with infirm or institutionalized elderly, but not with healthy, community dwelling persons. The usefulness of these interventions for the latter population should be studied. For example, expanded interval rehearsal, in which the time between repetitions of the items to be remembered is increased when recall is correct and decreased when recall is incorrect, has proven useful in clinical settings (Crovitz, 1985; Moffat, 1985). Engaging in appropriate motor activity while learning a memory task has also been facilitative (Backman, 1985). Finally, external memory aids have proven useful. For example, recall of future activities is helped by keeping notes of to-be-remembered items; by using calendars, pillboxes with the days of the week marked, pill "clock" reminder systems (West, 1985), alarm clocks, and diaries (Wilson, 1985), or by selecting specific locations for storing articles (West, 1985). Adaptation of the environment

in order to minimize the need to remember some information has been successful (Wilson, 1985). Whether reducing the memory demands in one area increases the likelihood of successful memory performance in another area may be explored.

RESEARCH IN EDUCATIONAL SETTINGS

As the population of older adults increases and as this population becomes increasingly involved in educational pursuits, the educational gerontologist is called on to maximize the effectiveness of instruction and learning. Research is necessary in order to explore the ways in which standard instructional techniques affect the elderly and the ways in which modifications of those techniques are necessary. Laboratory-based research indicates that both quantitative and qualitative changes in educational approaches are necesary. Ecologically valid research would clarify this issue for the educator.

With all student populations, a number of factors must be considered. Organization and clarity of materials and presentation, repetition, practice, multimodal aproaches, student involvement and activity, teacher-student goal setting, training in study techniques, feedback about performance, and reduction of student anxiety are all important to learning. Researchers must explore whether older students require an intensification of attention to

these factors, that is, quantitative changes in techniques which are used with younger persons.

In addition, researchers must examine whether there is a need for qualitative changes in instructional approaches. Much of the research reviewed in this dissertation indicates that memory interventions which are effective for the younger adult are also effective for the older person, though often the effect is less dramatic for the latter. It is not clear, yet, whether very different approaches for the elderly would be more facilitative. For example, studies have shown age-related deficits in organization (Craik, 1977; Friedman, 1980; Hartley, et al., 1980; Smith, 1980; Smith, et al., 1983;), a decrease in the spontaneous use of mediators (Hulicka & Grossman, 1967; Hulicka & Rust, 1964; Hulicka & Weiss, 1965; Treat & Reese, 1976), a tendency to perform better with verbal mediation rather than with visual mediation (Hulicka & Grossman, 1967), and reduction in processing speed (Arenberg, 1975; Birren, et al., 1980; Fozard, 1980; Salthouse, 1982). Older adults often exhibit increases in cautiousness, anxiety, and depresssion, particularly in situations with which they have had little recent experience (Richardson & Pratt, 1981; Wass & Olejnik, 1983), the educational settings being among these unfamiliar situations. Researchers must determine whether techniques are needed which specifically address the memory processing behavior of older people. Two model research questions are

presented here as examples of research into the quantitative and qualitative changes which may be helpful for the older student.

Multibaseline studies have been used in intervention research with infirm elderly populations (Moffat, 1985; Wilson, 1985). Such studies, in which a number of interventions are applied to a single task, result in information about the relative benefit of various interventive techniques. In the classroom, one might, similarly, apply a variety of techniques to a single learning task. For example, students may be presented with a language learning task. The intervention may include organization of the task, training to recognize that organization, training in visual mediation and verbal mediation, instructions to practice, and provision of a supportive environment such that anxiety is reduced. By presenting the various interventions sequentially rather than simultaneously, it is possible to chart points of significant improvement, and thus to assess the relative value of given techniques. If a factor other than the interventions is responsible for change, no dramatic points of improvement will be seen (Wilson, 1985). That is, if an extraneous variable, such as familiarity with the classroom situation or task, is responsible for improvement, learning should improve linearly. If neither an extraneous variable nor any of the interventions is facilitative, the learning should be represented by a flat line. When a range

of age groups comprise the sample, information would become available about the relative value of interventions to those different age groups. It may become apparent, for instance, that young adults show greatest improvement when material is well-organized and presented visually. The most important aid for the elderly adult, however, may be anxiety reduction and verbal presentation. In essence, the multibaseline study would increase information about quantitative needs of older learners for interventive techniques.

Research concerned with qualitative changes in instructional techniques has begun with studies concerning the sources of age-related changes in memory. However, studies have not ascertained whether remediation of these processing deficits is essential or even preferable (Cermak, 1980; Winograd & Simon, 1980; Yesavage & Sheikh, 1985). In fact, there is some indication that older people compensate for many memory changes without outside intervention (Backman, 1985; Charness, 1985). While it would be useful to devise and test interventions particularly designed for the older student, the first step would be to assess the interventive strategies already used by the elderly. Weinstein, Duffy, Underwood, MacDonald, and Gott (1981) studied the interventions reported by elderly persons for memory of experimental and real-life tasks. It would be useful to replicate this study in educational settings. Older persons would be asked to report on their memory

strategies and their assessment of the usefulness of the strategies. In addition, objective measures of success with the learning task would be obtained, and correlations of subjective and objective measures could be analyzed. Analysis of memory strategies used by the successful student might well indicate techniques which should be encouraged or taught to other older students. Successful techniques would also offer information about directions for the design of new interventions. Unsuccessful techniques would indicate areas of retraining which might aid the student.

CHAPTER IV

SUMMARY

As the number of older adults engaged in learning increases, it is incumbent upon educators and psychologists to examine both age-related changes in learning and methods of remediating deficits in learning processes. Researchers have looked at memory, an essential ingredient of learning, and have found deficits in the memory performance of older persons. Researchers have also looked at interventions meant to minimize or remediate memory changes. However, until this dissertation, no comprehensive review of the intervention literature had been conducted.

Manipulation of organizational techniques, the quality of the memory items, the modality of encoding and retrieval, mediation, orienting instructions, pacing, practice, and affective factors have been shown, in laboratory tests, to be effective interventions. Training programs have likewise been effective. However, the relative power and efficiency of individual interventions has not been assessed. It does appear that the most persistent aids to improvement of memory performance are practice and affective support. In addition, there is a need to examine the performance of the older adult in his natural environment. While interventions have been

useful in the laboratory, little research has dealt with changes in memory function and the effectiveness of interventions with real-life tasks.

Until ecologically valid studies have been conducted, it is suggested that attempts be made to alter the learning environment by application of laboratory findings to the real-world task. Many of the techniques suggested are similar to those used in any carefully designed educational setting, with an intensification of these techniques for the older adult. For example, attention to the pace of learning is important for all learners. An adequate pace for an older person, though, would be slower than that of a younger person. In addition, in some areas, older persons require interventions which younger persons do not need. Older persons do not mediate spontaneously and tend to use verbal mediators more often than visual mediators. Training and encouragement in the use of mediators, then, would be more helpful in a program for older learners than in one for younger persons. In short, research on interventions, taken collectively, indicates directions the educator and psychologist might take in helping the older adult maximize his memory performance. Additional research is clearly needed.

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