EFFECTS OF AGE ON RECALL – A QUALITATIVE CONTENT ANALYSIS OF STUDIES FROM 1987 TO 1998

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FROM 1987 TO 1998

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CHAPTER I

INTRODUCTION

Fear of memory loss is a common concern of people as they age. As the percentage of adults older than sixty-five increases, a growing interest in the cognitive and intellectual functioning of these adults has also emerged. Numerous studies have focused on the subject of memory and how it functions with increasing age. By and large, most of the populous considered the decline in memory capacities to be a natural and even unavoidable phenomena associated with the aging process (O'Donnell, 1993).

Older people frequently complain about memory failures (Lowenthal, et al, 1967), and there is a uniform trend to report more memory problems with advancing age (Dobbs & Rule, 1987). It is generally assumed that memory declines with advancing age, and that forgetting names, losing objects, or omitting a step in a familiar routine are things that happen as people grow older.

Older adults remember less and perform worse than their younger counterparts in several categories of memory tasks as evidenced by an extensive body of research. Specifically, when asked to deliberately recollect the contents of studies measuring memory functions, i.e., recall, older adults remembered considerably less information than younger adults.

Organization of material to be remembered, whether inherent or imposed, generally enhances recall. Older people are reluctant to use mnemonic devices spontaneously, however. Recall performance improved when encoding or retrieval strategies were either implicit in the material or explicitly provided for older subjects. Age differences persist, however, perhaps because the use of a particular mnemonic device, unless highly practiced, imposed an additional memory load. Elderly persons with the highest levels of education and socioeconomic status performed less differently than younger people on memory tests (Nolan & Blass, 1992).

For some time now, researchers and psychologists have been investigating the relationship between age and memory functioning. Several of these studies have reported on the differences between young and older adults on the effect of recall.

Recent studies of the function of older adults have revealed a pattern of impaired performance in the areas of verbal and non-verbal information. The retrieval of information takes longer and involves more errors after age fifty. As individuals age, more items accumulate in storage, resulting in more competing choices as people try to match specifications of what they want with the characteristics of each item in storage. This indicates that memory is rich and well stocked. Also, information processing clearly slows down with age. Many people find it takes longer to process information in order to retain it.

Recall and the Memory Process

Information stored in memory can be processed in a number of ways. Memory recall or retrieval is the ability to retrieve or reproduce learned material. Recognition is

the ability to identify material that has been encountered before. An example of good recognition and faulty recall is the recognition of a person's face but the inability to recall the person's name.

There are other forms of inability to recall information that has been truly forgotten. For example, in struggling to remember a word, a person may often recall the first letter and the number of syllables but not the word itself. In other instances, information may be remembered only under conditions similar to those under which it was learned. Such memory lapses are not fully understood, but they illustrate the complexities of memory storage and recall.

Retrieval describes how one gets information out of storage when it is needed. One method of retrieval is recall. Recall requires bringing forth to-be-remembered information. Recognition involves choosing from a group of possible answers. Therefore, recall is a more demanding test of retrieval than recognition. In tests of recall, major differences have been demonstrated for older and younger people. However, in tests of recognition, the differences between younger and older learners were small or nonexistent (Poon, Rubin, & Wilson, 1985). Age-related differences in long-term memory were more likely revealed if memory was measured by a recall rather than a recognition task, but they do share one important characteristic. Recall and recognition require conscious recollection of previous experiences. In both of these tasks, a person is aware of the fact that he or she remembered something experienced in the past (Rybash, Roodin, & Hoyer, 1995).

Since the 1960's, human memory has been studied primarily from the information processing approach. The mind was visualized as a computer with information being

entered, stored, and then retrieved as needed. Comprehending where people store or file what they learn, which is termed the structural aspect of memory, was the first major focus of study from this perspective. Three categories were used to describe the different components of memory: sensory memory, short-term (or primary) memory, and long-term (or secondary) memory (Rybash et al., 1995). Various authors describe each of these three forms of memory somewhat differently. In general, the structural model emphasizes that each form of memory has a distinct capacity in which information if filed for a period of time. Sensory and short-term memory have very small capacities and brief storage times with milliseconds for sensory memory and about one-half minute for short-term memory. Long-term memory has an enormous capacity and can store information for a lifetime. Recently researchers have visualized these structures as a continuum with the focus on the process that account for how material is transferred from one store to another (Rybash et al., 1995).

Emphasized in the process aspect of information processing are the mental activities that we perform when we try to put information into memory (learn), or make use of it as some later date (remember). Memory is usually divided into three phases. The processes involved include encoding or the acquisition phase in which the information is entered into the system. The encoding (acquisition) process interprets a stimulus and stores a representation of the interpretation in memory. Individuals code information on many different dimensions, and the type and level of encoding depends on the task requirements. Encoding can include physical, word meanings, and sentence structures. (Seamon, 1980).

Encoding refers to the registration or pickup of information; storage refers to the retention of information in memory; and retrieval refers to finding or using information in memory. From the memory processing perspective, researchers are trying to understand the factors that are associated with age differences in the efficiency of encoding, storage, or retrieval. There is a large amount of evidence to suggest an age-related encoding deficit and an equally large amount of evidence to suggest an age-related retrieval deficiency. An encoding deficit suggests that elderly persons are less capable of engaging in the organizational, elaborate, and imagery processes that are helpful in memory tasks (Rybash et al., 1995).

The storage phase of the memory process takes place when information is retained in memory. The final phase consists of output (retrieval) and describes how the material gets out of storage when needed.

Two of the most common methods of retrieval are recall and recognition. Recall requires bringing forth "to-be-remembered" information, while recognition involves choosing from a group of possible answers. An example of recall would be an essay exam, whereas a multiple-choice test would be an example of recognition. Recall is considered to be a more demanding test of retrieval than is recognition. The retrieval process consists of four aspects. recognition, recall, recollection, and reconstruction. Recognition is the ability to recognize things that are known through previous learning and is the major way adults use of their memory. Recall is the unaided reproduction of earlier learned material. Recall works best when the retrieval cues used most closely match the encoding cues used in initial acquisition. Some familiar examples of recall are talking or writing, which require the individual to remember the words needed in order to communicate thoughts.

Recollection is a process of remembering a complex of events that occurred at the time of learning. Reconstruction is the reproduction not of the learned material itself but of the order in which it was previously given (Conti & Felienz, 1993).

In general, recall and recognition are the two most important aspects of remembering. The ability to remember through recognition is greater than that by recall; for example, in reading an individual can recognize and know many more words than can be recalled in speaking or writing. Recall falls into several areas. These may include pictorial, texts, events, and word finding.

Recall and the Aging Process

In 1890, a famous psychologist, William James, distinguished between primary memory and secondary memory. James identified primary memory with the conscious awareness of recently perceived events and secondary memory with the recall of events that have left consciousness. James's distinction was based primarily on his own introspection, but other experimental evidence supports a similar distinction. Today a host of information processing models incorporates a distinction between primary or short-term memory and secondary or long-term memory. A generalized three-stage model indicates that processes that transfer information from sensory storage to short-term memory entails attention. The transfer from short-term memory to long-term memory requires rehearsal. Finally, the generalized model hypothesizes different laws of forgetting for the three memory stages (Rybash et al., 1995)

Forgetting from sensory storage is thought to result from the process of simple decay; information is lost within less than a second simply as a function of time.

Forgetting from short-term memory generally results from the displacement process in which new information is replacing old information. Finally, forgetting from long-term memory results from interference that occurs between memory for one piece of information and other information learned earlier or subsequently. Many investigators believe that interference does not destroy information in long-term memory but instead impairs the recall of information from long-term memory (Rybash et al., 1995).

Several psychologists are examining the manner by which information is transferred from short-term to long-term memory. Today, it is recognized that simple role rehearsal is not the only path or even the most efficient path to learning and remembering. Processes or organization, semantic elaboration, and imagery can be highly effective for enhancing long-term memory. Semantic elaboration refers to a strategy used to enhance memory. Semantic memory is the use of acquired knowledge about the world. When people use semantic memory, they can think about the meanings of words or concepts without reference to when or how they acquired such knowledge. Imagery is the formation of picture-like representations; a process known to aid memory. These might be less efficient or less likely to occur in old age. Although age-related differences are common in long-term memory, the magnitude of these differences can depend on the nature of information-processing individuals utilize. This is why organization, semantic elaboration, and imagery are so important and why the improvements of the use of these techniques are very effective tools for older adults (Rybash et al., 1995).

Research has been done from the information-processing framework, which was conducted on the topic of memory and aging. The general consensus from this work is that certain memory functions decline with age. A number of others have cautioned,

however, that because of methodological considerations and the variables being studied that this work must be interpreted with care. The vast majority of this research focused on comparing young adults, who were usually introductory psychology students, with older adults by cross-sectional designs. These two factors combined made it difficult to generalize across age groups because of subject and cohort bias. Also, most of this research was conducted primarily in laboratory settings using memory tasks and activities, such as repeating back nonsense words and list of random numbers that are not related to real-life learning tasks. The primary criticism leveled against this type of research on memory is that these tasks and skills were taken out of context of everyday life situations. With these limitations in mind, some documented research on memory in adulthood has been conducted (Rybash et al., 1995)

Short-Term and Sensory Memory

In general, few clearly defined changes have been found in both short-term and sensory memory as people age. Since fairly major changes with age occur in vision and hearing it would follow that these changes with age in both vision and hearing would be reflected in sensory memory. Yet, only minor deficits have been found although it is often difficult with present testing procedures to distinguish between age-related physiological decline in the senses themselves, especially hearing, and actual decrements in the process of sensory memory. Short-term memory is also relatively stable in relation to simple tasks. Some studies demonstrated, however, that when memory tasks become more complex or are speed-related, older people might be at a disadvantage in relation to short-term memory processing (Merriam & Caffarella, 1991).

Long-Term Memory

Long-term memory is where age deficits are more commonly found. Four major differences have surfaced in long-term memory for older in comparison to younger learners. These include changes in the encoding or acquisition of material, the retrieval of information, the level of processing, and the speed of processing. Few changes have been noted in the storage or retention capacity of long-term memory over the life span (Merriam & Caffarella, 1991).

In reviewing the processes related to long-term memory, researchers have questioned whether it was more difficult for adults as they age to get information into the system (to encode it) or get out (to retrieve it). The response to this question was both. However, it was not at all clear which part of the process created the most difficulty (Merriam & Caffarella, 1991).

Recall performance does improve when encoding or retrieval strategies are either implicit in the material or explicitly provided for older subjects. An implicit memory task is one that does not require an individual to consciously recollect a past event. Implicit memory has been referred to as memory without awareness. A person is not aware of the fact that he or she is remembering something while performing an implicit memory task. A memory task in which a person is instructed to consciously recollect a previous experience taps explicit memory (Merriam & Caffarella, 1991). Recently, there has been considerable interest in the study of developmental changes in forms of memory that do not seem to involve conscious recall or recognition. The findings of these studies suggest a relative preservation of certain types of implicit (or unconscious) memory in old age. Specifically,

age deficits are found on measures that directly or explicitly assess recall or recognition of previous information but not on measures that assess the non-conscious, implicit, or indirect effects of experience on subsequent performance. It should be pointed out that some investigators have found age-related declines using implicit measures but the magnitude of the age deficit was less compared with that obtained using explicit measures of memory (Merriam & Caffarella, 1991).

Problem Statement

Memory is an aspect of cognitive functioning that has been studied with reference to age. To understand the effect of memory on real-life learning, it is important to review the role of (a) recall and the memory process, and (b) recall and the aging process. A review of the literature is necessary to determine the relationship of these roles and to determine if a pattern exists in the scattered literature, which would reveal the effect of age on recall in memory.

Purpose

The purpose of this study was to analyze the contents of selected research articles in the area of recall in the aging process to describe the patterns within the research studies. Sample articles were selected from the 12-year period between 1987 and 1998.

Research studies have examined the effects of age on recall. This content analysis presents an overview of the results of several of those research studies published between 1987 through 1998. These studies were obtained from PSYCH, ERIC, and Dissertation Abstracts. This content analysis was conducted on studies on the following memory

tasks: (a) pictorial and spatial), (b) prose (b) printed text, (c) events, (d) word-finding and (e) Cloze tests.

Research Questions

Several questions guided this study. These include:

1. What are the criteria used to compare younger and older adults' memory differences?
2. How is recall different in younger and older adults related to categories of verbal and non-verbal information?

Limitations of Study

This study was limited to information contained in readily available documents to adult education practitioners in the Tulsa, Oklahoma, area. Therefore, the search for articles was confined to Tulsa University, Oklahoma State University (OSU), OSU-Tulsa University, OSU Library at Stillwater, and inter-loan library locations as well as the Tulsa Public Library. These facilities are available to practitioners, professionals, and students who have access to all these locations in Tulsa, Oklahoma. Several options were available for securing the articles. These include mail, Internet access, and personal visits to the libraries within Tulsa. The research was also limited to analysis of completed experimental studies from 1987 to 1998.

Definitions

Aging – Becoming old or older; the process of maturing; chronological age (Rybash et al., 1995).

Long Term Memory – The process involved in the storage, retrieval, and access of information over a lengthy period of time (e.g., hours, months, and years) (Rybash et al., 1995). Information is encoded by associating the information with our senses and experiences or by connecting the information to existing knowledge.

Episodic Memory – The memory for the details of personally experienced events, such as the ability to accurately recall details about the source or the context of remembered information (Rybash et al., 1995)

Explicit Memory Task – A task wherein a subject is directly instructed to consciously remember a previous event or experience (Rybash et al.,1995).

Implicit Memory Task – A memory task that does not require a person to consciously remember (Rybash et al., 1995).

Memory – The ability to remember; capacity to retain or recall that which is learned, and experienced, all that a person remembers that can be recalled to mind.

Older Adults – There are several distinctions within this age group: "young-old" (55 to 74 years) and the "old-old" (75 and older) There are other designations of "elderly" (those over 75) and the "very old" (those over 85)" (Neugarten, 1974). These age distinctions are reminders of differences and diversity of those generally thought of as "older adults."

Recall – Ability to retrieve or reproduce learned material.

Recognition – Ability to identify material that has been encountered before.

Retrieval – Finding or using information in memory.

Semantic Memory – In memory system theory, memory for basic facts (Belsky, 1997).

Sensory Memory – Information that is stored just long enough to be processed further. In sensory memory, auditory information is retained longer than visual information. Sensory memory is the fleeting after-image of a stimulus reaching a sense organ that rapidly decays (Belsky, 1997).

Short-Term Memory – Information that is stored and retained for a brief period, which is usually less than sixty seconds (Rybash et al.,1995). Short- term memory offers a limited storage area where information is prepared for long-term storage. In short-term memory an individual is conscious of the information and is actively thinking about it (Belsky,1997).

Summary

Recall and recognition are two methods of retrieval, which require the processing of information stored in memory. In recognition, cues are provided to the person and the individual will recognize the information when presented with a list of options. Recall provides no cues. Recall is more demanding than recognition. Differences in long-term memory were more likely revealed if memory were measured by a recall rather than a recognition task. Few changes have been noted in the storage or retention capacity of long-term memory over the life span.

One of the main purposes of memory is to help direct our learning to use the vast knowledge system, which is stored in our memory. The link between memory and learning are inseparable. The memory process involved in learning consists of encoding, storage and retrieval. Encoding refers to the registration of memory; storage refers to retention of information; and retrieval refers to finding or using information. Recall is the unaided reproduction of earlier learned material. Recognition is the ability to recognize things that are known through previous learning. There is a large amount of evidence to suggest an age-related encoding and retrieval deficiency. An encoding deficit suggests that elderly persons are less capable of engaging in organizational and imagery processes that are helpful in memory tasks. There is also evidence that differences have surfaced in older learners' speed of processing.

Five kinds of learning outcomes are intellectual skills, verbal information, cognitive strategies, motor skills, and attitudes. For the learning process to take place the passage of information occurs through the senses into either short-term or long-term memory by the level of attention and perceptions of the learners.

Tests that require long-term memory or the remembrance of events that left consciousness often show age-related declines. The magnitude of these differences can depend on the nature of information-processing individuals utilize. This is why organization, semantic elaboration and imagery are so important and why improvements of these techniques are effective tools for older adults. In general, few clearly defined changes have been found in short-term and sensory memory as people age. Short-term memory is also relatively stable in relation to storage and capacity and simple tasks. When

these memory tasks become more complex or speed-related, older people might be at a disadvantage in relation to the short-term memory processing.

Learning involves the acquisition of skills and knowledge that allow us as individuals to adapt to our environment by building on our previous experiences. These newly acquired skills for our behavior must be retained. We must be able to store our skills over time and activate them when we need them. Memory serves this function. Therefore, the purpose of this study was to analyze the contents of selected research articles in the area of recall in the aging process to describe the patterns within the research studies.

Ten cases were reviewed from 1987 through 1998, as well as other literature which compared younger and older adults memory functions related to visual, text, events and word-finding. The primary criticism leveled against this type of research on memory is that these skills and tasks were not related to real-life learning tasks. Some of these studies were speed-related which affected the scores of the younger vs. the older subjects. The general consensus form this research is that certain memory functions decline with age. A number of researchers have cautioned, however, that because of methodological considerations and the variables being studied that these works must be interpreted with care.

Chapters II reviews the literature available to illustrate the thought processes related to memory. It also explains the different aspects of memory. This review is necessary to determine the effects of age on recall. Chapter III describes the methods used to conduct a content analysis, which is concerned with the assessment of the findings of the defined problem of the effects of age on recall. Ten research studies will follow in

Chapter IV that contains the findings of recall of memory in younger and older adults. Chapter V will contain the conclusions and recommendations resulting from the review of the ten studies reviewed in the preceding chapter. There are some suggestions throughout the literature, which suggest that there are numerous interventions available to improve and facilitate the learning and memory process in adults. Several interventions have been included in the recommendations in Chapter V.

CHAPTER II

LITERATURE REVIEW

Recall and Thought Process

A discussion of memory and the learning process is not complete without the investigation into the human thought processes. Thinking may be viewed as the process of changing and reorganizing the information stored in memory in order to create new information. Indeed, the ability to think and learn is a vital component of humanness. It has been and continues to be a primary mechanism by which individuals adapt to their environment. If storage and retrieval were the only processes used to handle all information, people would be little more than glorified cameras and projectors (Scarr & Vanderzanden, 1984).

Image Process

The processes of thought depend on several devices or units: images, symbols, concepts, and rules. Human beings possess a remarkable capacity for mental visualization. It is one of the primary means for channeling information into memory. An image is a mental representation of a specific event or object. It is the most primitive unit of thought. The representation is not usually an exact copy. Rather, it contains only the highlights of the original. For example, an adult remembering a grandmother who died when the

grand-daughter was seven, would probably remember only a few details like the color of her hair or a piece of jewelry that she wore (Scarr & Vanderzanden, 1984).

Symbol Process

A more abstract unit of thought is a symbol, which is a sound or design that stands for an object, event, or quality. Most common symbols in thinking are words. Every word is a symbol that represents something other than itself. Symbols are arbitrary stand-ins for actual or imagined things. Although they stand for other things, symbols do not necessarily bear any relationship to them. The fact that symbols differ from the things they represent enables people to think about things that are not present, to range over the past and future, and to imagine things and situations that never were or will be. Numbers, letters, and punctuation marks are all familiar symbols of ideas that have no concrete existence (Scarr & Vanderzanden, 1984)

Concept Process

When a symbol is used as a label for a class of objects or events with certain common attributes or for the attributes themselves, it is called a concept. "Animals," "music," "liquid," and "beautiful people" are examples of concepts based on the common attributes of the objects and experiences belonging to each category. Thus the concept "animal" separates a group of organisms from such things as automobiles, carrots, and cheese. Concepts enable one to chunk large amounts of information. People do not have to treat every new piece of information as unique since they already know something about the class of objects or experiences to which the new item belongs. Thus by means

of concepts, they are able to sort large numbers of stimuli into manageable units and domains of related concepts (Scarr & Vanderzanden, 1984).

Rule Process

The fourth and most complex unit of thought is a rule, a statement of the relationship between two or more concepts. The world is not characterized by just so many bits and pieces of information. Instead, some items are linked to other items in an orderly or recurrent manner. Examples of rules include: "A person cannot be in two places at the same time" and "Mass remains constant despite changes in appearance" (Scarr & Vanderzanden, 1984).

Images, symbols, concepts, and rules are the building blocks of mental activity. They provide an economical and efficient way for people to represent reality, to manipulate and reorganize it, and to devise new ways of acting, learning, and remembering (Scarr & Vanderzanden, 1984).

Memory Encoding Process

To understand the act of remembering, it is helpful to understand its processes Memory passes through three stages when it is processed. These processes are encoding (acquisition), storage (retention), and storage and retrieval (recall). Encoding refers to the registration or pickup of information. The encoding phase is the initial process in which the information is entered into the system. The encoding process interprets a stimulus and stores a representation of that interpretation in memory (Semon, 1980).

Memory Storage and Retrieval Process

Storage refers to the retention of information in memory. The storage phase is where material is filed for future use. Retrieval refers to finding or using information in the memory. Retrieval is also described as how one gets material out of storage when needed. The ability to remember through recognition is greater than recall. Recall requires more effort than recognition because it demands more cues from the context. Information that can be recognized but not recalled may have been encoded less deeply or there may be some interference with the retrieval of the information (Ogle, 1986).

Recall Problems

Some familiar questions become evident when people experience problems with recall. Some of these questions can be as simple as why did I forget all those answers on that exam? People loose their car keys, forget their doctor's appointments, and cannot remember familiar words or names. Do these things sound familiar? Irritating in themselves, these memory lapses happen more frequently as one gets older, and that can be frightening. Storage or retention is a necessary process if a person is to use the information as the basis for the later act of remembering any details

The mind is supposed to be like a computer, but the brain does not always meet our expectations. As people age, they are constantly throwing out all the mental trash, attention lessens, and adults may feel stressed when faced with situations which cause them to forget what they are trying to remember (Lawren, 1994).

Recall and the Aging Process

The U.S. culture is so preoccupied with memory loss that it is reflected by the prevalence of cartoons about memory and aging. A common complaint among middle-aged and older adults is that their memories are not as good as they used to be.

As the loss of memory mounts, one cannot help but wonder: What became of the mind that was so sharp during youth? What is a reasonable expectation for an aging memory? Observations and images foster the idea that memory loss is a normal result of aging and thus is something that must be accepted. It also follows that if adults do suffer major changes, especially decline in their memory functions, that it would follow that the learning process may also be impaired. To understand how the aging process can affect memory, an examination is needed of how the process of memory itself is conceptualized

Since the 1960s, human memory has been studied primarily from the information processing approach. The mind was visualized as a computer with information being entered, stored, and then retrieved as needed. Conceptualizing where people store or file what they learn, termed the structural aspect of memory, was the first major focus of study from this perspective

Structures of Memory

Three categories have been used to describe the different structures of memory: sensory memory, short term (or primary) memory, and long term (or secondary) memory. Various authors describe each of these three forms of memory somewhat differently. In general though, the structural model emphasizes that each form of memory has a distinct

capacity in which information is filed for different periods of time. Both sensory and short-term memory have very small capacities and brief storage times. It is milliseconds in sensory memory, and about one-half minute in short-term memory. Long-term memory has an enormous capacity and can store information for a lifetime. Recently, researchers have visualized these structures as a continuum with the focus on the processes that account for how material is transferred from one store to another (Merriam & Caferella, 1995).

Some studies have found that older people remember, but it merely takes longer to occur (retrieve). Other study findings have shown that older people are actually more efficient than younger people in searching long-term memory. It is important to note that while some studies show that processing operations do not change with normal aging, the time needed for processing increases (Merriam & Caffarella, 1995).

The capacity of short-term memory does not undergo significant change with age. However, age-related deficits in active short-term memory (working memory) tasks and in the speed of short-term memory search have been reported. Older adults perform more poorly than younger adults on tasks of long-term memory especially when recall rather recognition is examined. Memory in the elderly is more robust when it is measured by implicit rather than explicit memory tasks. Implicit memory is defined as a memory task that does not require a person to consciously remember a previous event. Explicit memory is defined as a task in which a person is directly instructed to consciously remember a previous event or experience (Merriam & Caffarella, 1995).

When older adults are instructed in how to use efficient encoding strategies, they show an improvement in their ability to remember. Age-related differences in memory are

unlikely to occur when older adults draw upon previous knowledge to help them remember. Researchers try to explain age-related changes in memory using two perspectives, the biological perspective and the processing perspective. The biological perspective suggested that the age-related deterioration of the brain causes decreases in memory. The processing perspective suggested that age-related memory changes are the result of strategy differences for encoding and retrieving information. Whatever the perspective, older adults tended to overestimate the magnitude of the memory problems experienced by the normal elderly (Merriam & Caffarella, 1995).

There are several age-related changes in memory. Short-term memory is higher when stimuli are presented auditorily rather than visually. In addition, there is a significant decrease with age in recall or sequencing of nonsense syllables, words, and symbols. Also, there is a greater difficulty on recall performance than on recognition tasks, and the speed of recall decreases as people age (Merriam & Caffarella, 1995).

The most accepted change of aging related to memory is the decreased capacity to remember newly acquired information. Application, practice, and rehearsal facilitate the older adult's processing and retention of information in primary or short-term memory. Practice over time activates secondary memory (Rybash, Roodin & Hoyer, 1995).

Methods for Remembering

There are several ways people remember which supports different methods on how they should be taught (Cox, 1995). People remember 5% to 10% of what they read, 10% to 20% of what they hear, 30% to 50% of what they hear and verbalize, 70% of what they verbalize and write, and 90% of what they say as they perform a task. These facts support

brevity and simplicity in structured teaching. Sessions should be kept short and to the point to minimize fatigue. Simple messages eliminate irrelevant, confusing information. A single focus should be maintained for each session. This would eliminate the need for people to divide their attention. One important fact is that learning by doing, which employs multiple senses, is more effective than other methods of learning (Cox, 1995).

Encouraging news from cognitive aging research says that the brain retains an astonishing ability to rejuvenate itself. Stanley Rappoport, chief of the neuroscience lab at the National Institute on Aging, compared the brain of younger and older people engaged in the same efforts and found that older brains rewire themselves to compensate for losses. If a neuron is not working, neighboring brain cells take up the slack (Cox, 1995).

The Brain's Relationship to Memory

The brain, the storehouse of memories, is in the words of Farley (1988), "a wonderful gismo" (p.15). It weighs approximately three and a half pounds, and is one of the most complex systems in nature. When compared to any manmade computer, it is vastly more complex (Merriam & Caffarella, 1995). A great deal of research has been done to test the information processing framework of the way our brain functions in all aspects of memory and aging, and the general consensus from this work is that certain memory functions indeed decline with age. The vast majority of this work has focused on laboratory settings using memory tasks and activities, such as repeating back nonsense words and lists of random numbers. The primary criticism leveled against this type of research on memory is that these tasks and skills are taken out of the context of everyday life (Merriam & Caffarella, 1995).

Age Differences in Types of Memory

Age-related differences in long-term are more likely to be revealed if memory is measured by a recall rather than a recognition task. A recall task is quite different from a recognition task, but they both require conscious recollection of previous experiences. In both of these tasks, a person is aware of the fact that he or she is to remember something experienced in the past. Any memory task in which a person is instructed to consciously recollect or become aware of a previous experience is called an explicit memory task (Rybash et al., 1995).

By contrast, an implicit memory task is one that does not require an individual to consciously recollect a past event. Implicit memory has been referred to as memory without awareness. People are not aware of the fact that they are remembering something while performing an implicit memory task (Rybash et al.,1995).

In the late 1980's, two teams of researchers examined age-related differences in implicit and explicit memory in healthy, community-dwelling adults. As would be expected, these researchers found that older adults performed significantly more poorly than younger adults on tasks of explicit memory (recall and recognition). However, age differences were smaller or nonexistent on the implicit memory task (Rybash et al.,1995)

Comparisons of Types of Memory Retention

Human memory may be organized specified by three types of requests; feature, content, and function. Feature refers to organizational specifications; content refers to meaning, and function refers to the interpretation of content. Its much easier to retrieve

feature requests, such as the meaning of a word when read, than content requests, such as moving from the meaning to the discovery of a specific word (Conti & Fellenz, 1993).

Regarding the nature of the material, visual images are remembered more effectively than words. If people consider the way in which the original learning occurred, manual skills that are learned in a high state of proficiency appear to be retained indefinitely even though the degree of proficiency in the performance of the skill may decline through disuse. Any kind of manipulative learning is retained longer than verbal information under any circumstances (Conti & Fellenz, 1993).

The clearest observation to make about memory aging is that there are age-related declines on some kind of memory tasks and no age-related declines on other kinds of memory tasks. Many different kinds of test are used to assess memory, and the extent to which age-related changes in memory are observed depends on the type of memory task and the type of materials contained in the task (Rybash et al., 1995).

Some researchers have interpreted these patterns of intra-individual differences across tasks as evidence that there are several distinct types of memory. Other researchers maintain that there is really only one memory system and that intra-individual differences in performance across tasks are attributable to differences in task demands and processing strategies (Rybash et al., 1995).

Semantic Memory and Episodic Memory

Semantic memory refers to acquired knowledge about the world. When people use semantic memory they think about the meanings of concepts with reference to when or how they acquired such knowledge. An example of semantic memory is when a person

knows that they are writing a book on adult development. Another example of semantic memory is when a person knows that they are a student of X university and that you are an education major. Episodic memory refers to memory for the details of personally experienced events. For example, people might have retained an understanding of how to play a card game that they learned in childhood even though they had no episodic recollection of when or how they learned the game. Another example of episodic memory is when a person tries to remember when they last heard "Jingle Bells." Generally older adults exhibit preserved semantic memory even though there are substantial age-related declines in episodic memory (Rybash et al., 1995).

There are specific systems for procedural memory, perceptual representation, and short-term memory. Even though these systems interact when people carry out certain memory tasks, there is good evidence that suggests that these types of memory have particular functions. Procedural memory is knowing how to do something and is measured by a person observing a person carrying out the procedures of a task. Individuals (e.g., amnesiacs) can show procedural memory even in the absence of declarative memory regarding the procedure. Generally, there are no age differences in procedural memory, and there are age-related differences in the declarative aspects of the memory. The perceptual representation system which refers to knowledge of the perceptual structure and characteristics of objects in the world is probably unaffected by aging. Finally, short-term memory span, or the ability to hold a number of items in consciousness for a brief period of time, is also unaffected by aging (Rybash et al., 1995)

Therefore, there are some types of memory systems that are more affected by aging than others. There are different age trends depending on whether people are being

measured by episodic or semantic memory, and there are negligible declines or no age differences in procedural memory, perceptual representation and short-term memory Rybash et al., 1995).

Working Memory and Short-Term Memory Span

Working memory refers to the processes and structures involved in simultaneously holding information and using that information. Frequently, working memory tasks involve manipulating the contents of short-term memory or combining information held in mind with new or incoming information. Complex mental multiplication is an example of working memory. Working-memory tasks generally require the individual to mentally carry out some operation while also keeping in mind or storing other information. Aging has a pronounced effect on the ability to manipulate processing and a lesser or negligible effect on the passive (storage) aspects of memory (Rybash et al., 1995).

Compared with young adults, older adults are slower in searching or scanning short-term memory. In 1969 an ingenious procedure for measuring search speed was conducted which has been used to test elderly individuals. In this procedure, people are presented with a set of items (e.g., 6, 3, and 9) to hold in their memory. Then they are presented another digit (e.g., 9). Memory sets of varying lengths are used, and as one might expect, reaction times increase as the length of the memory set increases. A study in 1972 that compared early, middle, and late adulthood indicated that the two older adult groups scan through list of items in short-term memory at a slower pace than younger adults (Rybash et al., 1995).

Visual-spatial processing in short-term memory also slows in older people. In studies for visual-spatial processing younger and older adults were shown a capital letter at different degrees of tilt Sometimes the letter was in the normal plane and sometimes the letter was reversed from left to right (reflected). The task was to decide as quickly as possible whether each letter was normal or reflected. Judgments were made by pressing one of two response keys. The latencies, or how long it takes to make these responses, were longer as the degree of tilt increased. This effect of tilt on latency indicated that adults must mentally rotate the tilted letters to upright before making their judgment (Rybash et al., 1995).

We can best view this second memory system as serving as a gateway. Working memory is where the cognitive action is. It is where we keep information in awareness for a temporary period while we make the decision to either discard it or act to process it for permanent storage. Working memory is made up of two limited-capacity "bins." As each bin fills to capacity, information is displaced or pushed out. It also consists of an executive function, which controls attention as well as manipulating the material in these holding areas to prepare it for storage (Rybash et al., 1995).

A real-life example of the fleeting quality of the information in working memory happens when we get a phone number from the operator and immediately make the call. We know by experience that we can dial the seven-digit number without having to write it down and memory will not fail us if the phone rings. If we get a busy signal and have to try again, mysteriously memory fades. The information has slipped out of this holding place (Rybash et al., 1995).

To prevent this from happening, the solution is to process the phone number so that we have "memorized" it. This means that working memory must manipulate or encode the information so it enters a third, more permanent store called long-term memory.

Long-Term Memory

When we speak of memory, we are talking about this last system. Long-term memory is the relatively permanent, large-capacity store that is the repository of our past. While researchers find few age differences in tests of sensory memory, the studies clearly show that getting information into and/or out of this permanent warehouse is more difficult as we age. Some questions asked include are age-related memory deficits due mainly to an encoding/acquisition problem or to a retrieval problem? Or, in less technical terms, has the older person inadequately learned the material, or does the problem lie in difficulties with getting information out? (Belsky, 1997)

These topics have been debated for decades as psychologists designed studies to try to isolate the acquisition and retrieval phases of memory and measure the losses. As it became clear with age the efficiency of both encoding and retrieval seemed to decline, many researchers adopted a different perspective on change (Belsky, 1997).

Hundreds of studies of age differences in memory have a similar message. As the task gradually becomes more demanding and complex, older adults do worse. This suggests that the critical force affecting memory as we age is not the particular type of processing or memory operation (acquisition versus retrieval), but simply how much mental processing that task demands (Belsky, 1997)

Long-term memory can be assessed using a variety of measures, including free recall, cued recall, or recognition. In a free-recall task, a list of items- usually common words-is presented to adults, who then attempt to remember as many items as possible in any order. Results of some experiments showed an age-related decline for long-term free recall, but the recall span or capacity of short-term memory was relatively unimpaired by aging (Rybash et al., 1995).

Although age-related differences are common in long-term memory, the magnitude of these differences-indeed, their very existence--depends on the nature of the information-processing strategies individuals use. Three types of encoding processes are especially important: Organization, semantic elaboration, and mental imagery. Research suggests that all three processes might be less efficient or less likely to occur in old age. This research also suggests that with appropriate techniques, older adults can overcome or at least reduce this deficiency (Rybash et al., 1995).

Effective organization of information to be remembered is an aid to memory, especially for older adults. In 1987, Ratner and her colleagues examined age-related differences in organizational strategies in three groups of women: (1) young adult female college students, (2) young adult female high school graduates who were not enrolled in college, and (3) retired elderly females not enrolled in college. All of the women were required to learn different types of stories. Half of the women in each of the three groups were told to simply learn the stories; the other half were told to memorize the stories verbatim. In a memory test on the stories, the college students performed the best. It was discovered that they studied longer than the other groups and were more likely to use a variety of organizational strategies to help them remember the stories. New research

shows that there are both quantitative and qualitative age differences in reading and comprehending text materials (Rybash et al., 1995)

Another process that is known to affect long-term memory performance is imagery. A study was conducted in 1977 that focused on the recall of individuals in early, middle, and late adulthood. Those in the imagery condition were instructed to form mental images for each word on a list, but those in the control condition were given no instructions to aid recall. Imagery instructions did not affect recall in the early and late adulthood groups but did improve recall in the middle adulthood groups. The middle-aged adults in the imagery condition performed as well as young adults, although in the control condition they fell below young adults. Again, these results indicated an age-related deficiency in recall memory that can be eliminated through appropriate learning procedures. In this study, however, the learning procedure effective with middle-aged adults was not effective with elderly adults (Rybash et al., 1995).

CHAPTER III

METHODOLOGY

Design

Numerous studies have been conducted in the field of learning, and memory and how they are related to the aging process. Researchers have suggested investigations into learning and memory in conjunction with aging are surrounded by difficulties in separating learning ability from a host of variables in all the studies. Some studies find differences in the memory and the aging process, and others do not. Descriptive research involves collecting data in order to arrive at conclusions and recommendations resulting from literature review and studies to determine the answers to any research questions. A descriptive study determines and reports the way things are. The descriptive method is useful for investigating a variety of educational problems. Typical descriptive studies are concerned with the assessment of attitudes, opinions, conditions, and procedures. Once a descriptive problem has been defined, related literature has been reviewed, and hypotheses or questions stated, the researcher must give careful thought to sample selection and data collection (Gay, 1987).

One type of descriptive study is content analysis. Content analysis is often conducted on books or documents and creative productions such as musical compositions. Content analysis is often used on textbooks to determine such things as readability level

and the existence of bias. For example, content analysis can be used to determine if the vocabulary and content are appropriate for a certain grade.

> Content analysis studies may be quite simple, involving primarily frequency counts, or very sophisticated and complex, involving investigation of the existence of bias or prejudice in a textbook. (Gay, 1987, p. 236)

In order to describe the relationship aging as a factor in recall of memory, 10 studies in recall of memory in older adults were reviewed. These studies were in the areas of pictoral recall, verbal and spatial, computer-displayed and printed text, prose recall, recall of events, and word-finding. This content was analyzed to determine if age was a factor in recall.

Article Selection

In this study, verbal and non-verbal studies have been chosen in order to determine if both are affected in recall of memory in older adults. Studies were chosen in order to obtain a valid sampling of different theories pertaining to the subject of recall.

This content analysis presents an overview of the results of several of those research studies done during 1987 through 1998. These studies were obtained from PSYCH, ERIC, and Dissertation Abstracts. This content analysis was conducted on several studies on the following memory tasks: pictorial recall, verbal and spatial, computer-displayed and printed text, prose recall, recall of events, word-finding and Cloze tests. These sources and articles are congruent with findings from experts in the fields of learning, age and the memory.

Major theorists seem to agree in their view of the learner in an educational setting. Since images, symbols, concepts, and rules are the building block of ones mental activity,

people use them as a way to represent reality, to manipulate and reorganize it, and to devise new ways of acting, learning and remembering.

Memory passes through three stages when it is processed. These processes are acquisition, retention, and storage and recall. The articles selected illustrate research which has been conducted for all types of learning, both verbal and non-verbal, which will show a pattern of how the learning and memory process affects are age-related.

A great deal of research has been done to test the information processing framework of the way our brain functions in all aspects of learning, memory, and aging. The general consensus from this work is that certain memory functions decline with age. Age-related differences in long-term are more likely to be revealed if memory is measured by a recall rather than a recognition task. The clearest observation to make about memory aging is that there are age-related declines on some kind of memory tasks and no age-related declines on other kinds of memory tasks. There are different age trends depending on whether people use episodic, semantic, procedural, perceptual representation, short-term and long-term memory. The articles selected will illustrate all the aspects related to different memory functions and their finding will illustrate which ones show age-related differences.

Procedures

The databases that were used were PSYCH, ERIC, and Dissertation Abstracts. PSYCH is an index to psychology, behavior, personality, child development, family relations, homelessness, criminology and prisons. Psychological abstracts are summaries

of articles from special journals in special fields. The abstracts are updated quarterly and cover material from 1974 to present.

ERIC is an educational information retrieval and dissemination system. ERIC consists of abstracts of education publications, which include journal articles, reports, teaching aids, classroom guides, and documents. They are updated quarterly and cover material from 1966 to present.

Dissertation Abstracts are indexes to U.S. dissertations with some master's theses included, which are updated semiannually and cover from 1861 to present and abstracts since July 1980. They are summaries of graduate research (Key, 1980). The articles used for content analysis research were from the years 1987 through 1998, which cover the more recent findings on the subject of recall comparing younger and older adults. A period of 12 years contains sufficient sampling of research material to make a comparison of the most recent theories.

CHAPTER IV

FINDINGS

Pictorial

Maisto and Queen, 1992

The majority of the literature on age-related decrements in memory had focused upon memory for verbal information. Recently, new literature has been published that examined age-related declines in memory for nonverbal information, particularly pictorial material. There was a need to examine nonverbal information to study the picture superiority effect in young and older adults.

Content analysis was conducted on a study by Maisto and Queen (1992). This research attempted to confirm the equivalence of the picture superiority effect in young and older adults. In addition, it examined the age differences in recall for stimuli that consisted of a word and its pictorial representation combined. The research was limited by the number of studies and stated a need for studies of age-related declines in pictorial material

Specifically, the research question for equivalence of the picture superiority effect in young and older adults sought to determine: (a) comparison of the performance of young and older adults on a memory task that involved pictures, words, and pictures-plus-

words as stimuli; (b) explain the picture superiority effect in terms of a dual-coding hypothesis; and (c) replicate the findings of earlier studies. Previous studies had concluded recall for pictures was generally higher then recall for printed material. These studies also confirmed that dual-coding hypothesis involved the assumptions that imagery and verbal codes are independent but interconnected.

The procedures for the study of the age-related declines in recall and recognition of pictures consisted of six between-groups conditions which were created by crossing age (young or old) with stimulus type (words, pictures, or picture-plus words). Young and old subjects were tested separately in small groups within their age group. The subjects were told that the experiment involved memory and were instructed to study the items presented on the slides in order to recall them later. After viewing the slides, subjects were asked to complete the health and educational background questionnaire as a filler task. After completing the questionnaire, subjects were asked to record their age and sex on a sheet of paper and then list as many of the items from the slides as could be recalled. No time limit was imposed on recall, but after subjects felt that they could not remember any items, they were asked to complete the verbal intelligence questionnaire. The stimuli consisted of three sets of black-and-white slides of 51 items. One set was printed words and their pictorial representations mounted side by side.

The findings of equivalent picture superiority effect in old and young adults confirmed earlier studies by researchers. These results provided further evidence of the quantitative rather than qualitative decline with age in visual versus verbal memory processes.

The results were consistent with previous research and indicated an equivalent picture superiority effect for both young and old adults when pictures were compared to words. More specifically, although recall scores were significantly higher for younger adults compared to older adults, the superior recall scores for pictures versus words did not differ between age groups. However, the performance of older adults declined markedly compared to the younger adults in the picture-plus-word condition. Mean word recall of young adults was 17.35 and was 15.50 for the older adults. Picture mean recall of young adults was 23.17 and was 19.50 for the older adults. Mean of word-plus-picture recall of young adults was 24.17 and 12.39 for the older adults. These findings provided support for a divided attention model, which involved effortful processing of both visual and verbal aspects of stimuli. Situations of divided attention appeared to put older adults at a disadvantage compared to young adults.

Verbal and Spatial

Mungas and Ehlers, 1991

Verbal memory and learning changes associated with age have been well documented. Research had provided evidence of an age-related decline in verbal learning and memory. It had been found to vary according to a number of factors including but not limited to whether the paradigm involved free recall, cued recall, or recognition; the degree to which information is inherently organized; the familiarity of material; and other specific task parameters.

Age-related changes in spatial learning had received less attention. Several studies had shown significant age group differences in memory of spatial location. In contrast, a study in 1982 showed that recall of spatial location of words printed on cards did not differ across age groups though there were significant differences in recognition of words. The literature on information processing in spatial learning is sparse and is an important area for further research.

Studies which directly compared verbal and non-verbal learning might have considerable theoretical significance. A number of studies, particularly using the Wechsler Adult Intelligence Scale (WAIS) showed greater age effects for non-verbal than for verbal abilities. Some of these differential age effects have been attributed to non-verbal tests involving more of a speed component although though significant age effects have been demonstrated on non-verbal tasks independent of speed of response and time constraints. If non-verbal abilities are generally more affected by age, then one might also expect greater impairment of spatial than verbal memory. Some earlier studies had reported greater age-related decline of non-verbal memory

The purpose of the 1991 study by Mungas and Ehlers was to assess the relative effects of age on verbal and spatial learning and information processing. A verbal word-list learning test and a spatial analogue were used to obtain measures of recall across five learning trials. Analogous measures of information processing and organization strategy were also derived from the verbal and spatial learning tasks. The recall and strategy measures from these learning tasks were used to determine if age is associated with differential decline of verbal and spatial information processing and learning.

Some objectives this research sought to determine were measures of amount recalled for each of five learning trials and measures of information processing and organizational strategy by trials. One advantage of the similarity in format of the two learning tests was that the same measures of organization and information processing strategy could be derived from both tests.

Measures used in this study were (1) seriation, and (2) clustering. These measures had been identified as important experimental studies of verbal learning. In a previous study using verbal learning test both seriation and clustering showed significant age-group differences. The seriation measure assessed organization according to temporal order of presentation of information, a type of encoding considered by other researchers to be relatively automatic. The clustering measure reflected organization according to inherent semantic categories of spatial clusters. Semantic clustering in verbal learning is generally regarded as being effort intensive and placing demands on attentional capacity.

The procedures for the Mungas and Ehlers study consisted of testing the subjects by a trained examiner in one session. The order of test administration was fixed with the verbal learning test administered prior to the spatial learning test. Normal subjects were divided into 3 age groups of 24 subjects each, which were compared on word-list learning test, and on a non-verbal learning analogue of the word-list test.

The findings of this study were consistent with a previous study (Mungas et al., 1988). That study also showed clear evidence of an age-related decline in overall recall and semantic clustering and, in addition, showed that older subjects had greater difficulty with recall of abstract as opposed to concrete words. These two studies converged to indicate that older individuals were less likely to process verbal information at an abstract,

semantic level. These conclusions were consistent with a large body of literature and, theoretically, with accounts of age effects derived from both levels of processing theory (Craik & Simon, 1980) and capacity theory (Hasher & Zacks, 1979).

Results showed that age affected verbal and spatial learning and information processing in a highly similar manner. The finding of a significant age effect on the spatial learning test is consistent with a number of previously reviewed studies but is inconsistent with the Hasher and Zacks (1979) theory which regarded encoding of spatial information as relatively automatic and therefore less susceptible to age effects.

Significant age-group differences were found for total recall averaged across trials and type of task (verbal vs. spatial). Age was not differentially related to verbal versus spatial learning, and age groups did not show different patterns of recall across trials. Age was related to a clustering measure, which assessed organization of information according to verbal semantic categories or inherent spatial clusters. Younger subjects showed increased levels of clustering on earlier learning trials. Similar effects were observed for the verbal and spatial clustering measures. Age was not related to differences in organization according to temporal order of presentation of information. Results showed similar age-related changes in verbal and spatial learning and provided evidence that spatial learning like verbal learning is dependent upon effortful information processing.

Computer-Displayed and Printed Text

Moore and Zabrucky, 1995

Some researchers have compared reading from computer-displayed text and reading from the printed page, but most of the studies have been done with children and young adults, and the dependent measures used have been limited to reading times. The analysis of on-line discourse processing research by other researchers provided insights into qualitative and quantitative differences in the way younger and older adults process texts and into the relations between adults' comprehension processes and memory. The purpose of this study was to use a variety of dependent measures to assess differences in younger and older adults' reading and performance for computer-displayed text and printed text. The texts for the younger and older adults were read from texts either presented on the printed page or presented one sentence at a time on a computer. The computer-displayed text was self-paced, and sentences could be reread at any time during the reading. The effects of presentation mode were made on reading times, comprehension, and text recall. Comprehension was also evaluated during reading. Because older adults were found to be at a disadvantage when the attempted to comprehend sentences that requires retrieval of distant information, the distance of inconsistent sentences in texts was varied. Participants were interviewed after reading to determine whether they had noticed and could accurately comment on inconsistent information conveyed in the passages.

The subjects for the study were 40 younger adults with a mean age of 22.93 and an age range of 19-34 and 40 older adults wit a mean of 71.35 and an age range of 60-84.

The younger adults were recruited from a university, and the older adults were recruited from two seniors' groups at a local church The younger adults were given either course credit or an honorarium for participating in the study and the older adults were given an honorarium.

The materials used consisted of four expository passages adopted from beginning-level college textbooks in the natural and social sciences. The passages were written at 9th to 10th grade reading level on the Fry scale and each was 11 sentences long. The average number of words in each passage was 231 with a range of 218-243.

Four versions of each of the four passages were constructed. Across the versions of any one passage, the content of all sentences except for the context sentence remained the same. The context sentence differed across versions so that its relationship with a later occurring target sentence was either factually consistent (consistent condition) or inconsistent (inconsistent condition). The distance between the context and target sentences varied across passage versions and was either adjacent (close condition) or nonadjacent (far condition)

When the subjects were finished reading a passage, they were asked to tell the experimenter all about the passage in their own words. The participants were asked to be as complete and thorough as they could in the information they recalled. After the recall and interview, the subjects were asked to turn to a page of their booklets and answer the self-judged comprehension questions.

The present results indicated that the reading performance of younger and older adults was not differentially influenced by the method of presentation of text, whether the

text is presented on a computer screen or paper. Older adults recalled less information from texts than did younger adults.

The method of presentation influenced performance on several measures equally for younger and older adults. On-line presentation of texts resulted in better overall recall, recall of problematic information, and verbal report of text inconsistencies. The superior performance in the computer-displayed text condition was not due simply to longer reading times. The variance accounted for by method of presentation was essentially unchanged when reading time was controlled.

The above study suggested that adult's comprehension and understanding during reading and their recall of text can be improved with an on-line presentation of text material. It also suggested that certain on-line methodologies might influence both younger and older adults' reading processes. On-line methodologies that present text in meaningful units with brief pauses between sentences and allow for reader-controlled look-backs to previously presented units of text may have contributed to superior reading performance compared with normal printed page.

On-line presentation of texts resulted in superior comprehension evaluation and recall for both younger and older adults. Although the participants spent more time reading texts presented on-line than printed texts, the extra reading time did not account for the superior comprehension evaluation and memory found in the on-line condition. This present research did not provide any evidence that age-related deficits in reading performance were attributable to on-line methods of text presentation, but it did suggest that some on-line presentation methods result in improved comprehension and memory for adults.

Prose Recall

Ratner and Schell, 1987

Older adults often recall less information from prose passages than young adults do. Explanations have been offered for poorer performance, but the origin of these problems had not been explored as often. Specifically, age-related changes may be the result of biological deterioration or of having received fewer environmental demands to remember. If an individual's memory processing is shaped by day-to-day demands, then age-related differences in performance may have resulted as much from cultural factors as from the inevitable consequences of biological deterioration.

The purpose of the research by Ratner and Schell (1987) was to assess older adults' text recall and study strategies compared with those of two groups of young adults. One group was enrolled in college classes and the other group was not. Verbal ability was equivalent for the two groups.

If biologically determined deficits occurred as people grew older, then older adults should have performed more poorly than either group of young adults, and the non-college young should have performed similarly to their college counterparts. On the other hand, if environmental demands were important, then the non-college young should have performed similarly to the old adults.

The sample tested consisted of 24 retired older adults who were members of a social organization at a local recreation center or members of the university alumni association. This group had an average age of 69.4 and averaged 13.0 years of education. Another 24 subjects were college students with an average age of 21.9 and 13 4 years of

education. In the last group, 16 non-college young adults had an average age of 22.2 years and 12.3 years of education. None of this last group was currently enrolled in school, and none had attended classes in at least a year. Older adults and the non-college young adults were paid a small sum for their participation. The college students received course credit.

In order to provide some information about memory demands experienced in day-to-day life, groups were asked to estimate how many hours they read a month and how many of those hours were devoted to professionally related reading. All reading requires at least incidental use of encoding and retrieval skills, and professional reading encourages intentional remembering. Older adult and the non-college young read a similar amount of time: with an average of 46.5 hours for the older adults and 38.9 hours for the non-college young. Furthermore, a similar percentage of time was devoted to reading materials pertinent to these subjects' current or former professions: 11.9% for the older adults and 6.3% for the non-college younger adults. In contrast, the college students reported that they read an average of 98.3 hours and that 75.9% of their reading was related to their profession (e.g., taking classes).

Each subject was randomly assigned to one of two conditions, verbatim or control In each setting, a notebook containing four stories, two of each of the two types (procedural and temporal), was placed in front of the subject. The stories were presented so that one sentence was typed on a page. The pages were encased in plastic, and a large number was attached to the back of each page. A video camera faced the subject and was used to record study activity. The numbers allowed examiners to identify how long each

page was read and in what order. Study patterns were compared among groups and related to recall.

The same read-and-recall procedure was followed for all subjects during one practice and during four experimental trials. Only the instructions varied for the two conditions. Those in the verbatim condition were told to remember the stories word for word exactly as written. Those in the control condition were told simply to remember them. All subjects were encouraged to look back through the story and reread sentences as often as they wished. After receiving their instructions, subjects were told to open the notebook and begin reading a practice passage. When they finished studying, they indicated that they were ready to recall. They orally recalled the passage, and this report was tape-recorded. After answering any additional questions, subjects were asked to begin reading the first experimental passage. This procedure was followed until all four stories were completed. Stories were presented in four different orders so that each story appeared once in each position.

In this Ratner study, the non-college young adults performed more like the older adults than their college counterparts, despite the similarities in age and verbal ability between the two groups of young adults. In comparison with the out-of-school groups, the college students reported more information, studied longer, and spent more time reading the story sentences in units of two, especially when organization was most used (i.e., under verbatim instruction and when recalling the less structured temporal stories). In fact, the college students' more active studying may have facilitated overall recall and, in particular, may have helped them to report as much information from both story types.

In contrast, the non-college young adults and the older adults did not study as much and did not adjust their study patterns to accommodate the differences in story structure. They also recalled more of the procedural than of the temporal stories at least in the verbatim condition. This suggested that in the absence of organization provided by the learner the characteristics of the material influenced performance to a greater degree. Also, the relations between recall and study patterns seemed to be most consistent for the young college students. This pattern of results suggested that memory decline associated with increasing age resulted as much from cognitive demands as from biologically determined deterioration. If this is so, then memory differences between older adults and younger adults have been over-attributed, perhaps, to the natural aging process.

In summary, when memory performance of older adults and younger adults are tested, the older adults are rarely enrolled in school. Thus, the two groups in this study differed not only in age but also in the demands for remembering. In order to assess the contributions of these two groups, older adults' text recall and study strategies were compared with those of two groups of young adults. One group was enrolled in college classes, and the other group was not. Verbal ability was equivalent for the two groups. The college students outperformed both out-of-school groups; the out-of-school groups performed similarly to one another. These findings suggested that memory difference between old and young resulted as much from cultural factors as from the inevitable consequences of biological deterioration

Recall of Events – Experiment 1

Ratner, Padgett and Bushney, 1988

Knowledge of memory changes during adulthood had come primarily from studies of verbal materials. These studies had demonstrated repeatedly that older adults remembered less than the young. Verbal materials, however, represented only one type of information that people needed to remember. Actions embedded within an event represented another. Much of our routine experience and much of the content of conversational exchanges consisted of events. How and how well events are recalled is, therefore, an important research question. Because of findings from studies of memory for participatory events, a study by Ratner, Padgett, and Bushney (1988) examined old and young adults' memory for action-based information.

The purpose of this study was to examine older and younger adults' event memory. Both age groups participated in a hierarchically organized event that involved making clay. The goal was to develop an event that could be orchestrated in a standardized fashion and precisely recorded so that the encoding context could be measured and controlled Clay making was chosen because a pilot test revealed that participants found clay making interesting and entertaining. Motivation to perform a task had been suggested to influence memory performance especially when older adults were tested.

Two issues were of principal interest in this study. The first was whether the old would report the event as completely as the young. Although existing evidence was inconsistent, age differences were not expected. It was hypothesized that recall would be

similar for the two age groups because actions were performed in an ordered sequence to accomplish an overall goal. To test the age difference to its potential, the participants were asked to recall the clay-making even under intentional conditions

The second issue was whether the actions that made up the event would be reported equally often and whether differences in recall ability would vary with age. For both old and young, story propositions that are judged more important are remembered better than those that are judged less important. Thus, more important information in the event should be recalled more often than less important information and superordinate goals should be reported more often than subordinate actions. Nevertheless, old and young may differ in their reporting of the less central details.

Finally, all adults received a free recall task 1 week to 10 days after the event. Because it was expected, the two age groups would perform similarly in the event task, this would ensure that if they did it was not by chance that a unique and superior sample of older people had been tested Older adults have repeatedly been found to recall fewer items from a list of words, and the Ratner, Padgett and Bushney study sought to replicate these age-related differences. This would illustrate confidence that age similarities in performance were specific to event memory and not generalizable to any task that might have been given to these individuals tested.

The subjects of the event memory test consisted of 20 older adults averaging 67.9 years of age and 19 younger adults averaging 20.9 years of age. The older group consisted of an equal number of men and women, and the younger group consisted of 10 women and 9 men. Most of the younger adults were students in introductory psychology classes. They received course credit for their participation. Older adults were recruited

from local senior-citizen recreation centers or had answered a newsletter advertisement. They received a small honorarium for participation. The college students had received an average of 14.3 years of education, and the older adults had received an average of 12.8 years.

The clay-making event consisted of 36 subordinate actions. Each action was defined as belonging to one of four superordinate categories: Getting ready, adding the dry ingredients, adding the liquid ingredients, and mixing the clay together. Subjects were told they would be making clay and forming shapes from the clay. Clay shaping provided a filled interval between the end of clay making and the beginning of recall. Afterwards the subjects were told that they would be asked to report everything that they had done that could be remembered. When subjects were completed reporting the event, they were asked if there was anything else they could remember. The interview was ended when subjects indicated that they had reported all they could.

Seven to ten days later, all subjects returned for the free recall test. They were read a list of 24 unrelated nouns and told to remember as many as possible. After the list was read, subjects filled out a form for about one minute. They were then asked to repeat as many of the words as they could remember.

Each piece of information reported was coded as either superordinate or subordinate unit. The superordinate category involved actions at the top of the event hierarchy they represented the overall or primary goals of the events and the end products that were the results of those actions. The subordinate category involved actions enabling the accomplishment of the superordinate goals and the ingredients and objects necessary to carry out those actions.

Two temporal-order indices were developed to assess the degree to which the subjects reported the event actions in the same order in which they occurred. The first was the number of times that all of the actions from an earlier node (i.e., get ready, add dry ingredients, add liquid ingredients, and mix together) were recalled before any action from a later node. This index reflected the extent to which the order between nodes was retained in recall.

A second index of temporal ordering was the proportion of action pairs that were possible to order that were ordered accurately. The first action recalled was compared with the next action. If the first action actually occurred earlier in the event sequence than the second action and if the subject recalled no other actions that had occurred in between, the subject was given credit for one ordered pair Then, the second action recalled was compared with the third action and the same assessment was made. This procedure was followed until all actions had been compared with the actions that were recalled after them. The total number of pairs was then divided by the total that it was possible to report given the amount of the subjects' recall (i.e., n-1 where n is the number of actions recalled).

Despite expectations that older adults would perform more similarly to the young when their memory of personally experienced events was assessed, this study appeared to replicate the classic pattern of age-related memory decline which shows recall would be less for older adults than younger adults. Furthermore, it supported the findings of earlier studies which tested memory for events that were quite different from those examined here. The older adults reported fewer subordinate clay-making actions than the young, and within the subordinate category, they reported fewer actions at each level of

importance. Furthermore, temporal order of the actions in the event was reported less accurately by the older adults, although this did not appear to be responsible for their poorer recall. Only the most general statements that summarized the goals of the event--the superordinate units--were reported as often by young and old. Although this finding was consistent with some studies of prose recall, its meaning was unclear, because superordinate goals were not reported very often by either age group.

Recall of Events – Experiment 2

Ratner, Padgett and Bushney, 1988

Before the study by Ratner, Padgett and Bushney (1988) could conclude that the older adults report events more poorly than the young, at least under the conditions present in this study, he needed to ensure that the older adults understood the detail with which he expected them to remember and report the event. Several investigators had observed that the older adults are more likely than the young to report only the gist of a passage when asked to recall stories or other types of text. It was possible that the older adults were less certain of what they should attend to and encode or that they had made different decisions about what to report. Some had indicated that they thought the experimenter would be bored to hear the details again in spite of instructions they had received. Still others seemed reluctant to guess when they were uncertain about a particular action, which may have led them to report fewer actions than they might have actually remembered.

In response to these observations, the researchers decided to conduct a second experiment in which the subjects' recall instructions would be more specific. Before subjects participated in the clay-making event, they were told that they would be expected to remember and report everything in detail. It was also explained that unless the subjects provided details, the experimenters would not know if they remembered them.

Ten adults at each of two ages, old and young, participated in this study. Older adults were members of the university alumni association and ranged in age from 60 to 79 years with a mean age of 70.4. Young adults were college students enrolled in a psychology class. They were an average of 19.3 years and ranged in age from 18 to 20. Older adults had received an average of 16.3 years of education and young adults had an average of 13.5 years of education.

Before making the clay, subjects received the same instructions as they had been given in Experiment 1. Following this initial set of instructions, an additional one was added. A videotape was shown (going on a tour) to illustrate what was expected in this experiment. These procedures would be followed by the subjects in this study. The subjects were told that they would be interviewed after the clay-making event and were expected to remember details of this event and not try to tell an interesting story by summarizing the sequence of events.

In contrast to the first experiment, old and young adults reported the clay-making event equally well. Although some preliminary data suggested that memory for events might not be maintained equally well by both groups over time, the experimenters' instructions did apparently eliminate the differences that were initially observed. These findings indicate that if older adults understand what they are expected to encode or

report, they could perform as well as the young. This provided additional support that the age differences observed in the first experiment were not the result of the intentional nature of the task. It appeared that with more information concerning task expectations, older adults are able to perform better.

As in the first experiment, actions that were rated most important were recalled more often than those of moderate or low importance Level of importance did not interact with age. Once more, it was found that old and young adults' memory is similarly influenced by an action's relationship to the overall goal of an event. The instructions to encode and report the event in greater detail did not lead the old to attend to a more limited range of information than the young.

Thus, older and young adults participated in two experiments in a standardized, hierarchically organized event that involved making clay. Hierarchical structure was created by establishing a set of superordinate categories that organized and were defined by a series of subordinate actions. Immediately following participation in the event, subjects were interviewed for their memory of it. Despite expectations that older adults and young adults would perform similarly when memory for action-based information was tested, the older adults reported fewer event actions than the young adults. Older adults and younger adults performed equally well, however, when instructions were clarified in a second experiment. In both experiments, memory of older adults and the younger adults was influenced similarly by the hierarchical structure of the event. These results as defined and assessed by this study suggested that the older adults might encounter less difficulty remembering events than other types of materials.

Aging and Word Finding: Reverse Vocabulary and Cloze Tests

Lovelace and Coon, 1991

A common observation of the aged regarding subjective changes in memory function was that they had trouble bringing some things they knew to mind when they wanted; this is most notable with people's names and words they wished to use in conversation. This problem with semantic memory seemed at odds with the common empirical finding that vocabulary remained very much intact for healthy older adults (Botwinick, 1984). However, the usual vocabulary test was a test of the ability to get from words to their meanings (speech comprehension) whereas the complaint was made with regard to a difficulty in moving from meanings to specific words (speech production).

It was hypothesized that everyone experienced some asymmetry with respect to the relative difficulty of moving from meanings to words and words to meanings. It was rare that someone used a word that they knew without being able to think of its meaning. Yet, most people would occasionally want to use a word to convey a particular meaning and are unable to think of the word. There was a perception that word-finding difficulty increased in frequency as people grow older, and it was hypothesized that this asymmetry was greater for old than for young adults (Lovelace & Coon, 1991).

In this study, the participants were provided a direct test by giving forward and backward vocabulary tests on the same items to the same individuals. In addition, the Cloze procedure was used to see if there would be an age-related decline in ability to generate the deleted words specified by the running context of a prose passage.

The participants consisted of 31 young adults with an average age of 20 years and 24 older adults with a mean age of 70 years with a range of 58-87. The young adults were undergraduate students, and the older adults were community-dwelling elderly. On a 4-point self-rating scale for health (poor, fair, good, and excellent), 2 were fair, 16 were good, and 6 were excellent.

Two word-retrieval tasks were administered in each of two sessions, and each session lasted less the one hour. The two sessions were separated by 10 days on the average. One task involved vocabulary tests, and the second utilized a Cloze task. In the first session, a forward vocabulary test was given, followed by a brief practice passage for the Cloze procedure. The Cloze task was then carried out for two passages. In the second session, two more Cloze passages were followed by a reverse vocabulary test.

In the forward vocabulary test, 43 words were tested by each word being spoken aloud, and the participants were instructed to give the definition of the word. For the reverse vocabulary test, the definition of each of the same 43 words was provided, and participants attempted to provide the word. Each of these 43 words was a noun that did not have an obvious synonym. The words ranged from 4 to 13 letters in length.

For the Cloze tests, subjects were informed that they would be asked to read four passages drawn from magazines intended for the general public in which key words had been deleted. The passages were drawn from stories in The Reader's Digest, and were between two and three double-spaced typewritten pages in length. Since the word-finding problems for the aged appear more related to naming things, 32 common nouns had been deleted from each passage. The objective of the Cloze task was explained as follows.

> They were asked to read through . . magazine passages and try to guess what word the author used for each of the blanks created when some words were deleted. They were instructed not to read beyond the sentence containing the blank before filing it in, and told that they could not return to change a word once it had been entered.

On the traditional (forward) vocabulary test, the average numbers of correct definitions were 40.7 and 41.3 for young adults and older adults, respectively, out of a possible 43. On the reverse vocabulary test, the mean numbers of words correctly provided were 39.8 and 38.9, respectively. Although overall performance was quite high, and the absolute differences in performance levels were small, there was a significant main effect of test direction with the reverse vocabulary test producing lower performance than the forward test. The interaction of age with forward versus backward test was also significant. This interaction reflected a reversal of the direction of the effect of age between the forward and reverse vocabulary tests; the older adults did better than the younger adults at defining words, whereas the younger adults were superior at getting from meanings to words. For performance on the forward and backward vocabulary tests considered jointly; the responses to the 43 items for correct responses on both tests, the average number of correct answers for the younger adults was 38.5 and for the older adults the correct answers was 38.3

Finally, for the older adult group, some personal information was gathered from an interview/questionnaire. The questions concerned their date of birth, their amount of schooling, their general health evaluation, and types and amount of reading that they normally did.

Analyses were next performed on items that were correct on one test but not on the other. In both age groups, more individuals showed the pattern of being correct more

often on the forward than on the backward test; this is consistent with the hypothesized asymmetry of access. Furthermore, as predicted, this effect was greater for the older adults than for the younger adults, 17 versus 9 individuals from the young sample and 14 versus 1 for the older.

Although the overall performance levels for the two groups were higher than one might prefer for maximum sensitivity of the tasks, there is clear evidence that the older adults had greater difficulty moving from the definition to the word than did young adults. This finding is consistent with other evidence, both from subjective reports of older individuals and from laboratory research, indicating a greater word-finding difficulty for the names of things for normal, healthy older adults than for young adults.

The Cloze task was coded as being one of six types: (1) The actual word that had been deleted, (2) a synonym of that word, (3) one that fit fairly well and perserved the general gist, (4) one that was syntactically correct but semantically irregular, (5) syntactically incorrect, or (6) an omission. There was very little difference in the distributions of these six types of response as a function of age. The mean percentages of responses where the actual deleted word was given were 40% and 42% for younger adults and older adults, respectively. Mean proportions for synonyms were 17% for both groups, and those preserving gist were 25% for younger adults and 21% for older adults. These three categories, where meaning was at least roughly preserved account for 82% and 79% of responses of younger adults and older adults, respectively.

Responses that were semantically anomalous were about equally likely for the two age groups, accounting for a mean proportion of 17% and 18% for younger adults and older adults. Very few responses fell in the remaining two categories of syntactically

incorrect words or omissions. The only cell, which contained more than a fraction of 1% of the responses, was the omission category for the older adult participants, which contained a little more than 2% of the responses.

More omissions by the older adults might represent the expected pattern of greater failure to retrieve an intended word. Since these are group mean proportions, this could, of course, result from a single older adult who frequently failed to provide a response. To assess this, the data for individuals was examined. For the young, 7 of the 31 individuals showed one or more omission responses, whereas 12 of the 24 old individuals showed omissions.

The vocabulary tests did indicate an asymmetry in ease of moving between the word and the meaning. Participants had a greater difficulty getting from the idea to the word than vice versa. This is an effect that showed a significantly greater asymmetry for older adults than for younger adults, although the effect was not large in absolute terms for either group

For the Cloze task where the individuals sought a word on the basis of the context of the prior text and the current sentence, age differences were minimal. This Cloze procedure is similar to that in sentence completion studies, and it leads to the same general conclusion that the older adults are able to use the running context of a sentence to generate missing words with about the same facility as younger adults. As was predicted, the older adults were somewhat more likely to fail to provide any word. This was, however, a very infrequent event. In the 128 blanks to be filled, only half the aged subjects ever failed to produce some word as compared to 22% of the younger adults. This higher level of omission responses by the older adults, may have reflected criterion

differences such as greater cautiousness in responding (e.g., Botwinick, 1984) rather than or in addition to age differences in word finding.

Anyone who would interpret the small size of the effects in the present study must keep in mind that this was an attempt to induce an event for which the natural absolute frequency of occurrence is very low (Burke et al., 1988). Also, to the extent that the self-paced nature of the present tasks did not duplicate the normal time constraints placed on speakers operating in real time, the present tasks may be viewed as biased against finding age effects of a magnitude that would occur in actual daily speech. Earlier studies have shown that even for words that both young and old successfully retrieved from the definition, latencies were significantly longer for older adults than for younger adults. Thus, it is clear that the time constraints of conversation are likely to enhance differential age effects in word retrieval, and quite possibly greater age differences in performance on the Cloze task would have occurred had the task been paced

Differences in Semantic and Episodic Memory – Experiment 1

Foos and Sarno, 1998

Older adults do not perform as well as young adults on tasks that involve learning laboratory materials and being tested, episodically, for those materials. However, the ecological and external validity of such materials have often been questioned, therefore, attempts have been made to test older adults with familiar, real-world materials. Typically, older adults still perform worse than young adults with these experimenter-

selected, real world materials. To avoid the problem of experimenter selection of materials, in these studies the subjects were investigated only for real-world materials that had been rated by older adults (or older and younger adults) for superior memorability by older adults.

To find materials that would be familiar and memorable for older adults without being unfamiliar (or unknown) to young adults, a survey was sent to several hundred older and younger adults. They were asked to rate their memory, relative to the memory of someone in the other group (i.e., an older relative to a younger person and younger relative to an older person), for 30 different stimulus items. Surveys were returned with items rated by both age groups as likely to be better remembered by older adults, better remembered by young adults, better remembered by the rater's own age group, and better remembered by the other age group. In these experiments some of the materials rated as better remembered by older adults was used.

In the first experiment, the subjects were investigated as to whether or not the older adults would actually perform well on the materials that had been rated by members of their age group as being easier to remember. Did they know this information as well as, or better than, young adults, and would they be able to remember it when asked to recall it? If older adults suffered from some form of retrieval deficit, then even if they had learned this information very well, they may not perform as well as young adults when asked to retrieve it. Several different items were selected, and recall and recognition measures were used.

The items on the test had to meet three criteria. First, they had to be items that older adults could be expected to remember well. Thus items were chosen that had been rated as memorable by older or by older and younger adults.

Second, they had to be items that were known to both age groups. Such knowledge could, of course, be a result of direct experience and/or learning about it in school.

Third, they had to be items that could be clearly check for accuracy. Items that were part of and individuals personal history (e.g., names of elementary school teachers) were not selected.

The survey found that older and younger adults agreed on 15 items that would be better remembered by older adults which meet their three criteria. Broadway shows, U.S. Presidents and U.S. and world geography were chosen items for this experiment.

Both recall and recognition measures were used, because some previous studies indicated smaller age differences on recognition measures. Recent research suggests that older adults have difficulty encoding information for later retrieval (Poon, 1985); in the present case, however, no encoding was called for. Individuals were simply asked to remember items that were encoded previously. If older adults have a retrieval deficit, they should show lower overall performance and more difficulty on recall tasks than on recognition tasks, because recall demands more retrieval effort than recognition.

In summary, in Experiment 1 older and younger adults' memories for world knowledge via recall and recognition measures was compared. It was expected that the older adults would have higher scores on many of these items because they predicted

higher performance for themselves on such items. However, it the older adults did have retrieval deficits, their performance should have been lower, particularly on recall tasks.

Sixty-nine healthy, older and younger adults participated in this experiment. The older group consisted of 19 women and 16 men between the ages of 60 and 82 (M= 68.9 years). The younger group consisted of 25 women and 9 men between 18 and 24 years (M=19.9). Only individuals born in the United States were included in the analyses. New York was excluded because of the test of Broadway shows.

All individuals received forms to fill out. One recall form asked the participants to name as many presidents of the United States as they could (in any order). The other asked for recall of items of world geography. Participants were asked to name as many as the could of (a) oceans and seas; (b) countries in Africa, Europe, and South America; (c) cities in Australia, Canada, China, Japan, and Russia; and (d) states of the United States.

One recognition form asked individuals to recognize 20 African animals on a list of 40 animals marking "A" next to African animals and "N" next to animals not from Africa. The other recognition form asked individuals to pick out 20 Broadway show titles from a list of 40 titles by marking "B" next to Broadway shows and "N" next to shows/titles not from Broadway (those titles were made up)

All participants were told that the experimenters were interested in finding out how much the average person knows about several different kinds of information. They were given the first of four randomly ordered forms asking for information about presidents, world geography, African animals, or Broadway shows. The participants were given as much time to respond as needed, and they were given the next form only when they

indicated they were finished with the current form. No individuals were given access to any external sources of information, and they were carefully monitored during testing.

Thirty older adults and 32 young adults completed the two recognition tests for African Animals/Broadway Shows Items. The results showed the older adults performed significantly better than the younger adults, and that African animals were recognized at a significantly higher level than Broadway shows.

Comparisons showed that the older adults correctly identified significantly more African animals than the younger adults did (i.e., older M=9.07 compared with younger M=7.47). The older adults identified significantly more Broadway shows than the younger adults did (i.e., older M=7.40 compared with the younger M=3.69). The age difference was slightly larger for Broadway shows, thus producing the marginally significant interaction).

The older adults recalled more states than the younger adults, but the difference was only marginally significant. Mean numbers of items recalled by older and younger adults, for States was M=41.58 for older adults and M=36.85 for younger adults.

The older adults recalled significantly more countries than the younger adults (Africa – older adults M=6.23; younger adults M=3.18); (Europe – older adults M=11.22; younger adults M=6.77); (South American = older adults M=5.28; younger adults M=3.22).

The older adults recalled significantly more countries than younger adults (Australia – older adults M=1.80; younger adults M=.53); (Canada – older adults M=4.30; younger adults M=1.94); (China – older adults M=2.03; younger adults M=.25); (Japan –

older adults M=2.47; younger adults M=.81); Russia – older adults M=2.47; younger adults M=.91).

The older adults recalled more oceans and seas than the young adults, but the difference was only marginally significant. The older adults scored M=8.29 and the younger adults scored M=6.85 for ocean and seas.

The older adults recalled significantly more names of presidents than younger adults. The best recall was in the most recent presidents.

The results of Experiment 1 support the claims of older adults that they can remember several types of items better than younger adults. In none of these different cases did the young perform better then the older adults. The means of the older adults were always higher than those of young adults, though in two cases that difference was only marginally significant (i.e., U.S. States and oceans/seas). Older adults know what they know. Although older adults may have difficulties with experimenter-selected materials, they perform very well on materials that they rate as being more memorable.

No differences in retrieval between the two age groups were detected; the older adults performed better on more difficult (in terms of retrieval) recall as well as recognition measures. With these familiar items, older adults appear to have no retrieval difficulties, although there may, of course, be a retrieval deficit on less familiar items.

Differences in Semantic and Episodic Memory – Experiment 2

Foos and Sarno, 1998

The results of Experiment 1 clearly indicated that, for certain materials, older adults have more knowledge and/or better access to that knowledge than younger adults. There was no question that older adults are very successful in retrieving these materials. Experiment 2 was designed to determine whether age differences in encoding would be found for such familiar items in an episodic memory task where only a subset of familiar materials must be remembered. In such a situation, one must encode the subset for later recall or recognition. If older adults perform poorly because they lack knowledge about or familiarity with typical laboratory materials, and subsequent difficulty in retrieving such materials, then one might expect them to perform fairly well on the presidents and states of the present study. That is, with familiar, easily retrieved materials, older adults should perform fairly well if the major cause of prior poor performance was a general deficit in retrieval.

If, on the other hand, older adults have an encoding deficit, then they should perform much worse than younger adults even on these familiar materials. An encoding deficit should result in lower recall because of the difficulties in retrieving poorly encoded items, and persons with such deficits should have a greater difficulty on a recognition test where one must discriminate among studied items and closely related other items. Such items may be relatively easy to retrieve but difficult to discriminate from related distractors.

An earlier study found that older adults have an encoding deficit. In that study, older adults produced much higher false alarm rates when they attempted to recognize studied items in a field of related distractors. Several other studies also have revealed high false alarm rates for older adults when they were asked to choose items that had been presented from a field of related distractors. Such work supports the hypothesis that older adults do not encode information distinctively enough to enable them to choose the correct alternative from a field of related distractors.

All of these studies have, however, used experimenter-generated materials and controlled the amount of time spent studying such materials. Thus, there have been no manipulated differences in the degree of familiarity with the materials, and the results did not provide any clear evidence about whether older adults could not or simply did not encode distinctively or whether the items were more difficult for older adults to retrieve. It may be that, given more time, the older adults would have produced much lower false alarm rates. Of course, if older adults are simply unable to encode distinctively, then such manipulations should make little difference. This experiment attempted to address these questions.

The items selected for this experiment were U.S. states and presidents. The former have been rated as more memorable for each age group by members of that age group, and the latter have been rated as more memorable for older adults by both age groups. In Experiment 1, the older adults performed better on U.S. presidents than did the younger adults, but the older adults performed only marginally better on U.S. states. Thus, these two sets of items offer a range of stimuli in terms of both expected and previously obtained performance. In Experiment 2 the time taken by each individual to

study each type of item and the time spent taking the recall and recognition tests were measured

If there is an encoding deficit and familiarity plays an important role in the encoding process, then older adults should show the lowest performance on recognition (rather than recall) of the most familiar items. That is, presidents may receive less encoding attention by older adults because presidents are very familiar (Foos & Dickerson, 1996; Experiment 1), and the resulting less distinctive encoding should produce very poor performance on a recognition task. For example, if one is very familiar with the names of trees and, as a result, does not spend the time to encode the word "elm" very distinctively, then one may have more difficulty in recognizing the studies word in the presence of related distractors (e.g., "palm"). If one is not very familiar with the names of trees, then one might spend more time encoding the presented names. States, which seem less familiar (on the basis of Experiment 1 and ratings from Foos & Dickerson, 1996), could receive more encoding attention and, thus, more distinctive encoding, producing better performance during recognition.

In sum, Experiment 2 older and younger adults were compared for recognition and recall memory for presidents and states from lists they had just studied. If retrieval difficulties are the major factor in previously found age differences, then one might expect age differences to be minimal or even reversed (i.e., older adults would perform better than younger adults) in the present case. On the other hand, if older adults have a deficit in encoding, then younger adults should perform better particularly on recognition tests. Older adults with a general deficit in encoding should show high false alarm rates on both sets of items. Finally, if older adults encode differently as a function of familiarity, then

they should show less study time and higher false alarms rates, particularly for presidents. The most familiar items would receive the least amount of encoding.

Sixty healthy older and younger adults participated in Experiment 2. The older adult group consisted of 18 women and 12 men between the ages of 60 and 85 (M=70.07); 24 women and 6 men between the ages of 18 and 22 (M=19.73) made up the younger adult group.

The 40 names of U.S. presidents were randomly divided into two sets of 20 each. This division randomly selected presidents from the first 10, second 10, and so on, so that each set would have an equal number of recent and historical figures. Presidents with the same last name (e.g. Adams, Johnson, Roosevelt) were not placed in the same set. The 50 U.S. states were also randomly divided into two sets of 25 each with the restriction that those with names in common (e.g., North and South Carolina, North and South Dakota, Virginia and West Virginia) were placed in different sets.

In the recognition tests, all 40 presidents (in random order) or 50 states (in alphabetical order) were listed. The participants were asked to mark "S" for items they had studied and "N" for items they had not studied.

Half of the participants in each age group (i.e., 15 older and 15 younger participants) were given a set of presidents (i.e., 20 names) to study (a randomly determined 7 in each age group received one of the two sets and 8 received the other). The other half were given a set of states (i.e., 25 states) to study (a randomly determined 7 in each age group received on of the two sets and 8 received the other). The participants were allowed to study as long as the wished, and the study time was measured covertly.

After the first test, those participants who had initially studied presidents received a set of states and those who had initially studies states received one set of presidents. Again, a randomly determined 7 in each group received one set of states or presidents and the other 8 received the other set. Again, study time was measured covertly.

After the second study period, those who had received a recall test the first time received a recognition test, and those who had received a recognition test the first time received a recall test. Again, test time was measured covertly.

The results of Experiment 2 showed a significant effect of age. The younger adults performed significantly better than the older adults. Individuals performed better with states than with presidents, but this difference did not interact with age. The interaction between condition combination and type of item was significant, revealing better performance on recognition than on recall tests. That is, between-subjects condition combination of president recall and states recognition had higher scores with states, whereas the condition combination of president recognition and states recall had higher scores with presidents.

Finally, the three-way interaction among age, combination of conditions, and type of item was significant, showing larger age differences for recognition than for recall. The overall mean (presidents and states) for the older group was M=.64 propotion correct, study time M=6.02; and test time M=6.34. This compares to the overall(presidents and states) means for the younger group of M=.84 proportion correct; study time M=6.61; and test time M=3.94

Test of simple main effects revealed that the younger adults recognized significantly more presidents and more states than they recalled. This is the typical finding of better performance for recognition than for recall.

The present results support the hypothesis that there is an encoding deficit for older adults. They had lower performance scores than the younger adults on both sets of materials (recall and recognition tests). Previously obtained results cannot be attributable simply to unfamiliar materials and retrieval difficulties because these same items were easily retrieved by the older adults in Experiment 1.

This encoding deficit was most evident with the most familiar materials, U.S. presidents. The time that the older adults spent studying presidents was less than all other study times. As a result, when the older adults' scores were analyzed, it was difficult to separate information in that familiar knowledge base that had recently been studies from that which had not. The highest error rates were for the older adults for recognition of presidents A good knowledge base seems to encourage less distinctive encoding and, thus, lower performance, particularly for recognition of a studied item in a sea of related distractors.

Effects of Age on State of Awareness Following Implicit And Explicit Word-Association Tasks

Java, 1996

Age differences have been shown to be smaller in implicit than in explicit memory tasks. However, most of the work cited by these authors in their meta-analysis refers to

perceptual rather than conceptual implicit tasks – tasks that involve a more superficial than deep level of processing.

To support these findings, one refers to older adults' impairment at tasks requiring contextual information and the relatively smaller impairment of this subject group at tasks that involve familiarity. This explanation is compatible with investigations into "remember" and "know" measures of conscious awareness in memory and age. Remember (R) responses refer to the specific context of the study moment and its conscious recollection at test. Know (K) judgments refer to the knowledge that a particular event took place, and experience of familiarity in the absence of conscious recollection.

Other research in memory and aging incorporating these measures of conscious awareness have shown that in cued recall, younger participants make more R responses than older persons, whereas K responses do not differ with age. These studies have shown that in recognition too, younger participants make more R responses than older persons but that older individuals respond with more Ks than do younger people. Because earlier studies have suggested that older participants are less impaired at tasks involving familiarity than at those requiring deliberate recollection, it was proposed to investigate the relationship between conscious awareness as measured by R and K responses at post-implicit and explicit retrieval.

The aims of this study were threefold. The first was to introduce a conceptual task that is new to the field of aging. The goal was to discover whether this task would produce a similar pattern of results (i.e., whether age differences will be smaller in an implicit rather than an explicit version of the task) Word-association cues were held

constant across implicit and explicit tasks - only the instructions would vary. A read-generate study manipulation would determine the resultant classification of the task according to its greater conceptual or perceptual (data driven) components. It had been proposed earlier that a task showing a generation effect defined a conceptually driven test, whereas the reverse – higher read scores – defined a greater data-driven component.

The second aim of the study involved an endeavor to harness implicitly produced information and render it accessible to explicit retrieval. Following implicit retrieval, participants were asked to examine the word associations they had made because seeing their own implicit productions might facilitate conscious access to them. This would result in performance of the older participants being raised to a level similar to that of the younger participants Because older adults tend to be less impaired at implicit rather than explicit tasks, showing these participants the items they had just produced by implicit means could encourage their availability to conscious awareness. Thus participants are to be made test aware and then given a quasi-recognition test to carry out implicitly produced word-association responses.

The third aim of the study was to investigate the relationship between conscious awareness and implicit and explicit tasks. Participants made R and K judgments after implicit and explicit retrieval. These R and K judgments were made for each item recalled following word-association cued recall

It was predicted that if a generation effect was shown in the implicit word-association task, with little effect of age, then word-association priming could be added to the few conceptual tasks for which age is not a potent factor. Furthermore, presenting participants with their own implicitly produced free associations might encourage them to

make the link between involuntary and voluntary retrieval. Thus, age differences should decrease. Although it was anticipated that younger adults would make more R responses than the older adults following cued recall and recognition, K judgments were not expected to vary with age.

The participants in this study consisted of a younger group comprised of 20 students mean age = 26.5 years (range = 19-42), 7 men and 13 women. The 20 older participants (10 men and 10 women) had a mean age of 69.4 years (range = 63-79). All of the older participants were healthy, active, and living independently in the community.

The study words were 80 six-letter nouns, taken from the Little Oxford Dictionary, which had also been used in similar studies. The words were randomly divided into two different sets, A and B, for use as alternative study lists between participants. Within these lists, a further division was made do that items were presented in a mixed set of items to be either read or generated.

In the implicit test, participants were asked to freely associate to each of 40 words with a single-word response. Test cues were semantic associates of the study words, which had originally been piloted on a representative sample for each participant group to ensure a weak semantic relationship. Half of these test cues related to Set A and the other half to Set B.

Non-studied material acted as a baseline against which priming could be measured. The implicit word-association task was given before the cued recall test, partly so that participants should not be alerted to what was required of them in this implicit task and also so that any effect of priming might be captured within this short period. Other than this, study and test lists were fully counterbalanced across all experimental conditions.

Participants were presented, at a 4-s rate, with a set of words, hand printed on index cards. They were told to study the words for a later memory test. The nature of the test was not specified. The words were either printed in full (e.g., defeat) or took the form of a short semantic clue participants said silently to themselves, and the first letter of the word (e.g., not a victory/d.). In each case they were to say the target word aloud. Following this study phase, they took the Mill Hill test followed by the implicit word-association task, both of which were presented as filler tasks. In the implicit word-association task, participants were told to write next to each of two columns of printed items, the first English word that came to mind in association with each cue. Proper nouns were not to be included. Then instructions were given regarding R and K judgments. Thus after participants had freely associated to each of the cues, they were informed that some of their responses corresponded with original study items. They were asked to examine their responses and indicate which of these they now recognized from the study list. Next to each of these, they indicated with an R or K their mode of conscious awareness at retrieval. Then they did the cued-recall test, using the printed columns of words as cues to remind them of the study list items, again putting and R or a K next to each recalled item after the recall procedure. Participants were discouraged from guessing and instructed to leave blank any spaces that did no relate to study items.

Only exactly matching words counted as correct responses in all cases. Scoring on these tests was not contingent on correct responses at study (failure rate to generate a target in the allotted 4s was 3% and 4% for younger and older groups, respectively.

In the cued-recall (explicit) data the results indicated that the younger group had higher cued-recall scores than did the older participants in the generate condition. For the

implicit task, a greater number of associations were correctly made for studied than for non-studied material, with a large number of correct target associations occurring in the generate condition, irrespective of age. The mean score for younger participants in the explicit generate condition was 63, and for the read condition if was .07. The mean score for the older participants in the explicit generate condition was .40, and for the read condition was .06.

For the post-explicit task, the younger group made more R responses than did the older group. The results of the post-implicit data showed the older group failed to recognize a greater number of correctly primed targets than did their younger counterparts. The mean for R in the explicit test for younger adults was .25 and the mean for the K was .11. This compares to R in the explicit test for older adults as .14 and the mean for the K was .09 The mean for the R in the implicit test for younger adults was .08 and the mean for the K was .06. This compares to R in the implicit test for older adults as .05 and the mean for the K was .06.

This study extends and generalizes findings that show smaller age differences in implicit rather than explicit memory tests, to conceptual tasks new to research in aging. This work not only adds to the small number of studies that show preserved function in conceptual rather than perceptual priming but it has investigated the relationship between conscious awareness, implicit and explicit test distinctions, and age.

The examination of participants' post-explicit and implicit states of awareness yielded interesting results. As predicted, following cued recall, the younger adults made more R responses than did the older adults, whereas K responses did not differ with age. Post-implicit retrieval data showed opposite effects of age and awareness. That is,

although the younger group tended to make more R responses than the older adults, the older group members were less aware of their implicitly produced word associations as items from the study list than were the younger participants. Once again, K responses did not differ with age

The findings that the K response was unaffected by age either in cued recall or in the recognition of implicitly produced responses in important in two ways. First, these results confirm suggestions that older adults are more impaired at tasks involving specific contextual detail rather than those involving familiarity. Second, they extend previous work that has shown little effect of age on K responses in cued recall.

In conclusion, effects of age were shown in conscious recollection and generation in cued recall and in the explicit recognition of implicitly produced word associations. Little effect of age was shown in the word-association priming or memory in the absence of conscious recollection – K responses. Further investigation into areas of memory that might be preserved in older persons as well as impaired person is essential. There is a need to publish such information for the subjects of interest themselves – the aging population.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Pictorial

Conclusions

Since the art of memory is the art of attention, this leads to the following conclusions (See Maisto & Queen, Appendix):

1. Conditions which demand effortful processing and draw on limited attentional capacity reveal a deficit in older adult participants.
2. The most accepted change of aging related to memory is the decreased capacity to remember newly acquired information.
3 Both attentiveness and vigilance are important to memory and learning.
4. Selective attention and divided attention are two categories of attention that show age-related changes.

Recommendations

These conclusions suggest recommendations related to various interventions including application, practice, rehearsal and the use of imagery.

Adults learn better when they are given a task that does not cause them to divide their attention between two tasks. Maintaining a single focus for each session eliminates the need for divided attention. Application, practice, and rehearsal will facilitate the older adult's processing and retention of information in primary or short-term memory. Imagery is the formation of picture-like representations; a process known to aid memory. Meaningful material and tasks are more easily learned and remembered longer than non-meaningful or nonsense material.

Verbal and Spatial

Conclusions

A large body of literature shows that age affected verbal and spatial learning and information in a highly similar matter. It showed that spatial learning, like verbal learning is dependent upon effortful information processing which provide conclusions as follows: (See Mungas & Ehlers, Appendix)

1. Adults have greater difficulty with recall of abstract as opposed to concrete words.
2. Semantic elaboration and imagery are important tools for older adults.

Recommendations

Recommendations for techniques for improving memory are based on efficient organization of the items learned by chunking information into easily handled packages.

Factors such as meaningfulness, association, lack of interference and rehearsal influence a person's ability to retrieve material from memory.

Techniques that assist in organizing and chunking otherwise unrelated items are also likely to improve a person's memory. Concepts enable chunking large amounts of information. Each new piece of information does not have to be treated as unique, since things are already known about the class of object or experiences to which the new items belong. New knowledge is acquired and retained within old knowledge structures. Thus, when individuals are familiar with material to be learned and remembered or with related material, they are aided by existing knowledge structures, which provide them with something on which to relate the new information.

Computer-Displayed and Printed Text

Conclusions

The use of visual displays and working at one's own pace are helpful in any memory situation, which contributes to the following conclusions (See Moore & Zabrucky, Appendix):

1. On-line texts result in improved comprehension and memory in adults.
2. On-line texts are more visual and interactive which promotes improved memory.
3. On-line texts present opportunities for readers to look-back at text, and, therefore, it contributes to more retention than a printed page.

Recommendations

To eliminate some of the memory problems, which occur when text is read, the following would be recommended: Adults can learn and retrieve information better when they are presented with a visual display of how the material is structured. Learning problems in adults are related to the declining speed at which adults learn, rather than their mental capacity, therefore, it is helpful for adults to work at their own pace. Individuals learn at different rates. Allowing readers' look-backs to previously presented units of text may have contributed to superior reading performance compared with the normal printed page. Active rather than passive participation in the learning activity enhances learning. Minimize learning conditions that result in insufficient time to learn and to respond and provide opportunities for self-pacing.

Prose Recall

Conclusions

Cultural factors have an enormous influence on the development of our minds as well as many aspects of our memory, and the following conclusions illustrate this fact (See Ratner & Schell, Appendix):

1. Active and prolonged studying enhances memory for prose recall.
2. Older adults' memory is influenced by cultural factors.

Recommendations

Interventions can be recommended for improving the memory such as organizing information being studied, and by encoding the information more deeply. Also, minimize interference such as noise and distractions which can affect the learning process.

A fairly extensive body of research exists suggesting that the decline of memory in older adults may be associated with failure to properly organize the information for storage and retrieval rather than with deficits in capacity. Retention deficits are reduced when instructions to engage in appropriate acquisitional processing are provided. Information that can be recognized, but not recalled, may have been encoded less deeply or there may be some interference with the retrieval of that information.

Recall of Events – Experiment 1

Conclusions

Event memory is one type of memory, which shows fewer age-related differences which is supported by the following conclusions(See Ratner & Padgett, Experiment 1, Appendix):

1. Specific instructions given before the memory test result in improved encoding.
2. Any items which are judged to be important are remembered better than those judged less important.
3. People are motivated by being told what they are expected to remember.

Recommendations

It is recommended that a person attend to information for it to move into short-term memory where it is then rehearsed and displaced into longer-term storage. Redundancy of information is important. Learners should not have to infer what is important. Sufficient time is needed for the learner, and the process cannot be hurried. Specific instructions are vital to the learning process. If few opportunities have been provided to rehearse new information with practice, handouts, or coaching, or if there has been insufficient time for rehearsals, than the information simply may not have reached secondary storage. The use of cues has been found to be very effective in aiding older adults to retrieve from their memory. A cue is a hint or a signal indicating the nature of something to be recalled.

Recall of Events – Experiment 2

Conclusions

The importance of different methods of presentation, can enhance learning skills in adults as illustrated by these conclusions: (See Ratner & Padgett, Experiment 2, Appendix).

1. When instructions are not specific, and are not clarified older people will report fewer actions than the young.
2. Multiple medias of presentation improve the encoding and memory for recall of events.

Recommendations

Several interventions for older adults can be recommended to make any instructions clearer to produce the outcomes desired. Older adults are sometimes reluctant to guess when they are uncertain about a particular action, which can lead to fewer actions reported than might have actually been remembered. Encouragement and good facilitation, with specific results explained, can help the adults to understand how important their answers are in relation to the study being conducted. Also, if older adults understand what they are expected to encode or report, they could perform as well as the younger adults.

Providing more time for rehearsal (repetition) of new knowledge can help in the acquisition process. It will help older adults to be clear in transitions when one idea or concept is completed before moving on to another concept.

Aging and Word Finding

Conclusions

Word finding tests in memory are affected by the type of test given and the time required to remember the information if they are time paced as evidenced by the following conclusions (See Lovelace & Coon, Appendix):

Older adults are at a disadvantage when tasks are complex or speed-related.

Recommendations

It is recommended by most instructors in real life situations to give older adults more time for processing operations, since the time needed for processing increases with

age. Some comparisons of this test with another identical test which is time paced could provide some different results. Learning problems in adults are related to the declining speed at which adults learn, rather than their mental capacity, therefore, it is helpful for adults to work at their own pace.

Helping older adults relate new learning to past experiences and learning improves recall. Also, learning, especially with regard to skill development, is enhanced by repetition, preferably spaced systematically over a period of time. Since study cases are sometimes taken out of every context of real life it would be advisable to give these tests in a real life situation. Building any educational activities around the adult's learner's needs insures a more permanent learning.

Differences in Semantic and Episodic Memory – Experiment 1

Conclusions

The performance was compared on memory tests taken by older and younger adults for information that had been rated as more memorable for older adults or more memorable for each age group by adults in that age group. In Experiment 1, semantic knowledge was tested by having the participants recognize or recall information from memory (e.g., name as many states as you can). The older adults performed significantly better; thus hypotheses of superior knowledge and ease of retrieval of that knowledge for that age group were supported and leads to these conclusions (See Foos & Sarno, Experiment 1, Appendix):

Compared with younger adults, older adults perform better when dealing with real-world categories from their lived experiences.

Recommendations

Several implications and recommendations exist for drawing on the wealth of the real-world knowledge of older adults. Educators can build on the skills and abilities of older adults by informing and using their resources. Also providing meaningful and relevant tasks for the older learner will assist in the memory and learning process. Where older adults have acquired expert knowledge and are not suffering from any disease that would interfere with memory, their performance should be minimally slower but as competent as that of younger adults. The positive perspective of the effect of expertise on performance and the need for just a little more effort to learn new material should be promoted with adult learners.

Differences in Semantic and Episodic Memory – Experiment 2

Conclusions

In Experiment 2, lists of presidents and states were presented to the participants, followed by recognition and recall tests of episodic memory. The younger adults performed significantly better. The older adults studied familiar items on the lists for less time and made many more errors. Thus, the hypothesis of an encoding deficit influenced

by item familiarity for older adults was supported which leads to the following conclusions (See Foos & Sarno, Experiment 2, Appendix):

1. Item familiarity decreases effortful encoding among older adults.
2. Hence, a critical force affecting memory as we age is how much mental processing the task demands

Recommendations

It is recommended to gear the pace of learning to the group's capabilities. The implications for continued learning in the adult years are that one can expect younger adults to learn new material a little more quickly but that, given time and sufficient motivation, older adults will achieve equivalent learning outcomes. The positive perspective of the effect of expertise on performance and the need for just a little more effort to learn new material should be promoted with older adult learners.

Effects of Age on State of Awareness Following Implicit And Explicit Word-Association Tasks

Conclusions

Younger and older participants did word-association tasks after implicit and explicit instructions and a read-generate study manipulation. No age differences were shown in the implicit version of the test. A generation effect for both age groups suggested that word-association priming can be classified as a conceptually driven task and a new task at which older adults show a relatively preserved memory function.

However, the younger group did better on the explicit test in the generate condition. Participants were asked to examine their implicitly produced responses to make them accessible to conscious retrieval. Remember (R) and Know (K) measures of conscious awareness were applied to both post-implicit and post-explicit word-association responses. Age and awareness showed opposite effects in post-implicit retrieval. Younger participants tended to make more R responses than did the older adults, and K responses did not vary with age, but the older group was unaware of more primed items as study list members. Age differences were also shown in R but not K responses after word-association cued recall. The following conclusions can be reached from this study (See Java, Appendix):

1. Age differences are not apparent in implicit memory between younger and older adults.
2. Younger adults perform better than older adults in tests of explicit memory
3. Older adults are more impaired at tasks involving specific contextual detail rather than those involving familiarity

Recommendations

It is recommended to publish any memory studies of interest to older adults in order to make them aware of the findings in all aspects of memory to be more informed on those which would benefit from interventions. Implicit memory is one memory system which involves information that we learn and remember automatically, without conscious reflection or thought. Once we have learned an activity, we automatically "remember"

that activity Such knowledge about this aspect of memory might encourage older persons to build on their strengths rather than lack motivation as a result of apparent weaknesses. Educators can build on the skills and abilities of older adults by informing and using their own resources. Any memory task in which a person is instructed to consciously recollect (or become aware of) a previous experience is called an explicit memory task. Researchers have reported that older adults scored lower than young adults on tasks of explicit memory (recall and recognition). This is valuable knowledge for educators. The use of cues has been found to be particularly effective in aiding older adults to retrieve from their memory. A cue is a hint or a signal indicating the nature of something to be recalled. Also, providing more time for rehearsal (repetition) of new knowledge can help in the acquisiton process. An appropriate perspective to assume would be that effective learning and memory are life-long activities for most older adults.

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APPENDIX

OVERVIEW OF STUDIES OF EFFECT OF AGE ON RECALL

Overview of Studies of Effect of Age on Recall

Author	Purposes	Ages	Sample	Procedures	Results
Pictorial Maisto, A. & Queen, D. (1992)	Examine the age differences in recall for stimuli that consisted of a word and its pictorial representation combined.	Studied younger 20 males and 33 females and older group of 13 males and 39 females. (Mean age of younger = 20.7 and mean age of older =68.3).	The younger subjects were recruited from general psychology classes. The older subjects were volunteers recruited from several senior centers.	Stimuli consisted of three sets of slides of 51 items. One set was printed words, another set a drawing representation of the words, and the third their picture representations mounted side by side.	Mean word recall of younger adults was 17.35; the older adults was 15.50. Picture mean recall for younger adults was 23.17, and older adults was 19.50, and the word-plus-picture recall for the younger adults was 24.27, and the older adults was 12.39
Verbal and Spatial Mungas, D. & Ehlers, C. (1991)	Assess the relative effects of age on verbal and spatial learning and information processing.	Divided into 3 age groups: 30-45: 46-60; and 61-81, consisting of 29, 26, and 29 adults. There were 84 subjects comprised of 40 males and 44 females.	Subjects were volunteers and employees from Scripps Clinic and Research Institute of LaJolla, CA.	Subjects were all tested by a trained examiner in a single session. The order of test administration was fixed, with the verbal learning test administered prior to the spatial learning test.	Means were 30-45 age group.62; 46-60 age group .59; and 61-81 age group .53. Results showed that age affected verbal and spatial learning in a highly similar manner.
Computer Displayed & Printed Text Moore, D. & Zabrucky, K. (1995)	Compare the processing of text from computer screen and the printed page using multiple dependent measures to assess both comprehension and recall of younger and older adults.	Divided into 2 age groups: 40 younger adults age range of 19-34, mean age=22.93 and 40 older adults, age range of 60-84, mean age=71.35.	Younger adults were recruited from a university and older adults were active, community-dwelling individuals recruited from two senior groups at a local church.	The subjects were tested individually and read the four experimental passages each presented in one of four experimental conditions (consistent close, consistent far, inconsistent close, and inconsistent far).	On-line presentation of texts comprehension resulted in superior evaluation and recall for both younger and older adults.

Overview of Studies of Effect of Age on Recall

Author	Purposes	Ages	Sample	Procedures	Results
Prose Recall Ratner, H & Schell, D. (1987)	Assess older adults text recall and study strategies compared with those of two groups of younger adults.	Studied younger mean age = 22.2; with an age range of 20-27. Another group of mean age = 21.9 with a range of 19-28, older mean age = 69.4 with a range of 60-79.	24 retired university alumni 24 college students and 16 noncollege who had not attended classes in at least a year. These 64 adults were all females.	The same read-and-recall procedure was followed for all subjects in four experimental trials. Two conditions were met. The verbatim condition were told to remember stories.	The college students out-performed both out-of-school groups; the out-of-school groups performed similarly to one another. The college students studied longer. Differences also resulted from cultural factors.
Events Ratner, Padgett, & Bushney (1988) Experiment 1	Examine older and younger adults' event memory.	Studied 20 older adults (M=67.9) and 19 younger adults (M=20.9) 22 women and 19 men. Age range of older = 61-75. Age range of younger = 18-20.	Older adults were recruited from senior-citizen recreation centers. Younger adults were students in introductory psychology classes.	Clay-making consisting of 36 subordinate actions defined as belonging to four superordinate categories. They were told to report everything they could remember.	The older adults reported fewer subordinate clay-making actions than the young, and within the subordinate category, they reported fewer actions at each level of importance.
Events Ratner, Padgett, & Bushney (1988) Experiment 2	Examine older adults' and younger adults' event memory.	10 older adults (M=70.4) and younger adults (M=19.3). Age range of older = 60-79. Age range of younger 18-20.	Older adults were members of alumni association. Younger adults were honors students in a psychology class.	Subjects were asked to report a clay-making event also, as in Experiment 1 above. This study required subjects to report every detail and be much more specific than in Experiment 1.	In contrast to Experiment 1, the old and young adults reported the clay-making event equally well. It appeared that the more information that older adults have concerning task expectations they perform better.
Word-Finding Lovelace, E. & Coon, V. (1991)	Examine older adults and younger adults word finding and perform Cloze test.	31 younger adults (M=20) and 24 older adults (M=70). Age range of older = 58-87.	Older adults were community-dwelling elderly. Young adults were undergraduate students.	Subjects were tested on forward vocabulary tests for definitions of words which were given, and backwards for words which were given with definitions asked from them. They were also given a Cloze test wherein they were asked to supply the missing word in a passage. These tests were not time paced.	The interaction of age with forward versus backward test was significant. This interaction reflected a reversal of the direction of the affect of age between the forward and reverse vocabulary tests. On the Cloze task, age differences were minimal.

Overview of Studies of Effect of Age on Recall

Author	Purposes	Ages	Sample	Procedures	Results
Semantic & Episodic Foos, P. & Sarno, A. (1998) Experiment 1	Examine older adults and younger adults in semantic and episodic memory.	34 younger adults, 25 women and 9 men (M=19.9) and 35 older adults, 19 women and 6 men (M-68.9). Age range for older 60-82, age range for younger 18-24.	All participants were U.S. born citizens who had been mailed a survey to rate their memory.	Semantic knowledge was tested by having the participants recognize or recall information from memory (e.g., name as many states as you can).	The older adults performed significantly better than the younger. Thus, the hypotheses of superior knowledge and ease of retrieval of the knowledge for that age group was supported.
Semantic & Episodic Foos, P. & Sarno, A. (1998) Experiment 2	Examine older adults and younger adults in semantic and episodic memory.	34 younger adults, 25 women and 9 men (M=19.9) and 35 older adults; 19 women and 6 men (M=68.9). Age range for older 60-82, age range for younger 18-24.	All participants were U.S. born citizens who had been mailed a survey to rate their memory.	Knowledge was tested by giving participants lists of presidents and states followed by recognition and recall tests of episodic memory.	The younger adults performed significantly better. The older adults studied familiar items on the lists for less time and made many more errors. Thus, the hypothesis of an encoding deficit influenced by item familiarity for older adults.
Implicit & Explicit Java, R. (1996)	Examine younger adults and older adults in implicit/explicit word-association tasks.	Younger group was 20 students (7 men and 13 women M=26.5). The older group consisted of 20 participants (10 men and 10 women, M=69.4). Age range for older 63-79, age range for younger 19-42.	The younger group were university students. The older adults were healthy, active persons living independently in the community.	The younger and older participants did word-association tasks after implicit and explicit instructions and a read-generated study manipulation.	Effects of age were shown in conscious recollection and generation in cued recall and explicit recognition of implicitly produced word-association. Little effect of age was shown in word-association priming or memory in the absence of conscious recollection.

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Professional Memberships: Mingo Valley Homeowner's Association; Fixed Route Passenger Advisory Committee – MTTA; Antique Automobile Club of America; SPCA volunteer; Day of Caring for United Way volunteer; Tulsa Garden Center volunteer.