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Memory Change and Cognitive Function among the Elderly

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MEMORY CHANGE AND COGNITIVE FUNCTION

AMONG THE ELDERLY

by

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ABSTRACT OF THE DISSERTATION

Memory Change and Cognitive Function

Among the Elderly

The Problem: The deleterious effects of aging on various cognitive abilities are widely recognized, yet little is known regarding what constitutes "normal" memory test performance in individuals over the age of 74. In this study, forgetting rates for verbal and nonverbal material from the Wechsler Memory Scale-Revised (WMS-R) were examined in groups of older healthy individuals aged 50 - 74 and 75 - 95. Despite equivalent scores on measures of global cognitive status and attention/concentration, the older group demonstrated significantly poorer performance on the Delayed Memory Index. Preliminary normative data for normal elderly subjects on the WMS-R are presented, and the need for appropriate norms for elderly individuals is discussed.

The Research: As part of an ongoing neuropsychological investigation of normal and abnormal aging, subjects over the age of 49 were recruited via local flyers and newspaper advertisements. For this study, subjects between the ages of 75 and 95 were included, along with a younger comparison group of individuals aged 50 - 74.

All subjects were carefully screened via telephone interviews for neuropsychological risk factors, and those with a history of neurological disorder (e.g. stroke, head injury), learning disability, major psychiatric disorder, major medical illness or substance abuse, were excluded.

The resultant sample was comprised of 30 subjects between the ages of 75 and 95, and 35 between the ages of 50 and 74. All subjects were administered the WMS-R according to standard procedure (Wechsler, 1987). For the purpose of this study, the general composite Index scores of the WMS-R were calculated for comparison of the two age groups. These general Index scores include five parameters of memory: Attention/Concentration, Verbal Memory, Visual Memory, Delayed Memory and General Memory.

The Results: The older and younger groups were significantly different in terms of age, but not in educational level or the raw Attention/Concentration score. In terms of test scores, both groups obtained highly similar scores on General Memory, Visual Memory and Verbal Memory. The older group achieved a significantly lower score on Delayed Memory.

These results represent some of the earliest data regarding WMS-R performance in healthy older individuals.

Because of the above average level of education and excellent health status of these samples, however, the generalizability to other elderly groups (i.e. those with less education and various health risk factors) may be limited. Nevertheless, until more large scale age and education-adjusted norms are available, data such as these may serve as general preliminary guidelines for the interpretation of older subjects' performance on the WMS-R.

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CHAPTER ONE

Statement of the Issue

Introduction

What constitutes normal aging and normal age-related memory decline is not yet fully understood. Although the deleterious effects of age on memory abilities that have been reported are more apparent on some measures than on others, many studies have demonstrated poorer performance among older adults when compared with their younger counterparts on various tests of memory (Kausler, 1982).

Interest in the elderly has accelerated in recent years because of a growing awareness that there has been, and will continue to be, a large increase in the size of the senior population. Because the prevalence of diseases that cause cognitive impairment rises sharply with age, there is an increasing need for clinicians to be knowledgeable about age-related changes in function and disorders that are frequently found among the aged. The number of persons aged 65 and older has grown and will continue to grow more rapidly than other age groups. The gerontological literature tells us that until the early nineteenth century, the average lifespan of human beings

was fairly constant, ranging from 30 to 40 years. This began to change in the late 1800's and has accelerated throughout this decade. In 1820, death at age 30 was 10 times more likely to occur than in 1975. During the 20th century, the average life expectancy of an American has increased by more than 25 years--from 47 years in 1900 to 75 years in 1980 (Kovar, 1977). In 1900, 4% of the population was over 65 (1 in 25). Today 11% of all Americans are elderly (1 in 10). It is expected that by the beginning of the next century older individuals will comprise 17% of the population (1 in 5). Interestingly, more than half of the people who have lived past the age of 65 since the beginning of recorded history are alive today. Very important, all age segments of the elderly population are expected to grow rapidly, but the growth of "the extreme aged" will be especially large. By the year 2000 there will be 100,000 centenarians (Bengtson and Schaie, 1989).

While the phenomenon of aging seems clear, the study of aging is extraordinarily complex. There has even been considerable debate about the definition of aging. The aged are not easy to categorize because they are so varied. They are so varied, in fact, that for years it

had commonly been held that there are greater differences among old people than among young people considering how varied the young are. A relatively recent study put doubt into this commonly held idea (Bornstein & Smircina, 1982), but no one doubts that no two people are alike, just as no two young people are. One can expect large differences among the elderly. First, one can start with the large differences among the young. Then, as people grow old, some functions decline, some remain essentially the same, and up to a point at least, some improve. Thus, the range of function varies from poor to very good and this range is very large among the elderly.

This large variation among older adults makes generalizations about them difficult. Is age 55 old? Is 75? Neugarten (1975)suggests that older adults are best thought of in terms of two groupings: One group is the "young-old", ranging in age from 55 to 74, and the other group is the "old-old", comprising people over 75. These two groups are very different--the young-old are healthier than the old-old, their abilities are greater, and the ratio of men to women in this younger group is larger. Perhaps two groupings is too limited in scope. It might prove advantageous to consider the young-old (55 - 64), middle-old (65 - 74), and the old-old (75 and over. Perhaps in the over-75 category, it would be

helpful to make another distinction: The old-old (75 - 84) are different from the very old (85 and over group). Each of these groups is different. The more numerous and differentiated the groupings, the more one can learn about aging and the individual. One can best understand the aging individual with knowledge of how he or she compares to those younger, to age peers, and to those older. It is for this reason that group trends, from early life to old age, are important to this study.

What is normal aging and age-related memory decline? Some gerontologists emphasize the losses associated with age by saying that "senescence is a change in the behavior of the organism with age, which leads to a decreased power of survival and adjustment" (Comfort, 1956). Most gerontologists agree that aging is an involuntary and irreversible process that operates progressively with the passage of time and is revealed in different aspects of function. Others emphasize that decremental, as well as incremental changes, occur over the adult life span.

In a general way everyone knows what aging is, yet when it comes to describing and understanding it, no one definition seems adequate. Havighurst (1957) was concerned with social competence and concluded that this

does not decline with age. Shock (1972) was concerned with biological organ systems, which clearly decline with age. Similarily, many behavioral models of aging are more or less independent, each describing or encompassing just a part of the total.

For most legal purposes, old age might be thought to start sometime during one's 60's. It is during this age that, historically, people planned retirement from work and looked forward to financial benefits from government and private pension plans. Recent legislation in the United States moved the age of mandatory retirement to 70, and it is expected that mandatory retirement based on any age will soon be illegal. When this happens, old age might be seen differently. Old age is continuous with young age. There really is no specific age or period to mark the start of aging or old age.

Statement of the Problem

Regardless of whether one studies psychological aging for what might be characterized as intellectual, humanitarian, or practical reasons, it is obvious that considerable amounts of accurate information about age differences in behavior are necessary. The popular stereotypes portray the older adult as a fragile and feeble person whose physical and mental capacities are continuously deteriorating.

It may be that the prevailing sterotypes are inaccurate, out-of-date, or characteristic of only a small proportion of edlerly adults. For example, many people automatically associate the later years with a nursing home, and yet some statistics indicate that only about 4% of adults over the age of 65 reside in such institutions (Kastenbaum & Candy, 1973). Most older people actually live in a family setting, frequently in their own households. The households are usually in the city, rather than the suburbs, but an appreciable percentage of older people live outside of metropolitan areas altogether (Botwinick, 1984). Similar misleading stereotypes may also exist with respect to the behavioral and intellectual capacities of older adults and thus considerable research is needed to obtain accurate, factual information about this growing segment of the population.

A primary reason for investigating the aging continuum is to determine the practical importance of aging for functioning in contemporary society. As life expectancy increases and birth rate decreases, it is quite predictable that the shifting age structure will impact upon society at large. One of the key issues in assessing the effect of an increasingly older population

upon society concerns the ability of older adults to contribute to their community and be self-supporting. The implications for future social policies differ greatly if it is concluded that an increased age is characterized by a progressive deterioration of nearly all job-relevant abilities, compared to the conclusion that only sensory acuity and physical strength decline substantially with normal aging. The accurate measurement of changes associated with increased age is therefore essential for decision making in the coming years.

Since diseases in the aged are superimposed on normal aging changes, one is likely to be able to understand any disease process better if the foundation upon which it is based is well understood. Normal aging changes influence the presentation of illness, its response to treatment, and its potential complications.

The goal of the study is to compare changes in the memory function of 50 - 74 year old normal subjects with 75 - 95 year old normal controls. The project has two major goals: 1) To examine rates of forgetting in healthy individuals between the ages of 50 and 95 and 2) to establish preliminary norms for healthy individuals over the age of 74. Such information should facilitate the differentiation of normal and impaired memory in the

elderly population. The goal of identifying the changes that occur over time has recently lead gerontologists to place great emphasis on distinguishing the effects of aging from the effects of the diseases that are more prevalent with age. This distinction is an extraordinarily important practical and theoretical one. If one evaluates all individuals, regardless of health status, one will have data regarding what is average for the population, but one will confound the results of age with disease. Some practical instances might help to clarify this issue. For example, if one were studying cognitive changes with age and one included in the population individuals with early Alzheimer's disease (a disease that is increasingly prevalent with age), average scores of the subjects would be substantially lower than if the subjects with disease were omitted. If one then developed test norms on the basis of these data, the norms would be inadequate in identifying individuals with mild degrees of dysfunction because of the inclusion of individuals with disease in the original population. Similarly, if one were attempting to understand the mechanisms of age-related cognitive change by relating measures of cognition to other physiological measures, important relationships might not be identified if individuals with disease were inappropriately included.

Gerontologists have begun to distinguish between primary (free of disease) aging and secondary (disease-related) aging (Albert & Moss, 1988). Since this is a relatively recent development, most early studies of aging did not screen subjects carefully to discriminate between healthy subjects and those with disease. It is important to consider this in reading their results. Today, most researchers of aging either exclude subjects who do not meet their health criteria or describe the illnesses their participants have in some detail. It is then up to the reader to determine whether the results apply to primary or secondary aging. Discrepencies between studies of aging that seem superficially similar can often be attributed to previously overlooked differences in subject selection.

At the same time, it is important to recognize that selecting only healthy subjects for a study may limit the degree to which that study can be generalized. Thus, it may be necessary to evaluate optimally healthy individuals for an understanding of normal aging and then gather data from subjects with a range of common diseases in order to be able to generalize to the average individual. While this may not be possible in many situations, it is a goal worth striving for if one is to truly understand the aging process.

Although one might predict that by including only healthy individuals in aging studies one would restrict the variability of the data, one of the most striking characteristics of age-related change measured in this manner is its variability. Within the same individual some functions change and others do not. This is true for both psychological and physiological data. An individual whose verbal IQ remains relatively stable into the eighth or ninth decade is likely to show a significant decline in Performance IQ. Similarly, an individual's internal organs frequently age at different biological rates.

It is also important to consider the interindividual variability that one observes among people as they age. While the mean value of a particular variable may decline substantially with age, one can find elderly subjects whose scores fall within the range of individuals 20 or 30 years younger than themselves (Albert & Moss, 1988).

Equally noteworthy is that age-related change appears to be both linear and nonlinear. Many physiological functions peak when individuals are in their late 20's or early 30's and decline in a gradual and linear manner into old age. Functions that change in a nonlinear manner may show change either early or late in their life

cycle. One can find functions that show either early change and late stability or early stability and late change. Thus, for some functions there are periods in which age-related changes are substantial and are either preceded or followed by plateaus in which there is no measurable change (Albert and Moss, 1988).

Hypotheses

From the goal of the study, the following hypotheses have been generated:

1) There will be no significant differences in memory performance of both age groups on the Attention/Concentration scores of the Wechsler Memory Scale-Revised (WMS-R).

2) There will be no significant difference in memory performance of both age groups on the Verbal Memory scores of the WMS-R.

3) There will be no significant difference in memory performance of both age groups on the Visual Memory scores of the WMS-R.

4) There will be no significant difference in memory performance of both age groups on the General Memory scores of the WMS-R.

5) There will be no significant difference in memory performance of both age groups on the Delayed Memory scores of the WMS-R.

Research Questions

As the population of the United States grows older and lives longer, more interest shall be generated in studying the problems faced by the elderly. Research on aging has grown exponentially in response to the increasing number of older adults in our society, the lower birth rate, and the resultant need to make better use of older adults' potential. These trends have continued and escalated, and the need for research on aging continues to grow. Consequently, research questions which arise from the various problems and trends currently faced are as follows:

1. What are the rates of forgetting in healthy normal individuals between the ages of 50 and 95 with specific subtests from the Wechsler Memory Scale-Revised (WMS-R)?

2. What are preliminary norms for healthy elderly individuals over the age of 74 on the WMS-R (i.e., Wechsler (1987) only provides norms for individuals age 74 or less)?

3. What constitutes normal aging?

4. What specific patterns of memory loss or change occur between a "young-old" group and an "old-old" group?

5. What are the predictors of memory change in the elderly?

6. What aspects of memory function should remain constant after age 50?

7. How does a thirty minute delay effect the retrieval process on a given test?

8. Given a controlled population to be tested, what other factors might contribute to variance on ability to perform on a memory test?

9. How might one expect the very aged (i.e., those over the age of 90) to perform on a memory test?

10. What are the norms of memory functioning for the extremely aged?

11. Since the very aged represent a special and unique population, what other variables such as gender or ethnic background might be useful for future research?

These research questions were investigated with the two groups of "young-olds" and "old-olds" through examination of their performance on the Wechsler Memory Scale-Revised (WMS-R). Emerging patterns were also studied from data such as level of education, gender, occupation and other information gleaned from a neuropsychological summary profile. The population for the study and the methodology are addressed in detail in Chapter Three.

Significance of Outcome

In this study, forgetting rates for verbal and nonverbal material from the Wechsler Memory Scale-Revised (WMS-R) were examined in groups of older healthy individuals, aged 50 - 74 and 75 - 95. Research which investigated age-related correlations in memory function can provide insights in determining the amount or the type of memory deficits in the elderly. In past research, there has been a lack of definitive results. Contradictory findings are abundant in the literature.

This state of knowledge may be the result of poor techniques, unsophisticated tests, or the presence of other factors directly or indirectly related to poor memory performance.

The primary hope for this study lies in the development of age-related norms for the elderly population. It is hoped that this important data will serve to demonstrate the exaggerated amount of cognitive decline attributed to old age. Since most of the data on memory in the elderly are derived from stereotypes of the elderly as well as self-reported complaints, it is inferred that real memory decline may not be as great as reported.

Definition of Terms

For the purpose of this study the following definitions will be used:

Attention/Concentration. This construct refers to one's ability to focus on a simple task and perform it without losing track of the task. Digit span forward is the most commonly used test of attention. Visual and auditory performance tasks that require the individual to identify a repeating letter or repeated letter sequence are another common means of evaluating sustained attention.

Delayed Memory. The assessment of the retention of both meaningful and incidental memory for verbal and visual recall after a thirty minute time elapse.

Divided Attention. Older subjects tend to perform poorly on tasks that require division of attention between two input sources. This also includes tasks that require them to perform two activities simultaneously. Older individuals tend to concentrate on one task at a time

resulting in a deterioration of performance on the other task (Broadbent & Heron, 1982).

Ecological Memory. This dimension refers to the correspondence between memory tasks and the demands imposed on memory in daily life. Ecological memory is assessed apart from the clinical setting. It refers to everyday memory and can only be observed in real life situations such as remembering to make a phone call or recalling digits of a phone number. This practical memory function has only recently been scrutinized by memory researchers.

Elderly. For the purpose of this study, the term elderly will be ascribed to those individuals 75 years of age and older.

Encoding. This is the process of receiving and storing new information for future recovery.

Information and Orientation. These consist of simple questions covering biographical data, time and space orientation, and common information from long-term memory. These questions usually precede a memory test to determine a mini mental status evaluation.

Learning. For the purpose of this study "learning" refers to the acquisition of general rules and knowledge about the world, while "memory" refers to the retention of specific events which occurred at a given time in

a given place.

Level of Processing. According to the level of processing model (Craik and Lockhart, 1972), the durability of memory is simply a function of the depth of processing carried out on the stimulus. Greater depth implies more elaborate, semantic analysis. Studies indicate that, in general, when subjects carry out more elaborate analysis of words, they remember them better (Craik and Tulving, 1975). This implies that the presentation of any stimulus initiates a hierarchy of processing stages that can be graded along a continuum of depth. The basic idea of the theory is that the more the subject uses the data and processes them, the less he will forget.

Mediators. These are resources and coping skills used to aid in memory retrieval.

Mental Control. In a memory test this is overlearned material that most examinees answer without difficulty.

Metamemory. In many ways, human memory can be considered analogous to a large information storage system to be confronted with problems similar to those facing a librarian, e.g., supervising the organization of information, monitoring what is stored, and determining the most efficient methods of assessing information.

Memory theorists currently conceptualize metamemory as a series of specific yet interactive stores: 1) Sensory Memory, 2) Primary Memory, 3) Secondary Memory, 4) Remote Memory and 5) Encoding and Retrieval Strategies:

1) Sensory Memory represents the earliest stage of information processing. It is highly unstable and characterized by rapid decay. If information is perceived and attended to, it is transferred to primary memory. There is considerable evidence to indicate that changes in sensory memory are minimal with age.

2) Primary Memory refers to short-term memory. It shows few, if any, losses with age.

3) Secondary Memory refers to long-term memory, namely information to be retained for a substantial period of time. The relationship between primary and secondary memory is presently viewed as interactive.

4) Remote Memory is information that has been retained for a very long period of time. Remote memory becomes particularly resistant to disruption. Researchers have hypothesized the

existence of a tertiary memory store for the retention of remote memory.

5) Encoding and Retrieval Strategies are methods used to improve recall such as attempting to organize the material into mental clusters or hierarchies or the use of mnemonic devices such as verbal mediators or images. Research has shown that shallow encoding strategies produce a poorer recall than deeper encoding strategies.

Mnemonics. This refers to the use of practice, organization and imagery such as semantic associations, used to improve memory performance. Both young and old adults are able to employ mnemonic systems to reach high levels of performance. Individual differences are great among both age groups.

Nonverbal Memory. This construct refers to age-related differences in memory for pictures, tones, touch, and smell. In general, the ability to reproduce or recognize geometric designs declines with age, but the loss is gradual until the sixth or seventh decade of life.

Plasticity. This concept refers to a change in memory performance due to the use of mnemonics and/or mediators.

Retrieval. The process of recovering information that has been stored (encoded).

Verbal Memory. Linguistic ability encompasses four domains: 1) Phonological, 2) Lexical, 3) Syntactic, and 4) Semantic.

A. Phonology refers to the use of the sounds of language and the rules for their combination. Phonological capabilities are well-preserved with age.

B. Lexicon refers to the actual name of an item to be distinguished from its semantic representation, that is, the meaning of the word. The lexicon of healthy older individuals appear to be intact, as are the semantic relationships of the lexicon.

C. Syntactic knowledge refers to the ability to meaningfully combine words. A large number of studies have shown that age has little effect on syntax.

D. Semantic knowledge refers to the meaning of a word. Older individuals appear to have difficulty with the semantic aspects of word retrieval.

Visual Memory. (Figural Memory). This type of memory is reflected in both the production and recognition of figures. This spatial or figural ability, can be assessed by constructional tasks, such as the assembling of blocks, sticks or puzzles; by drawing tasks that involve copying; or by matching tasks that require the subject to identify pictures with similar elements. Complex visual tasks show declines in the elderly. The performance of figure drawing tasks are affected by age.

CHAPTER TWO

Literature Review

Overview

Memory function is a principal indicator of psychological aging. Ebbinhaus (1850-1909) laid the groundwork for the objective study of human memory. He evaluated the effects of practice and rehearsal on the amount of retention and forgetting. Ribot's book on the "diseases of memory" and Korsakoff's paper (1889) on memory deficits focused attention on the pathological aspects of memory disorders. In an early article by Richardson (1891, p. 230) it was even suggested that "memory is a good test of age". William James (1890) devoted a detailed chapter to memory in his book, Principles of Psychology.

Memory is thus a content area within the psychology of aging that has been studied intensively since the earlier days of aging interest.

Earlier psychologists were concerned with the parameters of learning, and memory was treated as one of the many intervening variables. The learning process was equated with the attachment of responses to stimuli. The repeated simultaneous occurrence of stimuli and

responses strengthened the association with them. Forgetting was considered the result of the weakening of the associations. However, a temporary failure to remember was considered the result of competition between responses attached to the same stimulus. The weakening of associations was referred to as "extinction". In the late 1950's interest in memory per se surfaced with the focus being on short-term verbal retention. This was influential in opening up other lines of memory research such as research on visual memory and auditory memory. The psychology of aging has matured as a scientific discipline in the last 50 years. The history of its development has been carefully chronicled by Klaus Riegel in two major reviews of the discipline (Birren & Schaie, 1977; Eisdorfer & Lawton, 1973).

The literature in the psychology of aging began to become substantial only after World War II. Earlier publication on the psychology of aging had begun with G. Stanley Hall's 1922 book, Senescence: The last Half of Life and the work of Walter Miles and his associates in the 1930's. One journal on aging existed in 1940, Zeitschrift für Altersforschung; now there are more than 60 such journals around the world. The field of aging has itself come of age, thanks to the persistent

efforts of Nathan W. Shock, who produced A Classified Bibiliography of Gerontology and Geriatrics in 1951, 1957 and 1963, which has appeared in quarterly supplements in the Journal of Gerontology since 1956 and in bimonthly supplements since 1974.

Several publications, both summarized and integrated, have available data and theories on psychological aging. The American Psychological Association exerted leadership by publishing two volumes that summarized the available psychological literature on aging. The first, edited by Anderson (1956), was based on the APA conference held in 1955. The second, edited by Eisdorfer and Lawton (1973), brought together the existing body of psychological information on aging for the White House Conference on Aging. In the same year, a major introductory textbook on the psychology of aging was written by Botwinick (1973), who reviewed the existing literature and its implications. In addition, James E. Birren has edited four handbooks on the psychology of aging. The first (Birren, 1959) culminated 10 years of thinking on the need for a comprehensive handbook. The second handbook, edited with K. Warner Schaie (Birren & Schaie, 1977) took five years to compile. It represents the work of 42 contributors who concentrated

on theoretical aspects of biological, environmental, health, and behavioral issues. A third handbook focused on the psychology of adult development and aging (Birren & Schaie, 1985). It was designed to provide the reader with chapters written by experts over the wide range of topics that comprise the field. A fourth volume (Birren & Schaie, 1990) was motivated by the positive response accorded to the earlier editions and also by the need to take into account the growth of the literature, which might be described as massive.

Other investigative efforts on psychological aging theories and data can be found in the periodic updates devoted to aging in the Annual Review of Psychology by Birren (1960), Botwinick (1970), Chown and Heron (1965), and Schaie and Gribbin (1975)--and in edited review volumes such as those by Baltes and Schaie (1973), Goulet and Baltes (1970), Neugarten (1968) and Talland (1968).

Efforts to advance and promote research in the psychology of aging through integrated reviews continued in the late 1970's and early 1980's. Some examples are: 1) A review of the clinical psychology of aging initiated and edited by Storandt, Siegler, and Elias in 1979; 2) the Annual Review of Gerontology and Geriatrics edited by Eisdorfer in 1980; and 3) a review of memory and aging

from experimental and clinical perspectives by contributers from both fields (Poon, Fozard, Arenberg, & Thompson, 1980).

Psychological research in aging can be divided into four broad categories: Pre-experimental, experimental-manipulative, theoretically oriented, and intervention oriented (Birren, 1985). Although these categories are not always mutually exclusive, enough studies fall into a given category to justify this kind of a framework. Pre-experimental research is descriptive work that ideally sets the stage for the logical studies exemplified by the second and third categories. There are many examples of pre-experimental studies in aging research. Bottwinick and Siegler (1981) reported descriptive results of intellectual functioning from a Duke Longitudinal Study that stressed the role of attrition in longitudinal studies. Another example of descriptive research from the same study is that of Siegler, George, and Okun (1979) regarding personality variables. A project that is most extensive is the study of Schaie (1979) and his colleagues who followed individuals across their adult life span for over two decades, describing age relationships for subtests of the Primary Mental Abilities Test. Schaie concluded that cohort differences

played an important role in cross-sectional age differences. A number of studies of intellectual abilities in old age have been carried out (Cunningham and Birren, 1980; Cunningham, 1980 a; 1980 b; 1981). It was found that ability structures were very similar in the old who were compared.

There are many examples of experimental manipulations. One is a study by Berg, Hertzog and Hunt (1982) of mean reaction times in several adult age groups. They varied degrees of mental rotation and practice over several days. It was found that age changes in the speed of cognitive processing play an important role in responses to spatial ability tests. Kausler (1982) provides a very scholarly psychology of aging.

Evidence from experimental testing supports the conclusion that in old age, generated memories are less distinctive and less robust and sometimes are liable to be confused with perceived memories (Albert and Moss, 1988). The experimental results reported here revealed a bias whereby the elderly were particularly prone to make reifying mistakes, believing that what was only imagined, or never occurred at all, was actually perceived.

The goal of many of the studies in aging research

is the achievement of theoretically oriented studies. Most of the studies in the psychology of aging involve theories taken from the context of "mainline" psychology and then applied to elderly individuals. One example of this is a paper by Hasher and Zacks (1979). These researchers developed a distinction between "automatic" and "effortful" processing, which involves differential attention demands in memory functioning. Implications for this conceptual distinction are drawn for various age groups, including the elderly. For example, empirical research suggests that processing frequency information is not influenced by aging or depression. There is a distinct shortage of efforts to establish genuine theories of behavior regarding aging in the elderly. Examples of such theories are the ideas regarding speed advanced by Birren (1965, 1974), the ideas regarding cautiousness advanced by Botwinick (1978), and the need to integrate experience in a life review proposed by Butler (1975).

An increasing number of intervention studies are oriented toward improving the behavior or circumstances of the aged. For example, Willis, Blieszer and Baltes (1981) showed that performance of the elderly on tests of figural relations, widely believed to be age sensitive,

could be improved through training. One of the important points is that the demonstrated improvement of an ability with practice does not contradict decrement models, but rather clearly shows that declines are neither inevitable or immutable. The distinction between what is natural and what is inevitable is an important one for the study of aging.

The bulk of research demonstrates that aging is not a unitary process. Instead, aging can be divided into different sub-processes. According to Birren and Schroots (1980) senescing refers to biological aging, geronting to psychological aging and eldering to social aging.

Within each of these three perspectives--senescing, geronting and eldering--different assumptions are made about the nature of the aging process. In the psychology of aging, geronting, and eldering, Schaie (1977) discerned three metamodels of the aging course: 1) The irreversible decrement, 2) the decrement with compensation, and 3) the stability model. The irreversible decrement model supports traditional folklore that performance on most cognitive tasks tend to decline in late adulthood. The model implicitly specifies that age-related changes will occur as a function of increasing age, regardless of environmental inputs. These changes are further

characterized as irreversible in nature. The decrement with compensation model, expects age decrement past maturity, but emphasizes environmental conditions which may ameliorate and compensate for the deterioration. Both these models focus on intrinsic processes assumed to reflect "genuine aging". The stability model postulates that once maturing ends, adult cognitive capacity remains stable.

The obvious decrements in performance, seen with advancing age, brought about an over-simplified notion of a necessary age-linked decrement in psychological functioning. Thus, psychological aging tended to be seen in terms of a rather reductionistic perspective as psychological events ultimately could be accounted for on the level of biological analysis (Baltes & La bouvie, 1973).

Biological changes need not directly result in a quantitative or qualitative behavior change. The interaction between the two sub-systems of senescing and geronting--the psycho-biological relationship--should be considered in terms of a relative autonomy at the psychological level (Jarvik & Cohen, 1973; Marsh & Thompson, 1977).

Research in psycho-gerontology has implied a shift

from a psycho-biological to a psycho-social perspective, focusing on contextual effects. Particular interest has been devoted to influences from the historical as well as from the present environment (Gubrium, 1972; Dowd, 1980; Rebok & Hoyer, 1977).

In the psycho-gerontology of today both the psychobiological and the psycho-social perspectives are included; both types of relationships seem necessary in order to identify the forces impinging on psychological functions (e.g. Avorn, 1983). While the psycho-biological perspective tends to project an irreversible view of age-related changes, the psycho-social perspectives tends to predict reversibility or stability (e.g. Labouvie-Vief, 1976). Plasticity is often used as a description of such a possible positive development. According to Baltes and Willis (1982), plasticity can be used to indicate the range of functioning.

These ideas are based upon the notion of a performance-capacity gap. This gap often constitutes a departure in several theoretical approaches. In an ecological model of aging, the gap is described by the terms overt and covert competence (Svensson, 1984). While overt refers to the behavior exhibited under certain environmental cautions, covert refers to the performance

potential in the individual given certain environmental changes. In the extension of "the gap-notion" and inherent in the plasticity view are ideas about an enhancement or remediation of actual functioning in old age.

There is a strong view in the field of aging that the best research design is one in which the performance of an elderly group on a measure of interest is compared with the performance of a young group on the same measure. With few exceptions, the older group is expected to perform less well than the younger group. Such studies have usually demonstrated that old people are less intelligent (Wechsler, 1958); that their reaction times are slower (Welford, 1977); that they are poorer problem solvers (Storck, Looft & Hooper, 1972), and so on. Factors other than age, however, have been found to contribute to the performance differences between the young and the elderly. Sex, health and education have also been shown to be related to age differences in ability (Hertzog, Schaie & Gribbin, 1978; Tesch, Whitbourne & Nehrke, 1978; Young, 1971).

Review of Research Findings

Levels of Processing--Encoding

Memory studies have been widely used to evaluate

memory in both clinical and research settings. In terms of long-term and short-term memory, most interest has been directed at long-term memory along with the interaction of this function with short-term memory, and the control processes activated there (Smith, 1980).

In a study by Perlmutter (1979), age differences were found in free and cued recall tests following both incidental and intentional learning conditions. On the cued recall test the subjects were provided with cues that were associations that the individuals had generated themselves. The older participants performed equally well regardless of type of cue while the younger subjects benefited more from the self-generated association cues. Perlmutter suggests that older persons may be inefficient in producing, as well as utilizing, retrieval cues to enhance memory performance. However, other researchers have demonstrated that age differences occur even with recognition procedures (e.g. Botwinick & Storandt, 1974, Rabinowitz, 1984).

White and Cunningham (1982) conducted a study with the aim of utilized procedures that corrected for guessing in the recognition condition. The results showed a greater age difference for recall than for recognition, but recognition performance was significantly

poor in the elderly group. When correction for guessing was employed, parallel age differences in recall and recognition were demonstrated. Smith (1980) argues that it is impossible to separate encoding and retrieval since the latter is dependent on strategies utilized at encoding. Shaps (1980) performed similar studies and concluded that there is evidence for a dual-deficit theory.

An approach focusing especially on the encoding stage is Craik and Lockhart's (1972) depth or levels of processing approach. Craik purported that one reason for the elderly's poorer long-term memory is their failure to encode new information to a deep level sufficient to guarantee later retrievel.

While most research used word lists as stimulus material, some studies have also applied the orienting paradigm to the discourse domain. Simon, Dixon, Novak and Hultsch (1982) performed a study on text recall. Before reading a narrative test the subjects in three age groups were assigned to one of four orienting task conditions. No age differences were found in intentional recall. Recall in the younger group was affected by the orienting tasks in the predicted manner. The results from the middle-aged and elderly showed no significant gains from the semantic or deep conditions.

A Striking finding from a number of studies testing the levels-of-processing theory is that age differences in free recall generally are found to be more pronounced with semantic orienting tasks than with non-semantic tasks. Thus, deeper processing is more affected than shallower processing. As pointed out by Craik and Simon (1980), it seems that, while semantic encoding enhances acquisition, it does not necessarily influence the ability to retrieve information. However, when retrieval requirements are minimized, as in recognition tests, the superiority of semantic encoding can be demonstrated (Rankin & Hyland, 1983). The importance of encoding and retrieval conditions in semantic processing has been demonstrated in many studies (e.g., West & Boatwright, 1983).

Craik (1990) suggested that age differences in memory functioning for specific tasks are larger in free recall, and less in cued recall, and less again in recognition memory. These conditions reflect amounts of environmental support. One must consider that these tasks all tap episodic memory, which thus shows large age differences in some circumstances but negligible difference in others. Similarly, studies on priming of implicit memory (e.g. word fragment completion, perceptual identification, or learning to read mirror-image

script) show little or no age difference. These cases do not require the subject to remember details of the original experience--merely to complete the word or read the script--and involve substantial support and guidance from the stimulation itself. Craik (1990) posited that there consequently must be a complementary relation between environmental support and the need for self-initiated operations; more of one means less for the other.

Treat, Poon and Fozard (1978) investigated age differences in developing strategies when no specific instructions were given and whether instructions facilitated the use of the strategy on later occasions. Results revealed that a young group was superior on all recall lists except those following instructions. Within instructional groups, only the elderly control group, significantly improved. The data also showed that older adults were able to generate useful learning strategies on their own, given practice.

Light (1991) examined three reasons for expecting older adults to use less-effective encoding and retrieval strategies: Disuse, diminished attentional capacity, and reduced sense of mastery in memory tasks. This author addressed the popular hypothesis

that older adults are less likely than younger ones to engage in appropriate self-initiated encoding or retrieval strategies because the aging process is associated with reduced attentional capacity, a capacity taxed by use of strategies. Older adults will elect to use such strategies less frequently than younger adults, or to use different, less taxing strategies.

Metamemory

The term metamemory was introduced by Flavell (1971) to describe an individual's knowledge and awareness of memory or of anything pertinent to information storage and retrieval. An "efficient memorizer is seen as analyzing the task in light of his or her abilities and then selecting an appropriate strategy, if one is needed, to optimize performance" (Murphy et al, 1981, p. 185).

Several studies have been designed to scrutinize metamemory ability. Rabinowitz, Ackerman, Craik and Hinchely (1982) examined evidence that memory deficits are due to changes in metamemorial abilities. The subjects were asked to predict the amount of recall of word pairs after a fixed study period. The results were

striking in that there was a complete absence of age-related differences. The investigators concluded that metamemory skills remain intact with age.

Numerous studies of memory for faces have been reported (Winograd & Simon, 1980). Smith and Winograd (1978) studied face recognition following different orienting tasks. A decrement was found to be associated with age while no interaction was found between task and age. Peformance was markedly increased by the orienting conditions in which subjects were cued to judge trait characteristics of faces, thereby including verbal memory.

Recently the domain of metamemory has been expanded to include memory monitoring (self-knowledge about current memory use, contents, and states) and memory self-efficacy (beliefs about one's own memory abilities). When applied to the study of age-related impairments in memory, the metamemory perspective gives rise to several hypotheses--i.e. that older adults remember less well because they have erroneous beliefs about the nature of memory and the strategies appropriate for use in different memory tasks, because they are less likely to use task-appropriate strategies spontaneously, or because they monitor their encoding and retrieval process less effectively.

There is evidence that older subjects spontaneously use mediators less than the young. However, when instructed or trained to utilize these mnenonics it has sometimes been found that age differences are diminished. This differential age benefit remains controversial (e.g. Poon et al 1980; Winograd & Simon, 1980).

Maylor (1990 a) followed up on studies of memory abilities in which older people report particular difficulty in the retrieval of proper names. This has been singled out as the most noticeable and most frustrating change in cognitive ability. In this study, subjects over the age of 50 were presented with famous and nonfamous male faces. If the research participant recognized the face, they were asked for his name and for as much information about the person as possible. In recognition of famous faces, older subjects were less sensitive and more cautious than younger subjects. The number of "tip of the tongue" (TOT) naming responses as a proportion of faces recognized, increased with age, while the number of responses where the right name was produced correspondingly decreased with age. Older subjects reported fewer correct semantic features than younger

individuals. In multiple regression analyses, age was often a better predictor of performance than measures of current cognitive ability. Of particular interest, was the finding that the elderly were less able to report partial information about the target name, that is, its phonological attributes such as the first letter or number of syllables. The older group was found to be more cautious and not willing to guess.

Light (1991) found that there is little evidence to support age-related differences in the organization of knowledge. The author stressed that the organization of knowledge is stable across the adult years.

Ecological Memory

A prevailing characteristic of memory research in general is that it has been mainly concerned with episode memory. This is a serious limitation since memory in daily-life (ecological) involves both general knowledge or semantic memories and temporally and spatially organized events. Thus, an ecologically valid measurement should be representative of situations faced in daily life. This need is paramount with respect to clinical memory measurement.

Crook, Ferris, McCarthy and Rae (1980) administered a simple dialing task in order to test ecological memory function. The background for this task was findings of no reliable age difference in memory span tests, but, at the same time, observed difficulties in elderly subjects to execute daily-life tasks requiring immediate recall of numerical information. Both verbal and motor recall (when dialing) were examined for different strings of numbers. The motor recall distinguished the elderly from the young group more sharply than did verbal recall. A second real-life memory task was employed by McCarthy, Ferris, Clark and Crook (1981). They studied learning and delayed recall of a shopping list. The young group was superior in both initial learning and delayed recall measures compared to elderly normals. No difference in recognition performance was found between the groups.

West and Crook (1990) examined age differences in memory for telephone numbers of adults ranging in age from 18 to 85 years. Age declines in immediate recall were evident on 10-digit numbers, but not on 3-digit numbers. With 7-digit numbers, the youngest group performed significantly better than the oldest (70-85 years) group. Further, more marked age declines occurred when subjects had to redial a number after a busy signal.

Maylor (1990 b) examined the effects of age, intelligence, and retrospective memory on performance in a prospective memory task in which subjects aged 52 to 95 were required to telephone once a day, either between two times or at an exact time. The most important influence on performance was how subjects chose to remember to make the telephone calls. The best performance was from subjects who telephoned either in conjunction with another routine event or engaged in some form of advanced planning of the daily schedule. The worst performance was from those who relied on internal cues from their own memory. The effect of age was influenced by the cue used. For subjects using internal cues, those who forgot were older than those who remembered, whereas for subjects using the other cues, those who forgot were younger than those who remembered. This study is based upon the premise that remembering to do something in the future without being reminded (prospective memory) is possibly one of the most important aspects of memory functioning in everyday life.

Another aspect of ecological research is comprehension and retention of reading and listening materials. In a study by Smith and colleagues (1983) it was shown that

age deficiency was not found when the material was meaningful. Dixon, Simon, Nowak and Hultsch (1982) presented subjects newspaper articles. Subjects were assigned to either a reading or a listening condition. Recall was tested immediately and then one week later. The results indicated that the young remembered the text better than the elderly regardless of recall condition. However, age interacted with the input modality. The younger groups benefited more from the opportunity to read the material. These findings support an age-related impairment. It was suggested that the elderly's difficulty in text processing is related to organizational factors.

Cavanaugh (1983) measured age differences in comprehension and retention of television programs. It was found that a younger group showed superior free recall compared to an elderly. Interestingly, no difference was found between the young and elderly with high vocabulary scores. Age differences were found in the low-vocabulary groups only. This study emphasizes the need to consider inter-individual differences that might affect memory performance.

Albert, Lafleche and Wolfe (1990) tested cognitive flexibility in a comprehension test of proverb interpretation. Twelve proverbs were given to 89

optimally healthy subjects aged 30 to 79. The subjects were asked to explain the meaning of each. All subjects also received a battery of cognitive and spatial skills tests. The result of deficits in performance by the 70 year old subjects were attributed to a reduction in cognitive flexibility and not to changes in memory ability or to a differential increase in a particular type of abstraction error.

Clarkson-Smith and Hartley (1990) examined the game of bridge as a potential exercise in ecological memory and reasoning. Fifty bridge players and fifty non-bridge players between the ages of 55 and 91 were given tests of working memory, reasoning, reaction time and vocabulary. Data analyzed indicated that the bridge players outperformed nonplayers in measures of working memory and reasoning, but not vocabulary and reaction time. Results were consistent with the hypothesis that bridge, which provides specific experience in working memory and reasoning, should enhance performace in tasks tapping these abilities and not enhance performance in unrelated abilities. Although the results suggest that the superior performance of the bridge group may have resulted from the experience of playing bridge, one must consider the possibility that those who chose to play bridge were initially superior in working memory and reasoning.

Sinnott (1986) investigated the effects of age and passage of time on incidental and prospective/ intentional everyday memory. Seventy-nine volunteers between the ages of 23 and 93 years, were tested, twice, and 33 of these volunteers were tested three times over an 18-month period. They were asked to recognize or to recall, either in writing or orally, experiences from a 3-day period in which they served as research participants. Results showed that incidental, but not prospective/intentional, memory appeared to be influenced by age and passage of time. The results showed that in everyday life, age and passage of time cause poorer memory function, but significant items are remembered. This study provides an example of ways to measure memory for natural events that occurred weeks or months ago. For this reason alone, it is useful.

Another facet of research that is ecologically relevant, concerns memory processing for spatial arrangements. Bruce and Herman (1983) examined young and elderly on a memory task in which they were shown real world environmental scenes from familiar, as well as new perspectives. The results showed that the young were more accurate in recognition.

Zelinski and Light (1988) evaluated the hypothesis that older adults remember spatial information less well than younger adults because they use contextual clues less effectively. In this study young and older adults studied schematic town maps on which structures were presented and on which a network of streets were either present or absent. Ninety-six older adults ranged in age from 55 to 87 years. This study demonstrated that deficits in spatial memory in older people are probably not due to differences in the likelihood of using the contextual information available in memorizing maps.

These ecological studies raise the issue of how to design an age-fair measurement device that takes into account the compensation potential of daily-life situations. This contextual perspective must consider the life span enviornmental influences on different age cohorts. The actual degree of such contextual support can differ substantially between age cohorts and within the life span of a particular cohort. The existence of cohort effects clearly demonstrates that prior conditions have an impact that is carried over to influence behavior in later life (e.g. educational background).

Seen from the life span perspective for a particular age cohort, the psycho-social support on cognitive

functioning is likely to be different at different age levels. In early childhood expectations are high while this is less so in the case of the elderly (Baltes & Willis, 1982). This implies that the potential-performance gap might increase with age. Such a theory has implications for the plasticity view of "memory aging".

Self-Assessment of Memory

An issue significant in the study of memory is self-assessment of memory. It is often heard that elderly people complain about their "poor memory" for names, faces, dates and events. Zarit (1979) has suggested that the basis of memory complaints could be depression or stereotypes of memory and aging. Such stereotypes lead to a self-fulfilling prophecy in that experiences of occasional absent-mindedness are taken as signs of an age-related decrement. Low-perceived control then can show a relationship with complaints. However, the notion of memory as indicative of stereotype of memory aging "has not been explored to the same degree as the relationship between complaints and the affective status".

Orr, Reeves and Zarit (1980) conducted a follow-up study on memory performance and complaints.

All subjects had initially reported concern of memory loss, but test results indicated no signs of abnormality. It was found that performance and complaints were both fairly stable over a given period of time.

Erber, Szuchman, and Rothberg (1990) examined age differences in appraisal and attribution of memory functioning. A person perception paradigm was used to test 86 young subjects and 84 older subjects for evidence of a double standard in appraising everyday memory failures of young and older targets. Vignettes were judged on separate Likert scales for possible attributions for memory failure, need for memory training, and indications of need for professional evaluation. Results confirmed a double standard used by young and old: The failures of older targets were judged as signifying greater mental difficulty and greater need for memory training when compared with the identical failures of young targets. Older research participants were more lenient overall than young subjects in their appraisals. Young person's failure in remembering was attributed to lack of effort or bad luck, while older person's memory failure was often ascribed to a lack of ability or difficulty of the task. The more lenient recommendation evaluations given by the old, even when their mental ability ratings were

equivalent to those of the young, suggests that the old are willing to tolerate a higher level of perceived mental difficulty before recommending action. An age-related tendency toward tolerance of failures may extend to failures other than memory-related ones.

Larrabee and Levin (1986) compared memory self-ratings with objective test performance in an elderly sample. In this study 88 normal elderly subjects aged 60 to 90 were asked to perform self-ratings of storage, retrieval, attention/concentration, remote memory and depression. These self-ratings were contrasted with corresponding objective memory function tests. Self-rated remote memory was also associated with objective measures of recent/remote memory, and self-rated depression was additionally related to objective measures of attention/ concentration. The hypothesis of the study was that subjective report of memory dysfunction may not be strongly related to actual memory performance. Concurrent assessment of memory function by self-report and by objective memory performance has historically disclosed a weak relationship. There are indications in the literature that self-ratings of memory may be related to anxiety and stress. The results of this research are in accord with earlier findings.

Rabbitt (1982) found that absolute self-ratings did

not correlate with laboratory measures of memory performance in a group of normal subjects aged 58 to 82. However, the author found that subjects under the age of 30 showed significant correlations between memory self-ratings and actual memory test performance.

Literature Summary

While much progress has been made in the past two decades toward delineating the nature and extent of age-related deficits in learning and memory, many important questions remain to be examined.

There are questions that have yet to be resolved concerning age differences in organizational processes, other elaborative processes, and the relation between encoding and retrievel. Definitive research is needed in these areas.

In considering avenues for future investigation of adult development of learning and memory, ecological comprehension is an important focus for research. Daily memory represents one of the major sources from which adults of all ages acquire information. For example, discovery, observation and participation may be critical for learning procedures or skilled movements. In opening up new areas of investigation, researchers must take care to restrict their generalizations about

patterns of adult development to the format in which the data was learned (word list, discourse, observation, participation) and to the method by which remembering was assessed (verbal) recall, application of newly acquired information. Learning and memory performance probably changes along a number of dimensions across the lifespan. Therefore, the careful development of new research approaches could expand our current knowledge base significantly.

Research findings suggest that, if we are to understand the process of aging, we must begin to give closer attention to individual variation in aging and its origins. Promising signs are evident to those who are concerned with individual-difference research. An issue of Experimental Aging Research was devoted to an exploration of memory in the elderly, specifically, individual differences and their implications for the development of intervention strategies (Costa & Fozard, 1978; Kahn & Miller, 1978; Poon, Fozard & Treat, 1978; Poon, Fozard & Popkin, 1978). A symposium held at the 1978 meeting of the Gerontological Society was devoted to discussion of a longitudinal study involving cognitive training of older adults, in which individual differences were of critical importance (chaired by Baltes & Willis).

Neimak (1979), presented a convincing argument that not only are individual differences central to an understanding of the development of formal operations, but they interact with tasks and instructions in complex ways. Hayslip and Sterns (1978) examined individual differences in the relationship between crystallized and fluid intelligence. Several papers presented at the meetings of the American Psychological Association were devoted to the exploration of individual differences among the elderly.

Old people are different from each other. Old people may be more different from each other than they are, as a group, from young people. If these statements are true, they offer good reasons for investigating differences within the elderly population in our attempts to understand the aging process.

Given the great variability among the elderly, it is advantageous to consider the young-old (55 - 64), middle-old (65 - 74), old-old (75 - 84) and the extremely old (85+). This is especially helpful in assessing the extremely old.

Determining the contributing causes of the large individual differences among the elderly will provide valuable information on both the origins of decrements

associated with aging and the factors contributing to successful aging. It is necessary to obtain a baseline for what constitutes optimal aging. An important question for gerontologists to explore is what variables predict such successful aging. It is highly unlikely that "successful aging" is merely the absence of physical illness, since even among such individuals, there is considerable variability in cognitive, physiological and functional status. Future research should concentrate on what factors might contribute to the maintenance of high function with age. In meeting this goal it is imperative that future researchers in gerontology are able to define what is normal, optimal aging. If future studies suggest that the factors that contribute to optimal aging are under external control, then there is the possibility that gerontologists can contribute to the expansion of the number of people who age successfully in future generations.

CHAPTER THREE

Research Design and Methodology

Introduction

The goal of the study is to establish a baseline for determining what comprises the normal aging process. The research presented here should provide a foundation for normal aging changes in those individuals aged 50 and upward.

The generalizability of gerontological research has been hindered by a lack of norms for the elderly. Without such guidelines, research into the diseases of the aged cannot be adequately understood. Normal aging changes influence the presentation of illness, its response to treatment and its outcome.

It is hoped that this study will be able to define the parameters of normal and optimal aging. In investigating the norms for potential function among the gerontological population, it is important to rule out external factors that might adversely affect the performance of such individuals. In an effort to accomplish this objective, as well as define the abilities of this population, stringent recruitment of subjects is vital to the study.

Data Collection

As part of an ongoing neuropsychological investigation of normal and abnormal aging at the University of California at San Diego, subjects over the age of 49 were recruited via local flyers and newspaper advertisements. For this study, volunteer subjects between the ages of 75 and 95 were included along with a younger comparison group of individuals aged 50 to 74. All subjects were carefully screened via telephone interviews for neuropsychological risk factors, and those with a history of neurological disorder (e.g. stroke, head injury), learning disability, major psychiatric disorder, major medical illness, or substance abuse, were excluded. Individuals with a history of ingesting three or more drinks per day of any type of alcohol, for a week or longer, were excluded from the study. In addition, any individuals taking medications that might have adversely affected their memory test performance (e.g. benzodiazepines, antidepressants) were excluded from this study; subjects on low-dose antihypertensive medications, however, were included in both groups. Depression, or other major psychiatric problems, were also considered an impairment to memory function and these individuals were also excluded from the testing protocol.

The University of California at San Diego extension program provided the dominant source of research subjects.

UCSD's Alzheimer's Center at University Hospital furnished a substantial list of normal control volunteers for the study. The Veteran's Hospital at San Diego contributed another significant list of normal controls.

An important source of research participants was provided by the Peer Counseling program at San Diego State University.

Other senior centers, recreation halls and churches were contacted by personal visitation, flyers, and telephone.

Neuropsychological screening was performed over the telephone to rule out possible medical exclusion. If the volunteer passed the screening interview, a testing date was assigned. Transportation to the testing center was provided if necessary. Home tests were also arranged. All subjects were asked to sign a "consent to act as a research subject" form.

The memory test took approximately 45 minutes to one hour to administer. A quiet testing room, free of interruption, was arranged. All subjects were given a break for a snack and a cup of coffee. Pleasant converation was encouraged in order to provide a relaxing atmosphere as well as to allow additional pauses to prevent testing fatigue.

The testing began in August of 1987 and continued for eighteen months. Favorable response to the testing protocol resulted in word-of-mouth recruitment of additonal subjects.

Sample Selection

The resultant sample was comprised of 35 "young-old" subjects between the ages of 50 and 74, and 30 "old-old" subjects between the ages of 75 and 95. The mean educational level of the younger group was 14.4 years, and included 12 males and 23 females. In the older group, the mean educational level was 14.6 years, and there were 10 males and 20 females.

Individuals who were actively involved in their communities and in optimal health were selected from active retirement oriented localities such as Rancho Bernardo, La Jolla, Pacific Beach and the State College area. Several retirement apartment houses were contacted. These senior residences maintained active social calendars which proved to be instrumental in organizing testing dates as well as providing trnasportation to the testing center.

The Institute for Continued Learning (ICL), an extension class at UCSD, was a fruitful source of research participants. ICL affords an opportunity for retired and semi-retired adults to focus on learning more about the

world and the universe. These courses are developed and taught by representatives of its own members--some 300 men and women from all facets of business, professions and education. Each class is hallmarked by lively participation and discussion. Members are afforded the opportunity to attend all, or only select classes, which include the latest in Bio-Medical Science, Autobiographical Writing, Contemporary Issues and Discoveries in Archaeology, Music, Art, Theater and the Constitution. There are regularly scheduled events, as well as group activities, and trips of historic and artistic interest. Members are encouraged to take advantage of the use of UCSD's five libraries, Language Labs, cafeteria and other facilities such as the Crafts Center. ICL's Distinguished Lecture Series provides talks by members of the UCSD faculty. Community leaders provide Forum lectures on a weekly basis. ICL members are encouraged to enroll in other UCSD extension courses through reduced registration fees. Exercise classes, such as swimming and tennis for seniors, through UCSD extension were important contributors of active volunteers.

The popularity of the testing protocol quickly spread by word-of-mouth throughout the ICL community. This is a

select group of individuals in that most are from a professional background, most are financially secure (annual enrollment in ICL is $150), and a large percentage of the population are Jewish. The ICL newsletter furthered their participation in this study.

A significant number of the research participants were "snowbirds", couples who spent the winter months in the temperate San Diego climate.

One local tennis club provided the study with several participants.

The stereotype of the senior person was quickly dispelled when one became acquainted with this unique and inspirational group of individuals. It was not necessary to go to nursing homes for participants for a memory testing protocol. Research subjects volunteered their time enthusiastically. Some walked to the testing center, some drove their automobiles, and others were chauffered by private limousine. Home tests were requested not only for reasons of convenience, but also for the opportunity to share memoirs of a lifetime filled with success and symbols of shared happiness. These elderly individuals did not adorn shawls, nor did they grasp canes or walkers. Rather, they arrived in tennis attire or exercise garb, replete with tan, healthy

looking skin, running shoes and sweatbands. Many brought their own snacks, favorite blend of coffee, books, and were eager to share their interests. These special people generated enthusiasm for life, breaking the stereotypal image of the elderly. They were proud and anxious to share their personal histories. They took pride in their longevity. They chose to be viewed as representatives and leaders of their time, and were proud of it. As a group, they were very willing to share personal quests to maintain a meaningful life experience.

The motivation for participation in the study was altruistic in nature; an opportunity to do volunteer work, a chance to pay back a debt to society, or to shed some light on the differential diagnosis of Alzheimer's Disease. Several subjects had spouses or relatives diagnosed as having Alzheimer's Disease. All participated enthusiastically and appeared interested in the intellectual challenge of the testing battery. All appreciated the importance of a study on the aged population. These were people eager to dispel the image of being invisible, dependent or fraile. They were successful in this endeavor.

Instrumentation

All subjects were administered the Wechsler Memory Scale-Revised (WMS-R) according to standard procedure (Wechsler, 1987). For the purpose of the study, the general composite Index scores were calculated for comparison with the two population groups. These general Index scores include five broad parameters of memory: Attention/Concentration, Verbal Memory, Visual Memory, Delayed Memory and General Memory.

These WMS-R composite Index scores for each sample group were compared using an Analysis of Variance (ANOVA) at the .05 level of significance. Duncan Mean scores of the five general Indices of the WMS-R were used for comparative analysis of the two groups.

The WMS-R is an individually administered, clinical instrument for appraising memory functions in adolescents and adults. The scale is designed as a diagnostic tool to assess memory function. The functions measured include memory for verbal and figural stimuli, meaningful and abstract material, and delayed, as well as immediate recall.

The WMS-R considers the concept of memory as broad, encompassing many functions that are treated as mutually distinct. This test distinguishes between memory for verbal and visual material, or material received through different sensory channels.

The WMS-R represents an extensive revision of the original Wechsler Memory Scale (1945) and is intended to better address those aspects of memory function that are considered clinically significant.

The changes incorporated into the revised test include: Provision of norms stratified at nine age levels, replacement of a single global score with five composite scores which include Attention/Concentration, Verbal Memory, Visual Memory, Delayed Memory and General Memory, the addition of new subtests measuring visual and spatial memory, the addition of delayed recall, and the revision of the scoring procedures for several subtests to improve scoring accuracy.

The WMS-R is made up of a series of brief subtests, each focusing on a different aspect of memory. The specific tasks in the battery are preceded by a subtest containing questions often used as part of a general mental status examination. The eight tests that follow evaluate short-term learning and recall of both verbal and figural material; verbal stimuli are read to the subject and figural stimuli are presented visually. The verbal and figural subtests are alternated to provide variety and to help maintain the examinee's interest. Together, these eight subtests require about one hour of testing time.

The eight subtests are immediately followed by delayed-recall trials for four of the subtests. Two of these four trials test the retention of verbal material, and two test the retention of visual material. For both the verbal and visual delayed-recall trials, one task measures the ratio of paired associates learned earlier in the examination, while the other examines the retention of more meaningful and integrated material.

The Wechsler Memory Scale is the only test of memory that has been widely used in the field of neuropsychology. This test has been thoroughly revised and factor analyzed with consistent results. A study by Russell (1982) indicates that the WMS-R measures several kinds of memory. The revised instrument permits a more exact measure of recent verbal and figural memory than was possible using the original Wechsler Memory Scale. The new test has proved to be valid when used to separate normal aging from degenerative brain damage.

Butters et al. (1988) found evidence that the WMS-R is far superior to the original WMS for assessing memory disorders in amnesic and demented patients. Butters et al. (1988) reported that, although the revised instrument requires more time to administer and score, it also yields more valid quantitative measures of

anterograde memory disorders than the original scale. Improved face validity was found to be at least partially due to the exclusion of measures of attention, concentration and mental control from the calculations of the General and Delayed Memory Indices. In addition to this increment in validity, the WMS-R was also shown to be better able to distinguish amnesic disorders from some forms of so-called "cortical" (e.g. Alzheimer's Disease) and "subcortical" (e.g. Huntington's Disease) dementias.

The WMS-R is intended primarily for detecting poorer memory functioning (such as the aged population), and therefore most of its tests have relatively low "ceilings". (The exceptions are Logical Memory, Visual reproduction, and to some extent, Digit Span and Visual Memory span). This is appropriate for the elderly sample. The scale is not intended for making fine discriminations at high levels of memory functioning.

Data Analysis

SAS softwear was used to calculate results for the two groups using data obtained from the Wechsler Memory Scale-Revised. A standard ANOVA at the .05 level of confidence was used to compare the two independent variables

of the age groups with the five dependent variables of the WMS-R composite Index Scores which include: Attention/Concentration, Verbal Memory, Visual Memory, Delayed Memory and General Memory. Since the sample size was uneven, the cell sizes of the ANOVA are not equal. F tests were used to demonstrate significant differences in the comparison groupings.

Duncan's Multiple Range Test for the five variables of the WMS-R Indices were also calculated for the two age groups. The Duncan Mean test controls the type I comparisonwise error rate. As the cell sizes were not equal, the harmonic mean of cell sizes was calculated.

Emerging trends of age, sex and education were compared with the dependent variables of Verbal Memory, Visual Memory amd Delayed Memory, using the standard ANOVA at the .05 level of significance. In order to establish class levels, the age group was identified as o or y; o (old) included individuals aged 75-95 and y (young) was assigned to those individuals aged 50-74. Sex level was established as f for female or m for male. Education was grouped as one of three levels: C represented four years of college, HS designated graduation from High School and Post C stipulated more

than 16 years of schooling.

In addition, Attention/Concentration raw summary scores from the WMS-R were examined in order to assess the possible contribution of this factor to observed differences in memory test performance.

Summary

The exclusion rate for this study was necessarily high due to the strict requirements of a memory protocol. In ruling out numerous medications, cardiovascular and substance abuse; the sample size for both groups was equally small. However, similar studies show significant results using parallel populations. Normative data on the aged is extremely valuable. Inferences and norms can be established when using research groups of this size (Wechsler, 1987).

The addition of gender and education to possible contribution to variance in performance on the Wechsler Memory Test-Revised will allow for a broader investigation into the aging pattern of the two groups. Normative data on the aging cognitive patterns of females to males is limited and only recently begun to be scrutinized. The larger ratio of females to males in the study is representative of the greater number of females to males in the elderly population. The effect of education as a

predictor for memory performance is essential in establishing normative guidelines for the aged.

Memory for nonverbal as well as verbal material was assessed with the recently revised Wechsler Memory Scale. The reliance on verbal ability of most cognitive testing instruments makes the data obtained in this study quite valuable.

CHAPTER FOUR

Research Findings

Introduction

The purpose of the study was to compare changes in the memory functions of 50 - 74 year old normal subjects with 75 - 95 year old normal subjects controls. In order to compare the two groups, the five general Indices of the Wechsler Memory Scale-Revised were used to examine major dimensions of memory function. The contribution of "age-effects", sex and education to these five Indices was also examined. The function assessed include memory for verbal and figural stimuli, meaningful and abstract material, and delayed as well as immediate recall.

Population Description

The population was comprised of 65 individuals; 30 "old-old" subjects compared with 35 "young-old" research participants. All subjects were carefully screened to rule out health factors and medications that might adversely affect memory test performance.

Information from the two groups was obtained concerning gender, educational level and occupation. The population for this research was fairly equally distributed in both groups; it was predominantly female

and balanced with respect to education. The mean educational level of the older group was 14.6 years, and included 10 males and 20 females. In the younger group, the mean educational level was 14.4 years, and there were 12 males and 23 females.

Results of Research Questions

RESEARCH QUESTION #1: What are the rates of forgetting in healthy normal individuals between the ages of 50 and 95 with specific subtests from the Wechsler Memory Scale-Revised?

The older group performed considerably poorer on the Visual Reproduction, Verbal Paired Associates, and Visual Paired Associates of the WMS-R. Both aged groups obtained highly similar scores on Digit Span, Visual Memory Span, and Figural Memory. When raw summary scores were examined, both groups obtained similar Attention/ Concentration scores.

In comparing Scaled scores only of the five general Indices of the WMS-R at the .05 level of confidence, there were no significant differences among the two groups for each of the categories, with the exception of Delayed Memory. (See Table 1). Comparison of the performance of young-olds (50 - 74) and old-olds (75 - 95) using F tests revealed that the old-olds demonstrated

significantly lower scores (F = .0411). The Duncan's Multiple Range Test for analysis of means using Type I error was redundant in showing a significantly poorer performance on the part of the old-olds for Delayed Memory.

Frequency charts for Delayed Memory and General Memory of both age groups are found on pages 71 - 75. (See Tables 2, 3, 4, and 5).

Frequency charts are displayed for the General Memory Index Score and the Delayed Memory Score only. General Memory is a combination of the Visual and Verbal Memory Scores. Therefore, Visual and Verbal Memory Scores were not included in these charts.

The Attention/Concentration Score covers biographical data, orientation, and common information from long-term memory. Because nonimpaired examinees typically answer all of these items correctly, the Attention/Concentration Score was not included in these charts. Due to the stringent screening process of this study, it was expected that all subjects would perform well in this area. This was found to be true and therefore this score was not included in the frequency charts.

These frequency charts display the frequency distribution of each age group for General Memory and Delayed Memory. The Y axis displays the memory test Index score while the X axis shows the number of subjects. Therefore, one can

TABLE I

Analysis of Variance of the Five General Indices of WMS-R and Mean Scores in Comparing the "old-old" Group with the "young-old" Group.

WMS-R	ANOVA F test	DUNCAN MEAN
Attention/Concentration	.2487	Y 106.100 O 101.914
Verbal Memory	.1360	Y 109.743 O 104.067
Visual Memory	.1090	Y 118.143 O 112.000
Delayed Memory	*.0411	Y 116.314* O 107.967*
General Memory	.3121	Y 113.343 O 109.000

L = .05

Y = "young-old" 50 - 74 years of age

O = "old-old" 75 - 95 years of age

TABLE 2

Frequency of Delayed Memory for

"Old-Old" Group

GROUP OLD - OLD

DELMEM MIDPOINT		FREQ	CUM FREQ	PERCENT	CUM PERCENT
50		0	0	0.00	0.00
55		0	0	0.00	0.00
60		0	0	0.00	0.00
65		0	0	0.00	0.00
70		0	0	0.00	0.00
75		0	0	0.00	0.00
80		0	0	0.00	0.00
85	****	2	2	6.67	6.67
90	****	2	4	6.67	13.33
95	**********	6	10	20.00	33.33
100	******	3	13	10.00	43.33
105	**********	6	19	20.00	63.33
110	****	2	21	6.67	70.00
115	**	1	22	3.33	73.33
120	****	2	24	6.67	80.00
125		0	24	0.00	80.00
130	****	2	26	6.67	86.67
135	**	1	27	3.33	90.00
140	******	3	30	10.00	100.00
145		0	30	0.00	100.00
150		0	30	0.00	100.00
155		0	30	0.00	100.00
160		0	30	0.00	100.00
165		0	30	0.00	100.00
170		0	30	0.00	100.00
175		0	30	0.00	100.00
180		0	30	0.00	100.00

----+---+---+---+---+---+---+
2 4 6 8 10 12 14

FREQUENCY

** = one subject

TABLE 3

Frequency of Delayed Memory for

"Young-Old" Group

GROUP YOUNG - OLD

DELMEM MIDPOINT		FREQ	CUM FREQ	PERCENT	CUM PERCENT
50		0	0	0.00	0.00
55		0	0	0.00	0.00
60		0	0	0.00	0.00
65		0	0	0.00	0.00
70		0	0	0.00	0.00
75		0	0	0.00	0.00
80	**	1	1	2.86	2.86
85		0	1	0.00	2.86
90		0	1	0.00	2.86
95	********	4	5	11.43	14.29
100	**	1	6	2.86	17.14
105	**********	5	11	14.29	31.43
110	********	4	15	11.43	42.86
115	****	2	17	5.71	48.57
120	**************	7	24	20.00	68.57
125	****	2	26	5.71	74.29
130		0	26	0.00	74.29
135	**	1	27	2.86	77.14
140	**********	8	35	22.86	100.00
145		0	35	0.00	100.00
150		0	35	0.00	100.00
155		0	35	0.00	100.00
160		0	35	0.00	100.00
165		0	35	0.00	100.00
170		0	35	0.00	100.00
175		0	35	0.00	100.00
180		0	35	0.00	100.00

2 4 6 8 10 12 14

FREQUENCY

** = one subject

TABLE 4

Frequency of General Memory for

"Old-Old" Group

GROUP OLD - OLD

GENMEM MIDPOINT		FREQ	CUM FREQ	PERCENT	CUM PERCENT
50		0	0	0.00	0.00
55	**	1	1	3.33	3.33
60		0	1	0.00	3.33
65		0	1	0.00	3.33
70		0	1	0.00	3.33
75	**	1	2	3.33	6.67
80		0	2	0.00	6.67
85		0	2	0.00	6.67
90	**	1	3	3.33	10.00
95	****	2	5	6.67	16.67
100	**	1	6	3.33	20.00
105	******************	9	15	30.00	50.00
110	********	4	19	13.33	63.33
115	**	1	20	3.33	66.67
120	******	3	23	10.00	76.67
125	**********	5	28	16.67	93.33
130	**	1	29	3.33	96.67
135		0	29	0.00	96.67
140	**	1	30	3.33	100.00
145		0	30	0.00	100.00
150		0	30	0.00	100.00
155		0	30	0.00	100.00
160		0	30	0.00	100.00
165		0	30	0.00	100.00
170		0	30	0.00	100.00
175		0	30	0.00	100.00
180		0	30	0.00	100.00

2 4 6 8 10 12 14

FREQUENCY

** = one subject

TABLE 5

Frequency of General Memory of

"Young-Old" Group

GROUP YOUNG - OLD

GENMEM MIDPOINT		FREQ	CUM FREQ	PERCENT	CUM PERCENT
50	**	1	1	2.86	2.86
55		0	1	0.00	2.86
60		0	1	0.00	2.86
65		0	1	0.00	2.86
70		0	1	0.00	2.86
75		0	1	0.00	2.86
80		0	1	0.00	2.86
85		0	1	0.00	2.86
90	********	4	5	11.43	14.29
95	**	1	6	2.86	17.14
100	**	1	7	2.86	20.00
105	******	3	10	8.57	28.57
110	**********	6	16	17.14	45.71
115	********	4	20	11.43	57.14
120	******	3	23	8.57	65.71
125	**********	5	28	14.29	80.00
130	********	4	32	11.43	91.43
135	******	3	35	8.57	100.00
140		0	35	0.00	100.00
145		0	35	0.00	100.00
150		0	35	0.00	100.00
155		0	35	0.00	100.00
160		0	35	0.00	100.00
165		0	35	0.00	100.00
170		0	35	0.00	100.00
175		0	35	0.00	100.00
180		0	35	0.00	100.00

2 4 6 8 10 12 14

FREQUENCY

** = one subject

readily view the number of subjects who obtained each score.

In the columns, the Frequency column describes the number associated with subjects that fell into each memory window. For example, in the Frequency column for General Memory in the young-old group, one person held a score of 50. Four people showed scores of 90 (See Table 75). The Cumulation of the frequencies column progressively sum up the frequencies. The Percent column describes the percentage of subjects that fall in each memory category. That is, the frequency is divided by the total sample size. This reveals the percentage of individuals that fall into a particular bracket of memory. The Cumulative Percent uses cumulative frequency to calculate percentages of accumulated frequencies. One can use this to find the fifty percent point or median score.

These charts allow one to see normal distributions as well as outlying, isolated scores.

No other significant differences (at the .05 level of confidence) were shown in the other four categories using F tests or Duncan's analysis of the means. In the Visual Memory and General Memory, major changes with age seem only to be minimal differences between old-olds and young-olds and thus, only slight decrements can be attributed to age.

RESEARCH QUESTION #2: What are preliminary norms for healthy elderly individuals over the age of 74 on the WMS-R (i.e., Wechsler (1987) only provides norms for individuals 74 or less)?

A preliminary examination of the WMS-R Index scores calculated based on the test manual's standardization sample provided some clues as to the degree of underestimation of the 75 - 95 year old group's memory abilities. While the WMS-R scoring procedures help to adjust for age effects on some measures (e.g. Attention/ Concentration Index and Verbal Memory Index) in the 75+ age range, such correction factors do not appear to be entirely adequate, especially for the Delayed Memory Index (e.g., older group mean - 111.0; younger group mean = 120). Therefore, until appropriate norms and age-correction factors are available for the WMS-R in older populations, use of the standard WMS-R Index scores in individuals over the age of 74 cannot be recommended, and if calculated, must be used only as approximate estimates of memory function.

These results represent some of the first data regarding WMS-R performance in healthy individuals. Because of the above-average level of education and excellent health status of these samples, however, the

generalizability to other elderly groups (i.e., those with less education and various health risk factors) may be limited. Nevertheless, until more large scale age - and education - adjusted norms are available, data such as these may serve as general preliminary guidelines for the interpretation of older subjects' performance on the WMS-R.

RESEARCH QUESTION #3: What constitutes normal aging?

Existing research suggests that the differences in memory functioning between normal aging and Alzheimer's Disease patients are quite apparent even in very elderly patients. Butters et al. (1988) reported pooer performance on the Visual Reproduction and Logical Memory subtests of the WMS-R in Alzheimer patients. These are in marked contrast to the findings for this study's reported 75 to 95 year old normal individuals. In addition to these quantitative differences, the pattern of impairments for these two subjects population are distinct. Alzheimer patients show apparent decline on both the Visual Reproduction and Logical Memory tests, whereas, as noted previously, the very elderly subjects decline in retention over the 30-minute delay was much more evident for the visual than for the verbal memory task.

RESEARCH QUESTION #4: What specific patterns of memory loss or change occur between a "young-old" and "old-old" group?

The 75 - 95 year old subjects in this study demonstrated significantly lower performance than did the 50 - 74 year olds on the Delayed Memory Index. Since the groups did not differ in their Attention/Concentration scores, the noted differences in memory test performance do not appear to be the result of any general cognitive or attentional factors. It should be stressed, however, that overall retention of most materials remained high. Immediate recall of the five memory functions was similar for both groups. Only on the Delayed Memory did the very elderly subjects' mean scores fall significantly below those of the younger group.

RESEARCH QUESTION #5: What are the predictors of memory change in the elderly?

Age, gender and education were examined as to their contribution to variance of the five general Indices of the WMS-R, using an ANOVA at the .05 level of confidence (See Table 6). The study is limited in finding predictors of aging. Unexpectedly the single memory change in the elderly was age. Gender and education were not found to be predictors of memory change in the aged. Gender and education showed no significant difference using the F test and the Duncan Mean.

TABLE 6

Emerging Trends--Age, Sex and Education in Comparing Delayed, Verbal and Visual Memory Using an Analysis of Variance.

WMS-R	ANOVA F Test	F VALUE
Delayed Memory		
Age	.0456*	4.17*
Sex	.6244	0.24
Education	.9287	0.07
Verbal Memory		
Age	.1354	2.29
Sex	.8585	.03
Education	.2063	1.62
Visual Memory		
Age	.1150	2.56
Sex	.3560	.87
Education	.9368	.07

L = .05

RESEARCH QUESTION #6: What aspects of memory function should remain constant after age 50?

Attention/Concentration, Verbal Memory, Visual Memory and General Memory should remain stable after age 50.

In comparing scores of the five general Indices of the WMS-R at the .05 level of confidence, there were no significant differences among the two groups for each of the categories with the exception of Delayed Memory. (See Table 1).

F tests revealed that the older group demonstrated significantly lower scores (F = .0411) than the younger group. The Duncan's Multiple Range Test for analysis of means showed parallel results.

RESEARCH QUESTION #7: How does a thirty minute delay affect the retrieval process on a given test?

Both the Analysis of Variance and the Duncan mean findings showed that, of the five general Indices of the WMS-R, only the Delayed Memory showed a significant difference between the "young-old" and "old-old" groups. This information shows that the only real difference between the two age groups' performance on the WMS-R lies in this critical thirty minute delay inherent in the Wechsler Memory Test. Four such delayed-recall trials

contribute to a separate Delayed Recall composite score intended to indicate how much learned material has been retained over a half-hour score. Two of these four trials test the retention of verbal material, and two test the retention of visual material. For both the verbal and visual delayed-recall trials, one task measures the retention of paired associates learned earlier in the examination, while the other assesses the retention of more meaningful and integrated material.

RESEARCH QUESTION #8: Given a controlled population to be tested, what other factors might contribute to variance on ability to perform on a memory test?

In addition to the primary study on the effects of aging on memory test performance, the contribution of "age-effects", sex and education to the dependent variables of the five general Indices of the WMS-R were evaluated, using an ANOVA at the .05 level of significance as well as a Duncan Mean for each parameter. (See Table 6). The single contributor to variance in this examination was age. Gender and education showed no significant difference using the F test and the Duncan mean.

RESEARCH QUESTION #9: How might one expect the very aged (i.e. those over the age of 90) to perform on a memory test?

In the extremely aged group there were only four

individuals. Although the sample is far too small for much inferential data, their test results are valuable in and of themselves. Poorest performance was in the areas of Attention/Concentration and Verbal Memory which might possibly be due to difficulty with sensory encoding. Visual Memory was weak as well. Contrary to my study, Delayed Memory and General Memory scores remained relatively high in this subsample. These four individuals are rather unique and one must infer that their memories were superior. These four people represent a very unique group who might provide future data for a study on "successful aging".

RESEARCH QUESTION #10: What are the norms of memory functioning for the extremely aged?

A preliminary examination of the WMS-R Index scores calculated based on the test manual's standardization sample provided some clues as to the degree of underestimation of the 75 - 95 year old group's memory abilities--while the WMS-R scoring procedures help to adjust for age effects on some measures (e.g., Attention/ Concentration Index and Verbal Memory Index) in the 75+ range; such correction factors do not appear to be entirely adequate, especially for the Delayed Memory Index (e.g., older group mean = 111, younger group mean = 120). Therefore, until appropriate norms and age-correction

factors are available for the WMS-R in older populations, use of the standard WMS-R Index scores in persons over age 74 cannot be recommended, and if calculated, must be used only as approximate estimates of memory function.

RESEARCH QUESTION #11: Since the very aged represent a special and unique population, what other variables, such as gender or ethnic background, might be useful for future research?

According to national census data (U.S. Bureau of the Census, 1983) females begin to outnumber males to a noticeable degree after about age 50, and thus the ratio of women to men increases steadily through age 74 and beyond. Gender and Education were examined for their contribution to the testing parameter. Although no statistically significant correlation was found, some emerging trends are noticeable. They are reported under emerging trends in this chapter.

Emerging Trends

Effects of Age, Education and Gender

Age Effects

The validity of cross-sectional evidence for an age-related decline in cognitive abilities has been challenged on the basis that younger and older subjects may differ with respect to other variables that affect

their knowledge base and memory test performance. Because the older subjects were exposed to somewhat different (and perhaps less adequate) health care systems, it can be argued that these cohort differences, rather than age per se, may be responsible for the older subjects' worse performance on the WMS-R. Thus, cohort differences can possibly contribute to "age effects" in cross-sectional studies. Multiple cross-sectional studies of subjects who were tested decades, or even generations apart, would address this difficulty of "age effects". Differences in screening, test protocols and communities make this an extremely difficult task. Perhaps future studies on aging might address this dilema.

Education Effects

The population examined in this study has a relatively high level of education. The mean educational level of the older group was 14.6 years. In the younger group, the mean educational level was 14.4 years.

Previous cross-sectional studies have provided inconsistent evidence that age-related decline in cognitive performance may differ according to subjects' initial level of functioning or socioeconomic status (Albert, 1990). In a study of the Wechsler Adult Intelligence Scale-Revised (WAIS-R) which can be cross validated with the WMS-R

memory test (Russell, 1982), Albert (1990) reported significant age-by-education interaction effects for several subtests and summary scores. The pattern of results on the different measures suggested 1) either an advantage for the best educated subgroup or a disadvantage for the least educated subgroup from early adulthood through middle age; but also 2) a "regression toward the mean", with smaller differences among the three education subgroups at the highest age level. Albert (1990) has shown that a rather striking advantage (no evidence of age-related decline) in the college-educated subgroup at middle age level. However, the college-educated elderly subjects show considerable evidence of age-related deficit. The author reported that at the oldest age level, there is no evidence that education makes any difference in age-related decline of cognitive performance.

One must consider that the best educated and least educated subgroups may differ in health care and nutrition. Through the middle years, these subgroups therefore may differ significantly in subtle aspects of health status (e.g. prevalence of hypertension) that can effect intellectual functioning. Another possibility is that all subgroups experience similar age-related deterioration in cognitive ability, but that the subjects with higher

education are better able to function with those changes because they tended to have more formal education initially. In addition, another possible explanation of the observed age-by-education interaction effects is that well educated subjects tend to maintain cognitive abilities better through the middle age period because they use these abilities more. Conceivably, then, even the well-educated subjects' cognitive abilities suffer during their later years as a consequence of relative disuse or lack of intellectual stimulation.

Gender Effects

Although the gender distribution was not evenly matched throughout the entire study, emerging trends in gender performance can be seen. In the "young-old" group, the male-female ratio was 12 males to 23 females. In the "old-old" group, the male-female ratio was 10 males to 20 females. In both groups females clearly outnumber males. In the younger group this may be due to the fact that more females typically have time for "volunteer" work while males in this group were still of pre-retirement age and thus, were less apt to participate. This cohort is old enough that the number of men to women engaged in the work force exceeds younger cohorts in which both sexes are equally distributed in the work force. Many of the females in this younger group reported

their occupation as "homemaker". In the "old-old" group, the ratio of men to women was roughly the same, with men being less represented. However, in the extremely aged group (those 85 and over) more men participated. Because of the very small numbers in the extremely aged group, it is not possible to judge as to the representativeness of the sample gender ratio.

In both age groups men did significantly better on the Digit Span Test and Figural Memory Test. Men also did better on the Visual Reproduction Test. Women performed better on the Logical Memory tests as well as the Visual Paired Associates. Since the WAIS-R has been cross validated with the WMS-R, it is useful to compare the WAIS-R gender performance. The WAIS-R standardization sample included 940 men and women who did not differ in age or education; therefore matching was not necessary. For both batteries, men did significantly better on Arithmetic, Information, and Picture Completion, whereas women did significantly better on Digit Symbol; mean differences between the two sexes on these subtests ranged from 0.49 to 1.34 scaled score points. On the WAIS-R, men also did significantly better on Block Design (by .74 point), Picture Arrangement (by .43 point) and all three IQs (by 1.44 to 2.33 IQ points) (Albert, 1990).

Thus, sex differences on the Wechsler Adult Intelligence Scale-Revised are modest in size and mostly favor men. These results are comparable to the Wechsler Memory Scale-Revised (Russell, 1982).

These data indicate that significant change in cognitive function develop with age in the absence of disease. However, it is difficult to use the results of IQ and memory tests to determine the way in which individual cognitive functions change across the lifespan.

Summary

The purpose of this research was to investigate changes in memory function between two broad age groups with the five dependent variables of the Wechsler Memory Scale-Revised. Data was analyzed using an ANOVA as well as mean scores resulting from the analysis. Results of the tests were discussed in the sections dealing with the population description, the research questions and emerging trends. In the next chapter are the conclusions to the findings of the research questions and emerging trends. Implications for future study will also be addressed.

CHAPTER FIVE

Summary and Conclusion

Introduction

The deleterious effects of aging on various cognitive abilities are widely recognized, yet little is known regarding what is involved in the normal aging process. The concept of normal aging and normal age-related memory decline has not yet been fully defined. The number of persons aged 65 and older has grown and will continue to grow more rapidly than other age groups. An accelereated interest in the field of gerontology reflects an expanding cognizance that there will continue to be a large increase in the size of the aged population.

A study of the aging process is exceedingly complex. The aged are not easily categorized because they are so varied. Research literature is abundant with myriad ways of grouping this diversified population. One can best understand the aging individual with knowledge of how he or she compares to those younger, to age cohorts, and to those older. It is for this reason that group trends, from early life to old age, are imperative to this study.

The intent of this study is to establish a baseline model for the normal aging continuum. An optimal aging paradigm will provide guidelines for future heuristic studies of the field of advancing age. In limiting the study to nonimpaired subjects, it is hoped that their performance on the Wechsler Memory Scale-Revised will illuminate normative data for elderly individuals. It is hoped that this important data will serve to demonstrate the exaggerated amount of cognitive decline attributed to old age. Since most of the data on memory in the elderly are derived from stereotypes of the aged, it is inferred that real memory decline may not be as great as reported.

Research Findings

The purpose of the study was to compare changes in the memory functioning of 50 to 74 year old normal subjects with 75 - 95 year old normal controls. The project was comprised of 30 subjects between the ages of 75 and 95, and 35 between the ages of 50 and 74. All subjects were administered the WMS-R according to standard procedure Wechsler (1987). The five general WMS-R memory composite Indices were compared using F tests from a standard ANOVA at the .05 level of confidence. In comparing scores of the five general Indices of the WMS-R, no significant

difference was found among the two age groups, with the exception of Delayed Memory. In the other four categories of Attention/Concentration, Verbal Memory, Visual Memory and General Memory, changes with age seem to be minimal between old and younger persons and thus, only slight decrements can be attributed to age. Older persons do not perform as well on tasks requiring recall than on tasks requiring only recognition. Gradual memory deficits occur in nonverbal memory. The global deleterious effects of age-related memory decline is clearly not supported by research.

In addition to the primary study on the effects of aging on memory test performance, the contribution of "age-effects", sex and education to memory function was examined. Of these three factors, age was the sole contributor to variance. Gender and education showed no significant difference in memory test performance.

These results represent some of the earliest data regarding WMS-R performance in healthy older individuals. Valuable data such as these may serve as general preliminary guidelines for the interpretation of older subjects' performance on the WMS-R.

Limitations of the Research

The demographics of a study confined to San Diego County is self-limiting. A desirable research protocol

would be one in which small samples of elderly people are tested throughout the United States. However, the acquired data is valuable given the dearth of existing normative data available on the elderly, especially the extremely aged; those 85 and older.

The sample is a population largely made up of retired professional people. This relatively affluent group may not be representative of the nation as a whole.

Additionally, the stringent criteria for the testing protocol may have served to create a biased sample due to the absence of significant health factors. This select group of individuals may be a threat to the internal validity of the experiment. These people were optimal individuals for a research project, however, paradoxically, they represent a rather unique group. As a whole, they were intellectually stimulated, physically active and most were self-actualized individuals. As part of the telephone screening interview, prospective research subjects were asked why they chose to participate in the study. Most volunteered out of a spirit of generativity.

Discussion

Much progress has been made in the past two decades toward delineating the nature and extent of age-related

deficits in memory functioning. Findings of greater age-related decrements in visual rather than verbal memory (as well as greater variability among older subjects) have been reported using the original Wechsler Memory Scale as well as the Wechsler Adult Intelligence Scale-Revised (WAIS-R) which has been cross validated with the WMS-R (Russell, 1982). Likewise, greater age-related declines have consistently been reported on the Performance subtests of the WAIS-R (which depend highly on visuoperceptual and visuospatial skills) than on the Verbal subtests of the WAIS-R. Such results correspond to the differential age-related decline that has been ordered on measures requiring "fluid" as opposed to "crystalized" cognitive abilities (Hayslip & Sterns, 1978).

Albert (1990) has validated the parallel age-related decline of the subtests of the WAIS-R with subtests of the WMS-R. A similar pattern of performance and age-related decline can be seen in the decremental Performance subtests of the WAIS-R, while, at the same time, subtests of the Verbal scale of the WAIS-R remain rather stable in the elderly. This author found that the decline on the Verbal Scale of the WAIS-R does not generally exceed one standard deviation below the peak performance of younger people until subjects are almost 80. The

Performance scale on the other hand, drops more than one standard deviation by age 60. This finding has been replicated by many investigators and has been called the "classic aging pattern" (Light, 1991).

This Verbal-Performance discrepancy has been explained in a number of ways. It was first argued that the discrepancy was primarily related to the increased slowing that is seen in the elderly. All subtests of the Performance scale of the WAIS-R are timed tasks. However, Albert (1990) noted that in subsequent tests given in an untimed fashion, older subjects benefit more than younger subjects, but they never reach the high performance levels of younger subjects. Thus, the Verbal-Performance discrepancy remains, even when speed requirements are eliminated.

Other investigators (Wechsler, 1987) have noted that the Verbal scale on the WAIS-R evaluates skill and knowledge that have been acquired relatively early on in life and are then reinforced throughout one's lifetime (e.g. general information, arithmetic). These skills are well-practiced, familiar and probably overlearned. They are, therefore, likely to be less sensitive to subtle age-related decrements in ability. The Performance scales, on the other hand, measure the learning and manipulation of unfamiliar materials

in situations where speed as well as accuracy are essential. Thus, the Performance subtests of the WAIS-R measure psychomotor and perceptual abilities, as well as integrative, much like the WMS-R Visual Reproduction test.

Recently, some investigators have suggested that the classic aging pattern represents a selective deterioration in the right versus the left cerebral hemisphere, since all the Performance subtests require some degree of visuospatial ability (as in the Visual Reproduction test of the WMS-R). However, there have been conflicting reports in the literature in describing these shifts of dominance (Albert 1990).

Other Findings

The major changes in human memory with age seem only to be minimal differences between old and young persons and thus, only slight age decrements can be attributed to age. Older persons perform more poorly on tasks requiring recall than on tasks requiring recognition. There are very few studies on the effect of age on nonverbal memory such as for pictures, tones or smell, but the few studies that have been conducted show gradual memory deficits with increasing age (Bengston & Schaie, 1989).

Contrary to popular belief, older persons do not recall or recognize information from the distant past

(such as names and faces) as well as adolescents, although they do show high levels of retention (Maylor, 1990a). There is evidence that giving older persons special instructions before learning, instructions that force them to carry out a greater number of more elaborate, or deeper encoding/processing operations, significantly decreases the difference usually found between older and younger persons in recall and recognition. Under these conditions, older persons perform almost as well in recall and recognition tasks as adolescents. This failure to engage in deep encoding may parallel and explain the poorer performance of very young children on certain memory tasks (Crook & West, 1990).

Conclusion

The primary hope for this study lies in the development of age-related norms and guidelines for the elderly population. It is hoped that this important data will serve to nullify the extensive amount of cognitive decline previously thought endemic to old age.

Data on the two comparison groups has been presented for purposes of establishing and describing predictors of the aging process. Because of the highly selective sample of optimally healthy individuals, the generalizability of the study may be impaired. However, this should not

dilute its implications for the aged. Rather, the information derived from this study should provide a hallmark model for advancing age.

The present results should serve as a definitive paradigm for the aging continuum. Normal aging clearly does not involve the loss of intellectual abilities, it should not interfere with one's occupation or social functioning. Memory impairment is not synonymous with old age.

Not surprisingly, the older group scored lower on a thirty minute delay. However, the similar performance of both groups on the Attention/Concentration Index, Visual Memory Index, Verbal Memory Index and General Memory Index illuminates the exaggerated global decline of cognitive function previously thought germaine to old age. This examination of aging transcends many of the myths and stereotypes associated with advancing age. The knowledge gleaned from this research should transform one's belief about the senior years. At a time when Alzheimer's Disease is no longer a clinical word, but rather, a household adage, this model of aging will provide a new lens to view the potential aspirations of the elderly.

Implications for Future Research

The priority for future research should be directed

towards measurement in clinical groups as well as in everyday settings. Analysis of memory data, test performance and self-reports, according to the memory test dimensions and metamemory domains will provide significant information in the understanding of the specific nature of memory function. This has considerable value for the science of gerontology. The specific course of change in memory in different stages of life must be subjected to a longitudinal design which would reveal examination of intra-individual changes. The search for unique memory characteristics in different individuals also implies a priority for intervention studies. The results from such studies have important implications for memory studies. A further priority would be to obtain norms from different groups of subjects and to assess the stability of these norms. The latter implies a need for systematic cohort comparisons in order to understand the impact on memory functioning from sources other than age. Emerging trends might include gender patterns as well as cultural and ethnicity variables.

Further interest must be devoted to the development and evaluation of memory tests. As memory does not represent a unitary ability, it becomes important that there is a pool of tests covering a broad range of memory behavior, and from which a selection can be made for a

particular purpose. The test development can be inspired by the emerging contextual ideas and from neuropsychological findings demonstrating that task dependency is the rule rather than the exception. For example, at present, almost all tests are verbal in nature. Thus, there is a need for non-verbal tests which meet the requirements for testing the elderly.

Much research has been done recently to understand behavioral and cognitive changes with age. It is clear that a concerted effort and investment of resources must be made in order to gain an even better understanding of the aging process.

Previous research has served to quiet the myths concerning the global deleterious effects of aging. The decrement model is a reactive model, no longer valid in the study of aging. Future research must consider a proactive approach to gerontological research. Intervention strategies shall be replaced by a prevention perspective on the study of aging. This new paradigm is both necessary and compelling.

Future research should address:

Successful Aging

Ecologically Valid Research

Strategies to Improve Cognitive Function

Improved Measurement of Aging

Plasticity of Memory

Succesful Aging

An important area for gerontologists to explore is the predictors of successful aging. Future research should consider what variables contribute to the maintenance of optimal function with age. What factors might predict who will recover from major illness and regain physical autonomy? Are there psychosocial variables, such as self-efficacy, that will indicate who will recover from the loss of a mate? Are their intellectual descriptors that predict who will be active and productive during retirement and who will not? What are the enabling factors that allow some individuals to maintain optimal function even when the average individual is showing decline?

Ecologically Valid Research

Research on adult age differences in everyday memory performance need not abandon the traditional laboratory approach. However, the focus of this research should be on the analysis of conditions likely to affect the proficiency of everyday memory processes, rather than on tests of either the reason for general decrements in memory with aging or the generalizability to late adulthood of memory phenomena discovered by memory researchers. Laboratory simultation of these conditions is possible and will serve to enhance understanding of

older adults' everyday memory capabilities. At the same time, the external validity of laboratory research should not be accepted as a given. Memory researchers clearly need to develop more effective external criteria for evaluating everyday memory performance and to demonstrate adequate relationships between these assessments and their laboratory-based assessments of memory performance.

Strategies to Improve Cognitive Function

Even when age-related changes occur, it is likely that older persons can do a great deal to minimize the impact of such changes by developing strategies to circumvent them. In the area of cognitive performance, the reported success of cognitive training programs among the elderly suggests that substantial improvement can occur with training (Baltes & Willis, 1982).

Evidence has accumulated to suggest that cognitive remediation strategies may be an effective tool in modifying the performance of aged individuals on a wide variety of cognitive tasks. It is unclear, however, whether such techniques have any permanent effects on behavior and whether they are feasible as therapeutic intervention for a wide variety of people (Poon, Fozard, Cermak & Arenberg, 1980). Furthermore, it is unclear whether such training techniques have transfer effects

so that remediation for one specific skill will generalize to a broader class of behavioral situations. Another issue is whether such remediation is an example of actual new learning rather than merely a restoration of lost abilities.

If simple training techniques can be developed that are effective in reversing cognitive decline in a large proportion of the elderly population, functional daily living might be significantly extended in individuals who might otherwise be forced to reside in living situations and environments that require varying degrees of monitoring and protection. This is why the study of ecological memory is so critical to the future of gerontological research.

Improved Measurement of Aging

A challenge to workers in the field of gerontology is to develop more sensitive and accurate neuropsychological markers of aging. The ability to assess and monitor human performance in terms of one's psychological as well as physiological features rather than chronological age will be valuable in resolving issues such as retirement age, particularly as a greater number of people are working beyond what was once considered 'normal' retirement age.

At present, human measurement of age and time is restricted mainly to physiological measurement. Neuropsychological markers of time will need to be developed through longitudinal studies of aging that incorporate a multidisciplinary approach to the neurobiology of aging. In the past, aging has been studied in terms of separate entities, such as behavior, pathology or psychology. The further understanding of the biological basis of age-related disease, as well as the normal aging process, would be facilitated by comparing directly relationships among several domains of study at one time. This strongly emphasizes the need for the development of more research programs that utilize multidisciplinary approaches to the study of aging.

Plasticity of Memory

Research into recovery of memory function following injury to the brain has resulted in the transference of this knowledge to the study of the aging brain. Historically it was an accepted notion that the young brain has a much greater capacity for improvement following injury--than the older brain. Later research has shown the same rate of regrowth to occur in response to injury in both old and young (Shaps, 1980).

The hypothesis that regrowth or rejuvination is a

naturally occurring process in the normal aging brain, has great relevance to studies of human aging. Further work is needed to determine more precisely the nature of plasticity in the aging brain.

Concluding Remarks

This study was an attempt to obtain a better understanding of the cognitive changes associated with normal aging and age-related changes. It is hoped that the research presented here will contribute significantly to the science of gerontology by providing behavioral baselines for the elderly. It is hoped that these advances will have significant influence on both the direction of gerontological research and on the treatment of older individuals, which will, in turn provide the framework for new directions of research in the 21st century.

In examining the statistical charts and in looking at the individuals assessed in this study, there is a remarkable lack of norms. As stated in Chapter One, what constitutes normal aging remains ambiguous. Frequency chart scores reveal many outlying scores, distinct from the bell curve. There is a striking absence of "normals". One might say that being "normal" is "abnormal".

In reviewing the predictors of aging, no significant emerging trends could be concluded from the study. Age effects were limited by vastly different health standards for each cohort. An individual born in the early part of the 20th century has a far different medical advantage than an individual born two decades later. In evaluating level of education, one must consider that it was common for a very bright individual to not complete his or her high school education in the early 1900's. Few attended college. Later cohorts almost always completed high school and many went on to college. Gender effects were equally limited in showing any significant effects.

The intent of this study was to establish norms for elderly memory performance. The limited generalizability of normative data gleaned from the study must not dilute the importance and magnitude of this endeavor.

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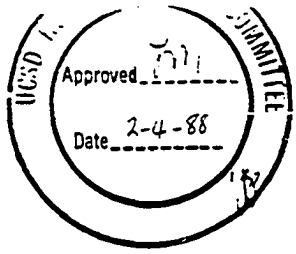
APPENDIX



SAN DIEGO SCHOOL OF MEDICINE
DEPARTMENT OF PSYCHIATRY
M-003

Appendix A-125
88-90

UNIVERSITY OF CALIFORNIA - SAN DIEGO

CONSENT TO ACT AS A RESEARCH SUBJECT

Nelson Butters, Ph.D. is conducting a study to find out more about memory, perception and thinking in outpatients with affective disorders and in patients with neurologic disorders such as Huntington's Disease and Alzeheimer's Disease. I have been asked to participate because I may have a neurological, psychiatric or alcohol problem, or because I am a normal control subject.

If I agree to be in this study, the following will happen to me:

1. I will be given several tests of memory, perception and problem-solving.

2. I will be tested for no more than 3-4 hours for 1 to 3 days.

Participation in this study may lead to fatigue and/or boredom. Frequent rest intervals will be interspersed during the three-hour period to reduce fatigue, and the tests have been designed to be as interesting as possible to me.

There will be no direct benefit to me from these procedures. The investigators may learn more about the kind of thinking and memory problems that are associated with different neurological and psychiatric disorders. If I am a patient, the results of this testing may also help my physician to understand my condition better.

Dr. Butters or his Research Assistant have explained this study to me and answered my questions. If I have other questions or research-related problems, I may reach Dr. Butters at 453-7500, ext. 3944.

Participation in research is entirely voluntary. I may refuse to participate or withdraw at any time without jeopardy to the medical care I will receive at this institution.

Research records will be kept completely confidential. My identity will not be disclosed without my written consent unless required by law.

I have received a copy of this consent document and "The Experimental Subject's Bill of Rights".

I agree to participate.

Subject's Signature	Witness	Date

CONTROL SUBJECT SCREENING FORM (8.87)

1. Full name: DATE:

2. Age:

3. Date of birth:

   Primary language:

4. Highest grade completed:
   (*list degrees & where obtained)

5. Occupation: Current: Past:
   Spouse's occupation:

6. Home address:

7. Telephone number:
   Alternate number:

8. Marital Status:
9. Number of children:

---

10. Y N Do you have any major medical illnesses, such as:
    diabetes, heart disease, lung disease, kidney disease,
    cancer of any type, or other?
    If yes, list briefly & give dates:

11. Y N Have you had any major surgeries?
    If yes, list type & when, if relevant:

12. Y N Have you ever had a heart attack?
    If yes, when, and was CPR needed?

---

13. Y N Have you ever had a head injury with a loss of consciousness greater than 15 minutes? (if > 30, exclude)
    If yes, how long LOC?

14. Y N If yes, did you have any symptoms that didn't go away
    (e.g. memory problems, paralysis, weakness, numbness)

15. Y N Have you ever been hospitalized for a head injury?
    If yes, how long?

16. Y N Have you ever had a stroke?
    If yes, when:
    Any residual symptoms? (e.g. speech problems,weakness, numbness, visual problems, or other? (LIST))

17. Y N Have you or anyone in your family ever had: encephalitis, meningitis, dementia, Alzhemier's disease, Huntington's disease, Parkinson's disease, multiple sclerosis, epilepsy or seizures, carbon monoxide poisoning, poisoning with pesticide or other toxic chemiscals, or a brain tumor? If yes, list & note who, when and subsequent problems:

18. Y N Have you ever had brain surgery?
If yes, when & why:

19. Y N Have you ever been seen by a neurologist or neurosurgeon?
If yes, why & when?

---

*20. Y N Have you ever been treated for drug or alcohol abuse?
If yes, when & how long: (if > 5yrs continuous, exclude)
What drug(s):

21. How much do you drink? Amount: (average per day, week or month this past year):

21a. Y N Have you averaged 3 or more drinks of any kind per day for a week or more? If yes, a) how many per day:
b) for how long: c) When:

22. Y N Have you ever been trouble (on the job, with police, or otherwise) for using alcohol or other drugs?

23. Y N Have you ever used "speed," "LSD," amphetamines or other street drugs, or inhalants (e.g. glue, paint, gasoline)
If yes: a) What substance(s):
b) How much on the average:
c) For how long:

24. Y N Do you regularly use any medication?
If yes, give general description & list the number (e.g. sleeping pills, antihistamines, valium, etc.)

---

25. Y N Have you ever seen a psychiatrist or psychologist for treatment?
If yes, when & why (be very brief; include med's):

26. Y N Have you or anyone in you family ever been hospitalized for psychiatric problems?
If yes, who, when, why & how long:

26a Y N Have you ever had problems with depression?
If yes, ever receive treatment for it? (what type & length):

26b Y N Have you ever attempted suicide?
If yes, who, when, # of times:

28. Y N Have you ever taken medication for a psychiatric illness?
If yes, what & how long:

29. Y N Were you ever told that you had problems learning in school?

30. Y N Were you ever in special education classes or held back a grade?

31. Are there any other problems you've had which I should know about?

*If subject seems appropriate & without major questions about their cognitivie functioning, go ahead & sign them up for a testing time.

NOTE: For < 40 S's, we'll pay $50 for full battery + clinical interviews + MRI.

For those > 50 for Dr. Cullum's project (memory study), Janet will set them up to be tested; we'll pay $5 per hour, & it takes about 2-3 hrs. (additional testing & possibly MRI's to be arranged for some subjects)

Summary of this case:

___ Seems appropriate without question
___ Needs further screening
___ Exclude (if so, why:

__ Scheduled for testing on _____

__ Scheduled for OPCRC full battery
__ Scheduled for older control battery (NIA grant)

Other comments:

Subj. ID: ____ **NIA NEUROPSYCHOLOGICAL SUMMARY** Date Tested:

Group: ____ Examiner:

DOB: ____

Age: ____ Educ: ____ Sex: ____ Hand: ____ Race: ____ Occup: ____ Marital: ____

WMS-R

	Raw Sum	Scaled
Attn/Concentrat:	____	____
Verbal Memory:	____	____
Visual Memory:	____	____
Delayed Memory:	____	____
General Memory:	____	____

Vis. Repro A:____ B:____ C:____ D:____ Tot:____

VR Delay: A:____ B:____ C:____ D:____ Tot:____

Beck: ____ **Zung:** ____

MMPI:

(T's)	L	F	K	1	2	3	4	5	6	7	8	9	0

RAW:

Info/Orient: ____ Mental Ctrl: ____ Figural Mem: ____

DigitsF: (____, ____) Tot: ____ DigitsB: (____, ____) Tot: ____

VisSpanF: (____, ____) Tot: ____ VisSpanB: (____, ____) Tot: ____

Log Memory A: ____ Log. Memory B: ____ Total: ____

Delay: A: ____ Delay B: ____ Total: ____

Verbal PA Easy: ____ Hard: ____ No. Trials: ____

Delay: Easy: ____ Hard: ____

Visual PA: ____ No. Trials: ____ Delay: ____

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August 23, 1991

TO: Miss Janet Conant

FROM: Nelson Butters, Ph.D.

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Nelson Butters, Ph.D.
Professor of Psychiatry

NB/lc