CROSS-SECTIONAL AND LONGITUDINAL ANALYSES OF THE EFFECTS OF AGING ON MEMORY IN HEALTHY YOUNG, MIDDLE-AGED, AND OLDEST-OLD ADULTS

A thesis presented in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in Psychology
at Massey University, Palmerston North,
New Zealand

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2006

To my mother, Jeanie Paton, now 90 years of age, an indomitable Scotswoman whose remarkable memory ignited my curiosity in just what does happen to memory during the aging process

Abstract

While a growing body of research indicates that older adults typically perform more poorly on many types of memory tasks than do younger adults, relatively little research has addressed the question of whether this trend continues unchanged into the late ninth and tenth decades of life. Such decrements in memory have been reported as linear declines from early adulthood up until about 80 years of age. Questions arise as to whether such memory declines slow or accelerate in very advanced aging, and to what extent differences are due to aging, per se, or variables that intervene between age and memory.

To address these two questions, six memory types – verbal recall, nonverbal recall, short-term memory, working memory, face recognition, and prospective memory – were examined using both cross-sectional and longitudinal methodologies. The six types of memory and the influence of verbal processing speed, nonverbal processing speed, and intelligence were examined in mixed-gender groups of 20 - 40 (n = 40, M = 30.7, SD = 5.52), 50 - 70 (n = 44, M = 59.2, SD = 4.94), and 85+ year olds (n = 42, M = 87.8, SD = 2.43), at two points, the second occurring two years after the first. Each participant completed tests of word recall, geometric shapes recall, short-term memory (digit span), working memory (letter-number sequencing), face recognition, and prospective memory. Additionally, there were two processing speed tasks (Identical Pictures and Finding As), and the National Adult Reading Test of verbal fluency was used to estimate intelligence. The Mini-Mental State Examination and the Beck Depression Inventory (BDI-II) were used to screen for dementia and depression, respectively.

At Time 1 testing the 85+ participants showed declines in all memory types (compared to the 20 - 40 year olds). Nonverbal recall (66.2% lower than the young group), working memory (46.2%), verbal recall (45%), and prospective memory (38.2%) produced the largest differences, short-term memory (12.3%) and face recognition (14.7%) the least. Two years later, the 85+ years old participants had shown further declines, relative to the 20 - 40 years group. Nonverbal recall (72.3% lower than the young group), prospective memory (63.2%), working memory (55.3%), and verbal recall (54.7%) continued to produce the largest decrements, with short-term memory (18.9%) and face recognition (19.8%) the least. The results for the young and middle participants

did not change appreciably between Time 1 and Time 2. The difference between unadjusted scores and scores adjusted for intelligence, verbal processing speed, and nonverbal processing speed, increased markedly between Time 1 and Time 2 testing for the oldest-old participants.

These findings support the view that while memory declines may be approximately linear from age 20 to 80 years, there is a sharp decline in most types of memory after the age of 85 years, recall and working memory suffering the most. Intelligence and processing speed have an effect on some types of memory, but age is by far the largest contributor to memory decline. Furthermore, as expected, all memory types declined over the two-year period, with prospective memory, verbal recall, nonverbal recall, and working memory showing the greatest declines. Short-term memory and face recognition declined at a noticeably slower rate.

Acknowledgements

First and foremost, I wish to express my thanks to my supervisors, Associate-Professor John Podd, Dr. Stephen Hill, and Dr. Julie Bunnell. From the moment I contacted Dr. Podd asking him to supervise my research, he was instrumental in gathering the team who would be enthusiastic and supportive throughout the research process. I am deeply grateful for the generous sharing of knowledge, expertise, and encouragement I have received. Thank you, especially, Dr. Podd for your unique combination of exacting academic standards, statistical 'know-how', academic curiosity, and a sense of humour which has lightened the journey for me many a time.

Special acknowledgement must be made to the participants, who bought this piece of work to life. It was a delight to work with people who were fully supportive of what I was doing. I was grateful to participants who gave of themselves amidst busy schedules of work and study. It was a particular pleasure to spend time with many of our oldest citizens. I appreciated their generosity in sharing their time, stories, and numerous cups of tea! I was touched by their willingness in allowing me to investigate what was often a source of worry to them – their memory. I especially appreciated the oft-expressed belief of the older volunteers that together we were making a contribution to understanding the process of aging. Thank you.

Thank you to Malcolm Loudon of Massey University who took my ideas and diagrams and turned them into a splendid computer-based geometric shapes test, and likewise built other test materials into computer software programmes. Thank you, too, to Hung Ton of Massey University for his willing assistance in all matters relating to the compilation and provision of the test battery. You are both much appreciated.

Thank you to my mother, Jeanie Paton, for her constant support. My mother was invaluable to me in her capacity of proof-reader for this research, and in her unwavering belief in me. I am grateful, too, to my children and grandchildren as they have understood and accommodated my absorption in the research process.

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PREFACE

There may be no more pressing intellectual need in our culture
than for people to become sophisticated about the function of memory.

Hampl (1996, p. 211)

Memory is at the very core of human existence. Everything from daily activities to the smallest perception, thought, or reflection involves the memory. Our every action, speaking, writing, opening a door, driving a car – all mobilise and depend on memory.

One of the most remarkable and far-reaching demographic development in the last century has been the 'greying' of populations. By 2051, it is anticipated there will be 1.18 million people aged 65 years and over in New Zealand, representing an increase of 165% since the year 2000. Within this demographic group, the number of people aged 85+ years is expected to rise to 320,000 by 2051 (Statistics New Zealand, 2004). While there has been an explosion of research on memory over the past two decades, there has been little investigation of the changes in memory of healthy, community-dwelling individuals, particularly those over 85 years of age.

The automatic linking of age and forgetting may well play a significant role in shaping the stereotypes of aging. Writing in 1793 (Partington, 1996, p. 376), Samuel Johnson has said:

> There is a wicked inclination in most people to suppose an old man decayed in his intellects. If a young or middle-aged man, when leaving a company, does not recollect where he laid his hat, it is nothing; but if the same inattention is discovered in an old man, people will shrug up their shoulders, and say, 'His memory is going'.

However, existing alongside the biased expectations, clearly memory deficits do occur with advanced aging. To clarify how memory is affected by aging, it is imperative intensive research effort is carried out. Nevertheless, despite the urgency of the need the bias against older people has existed even within experimental endeavour,

including leaving them out altogether. Although a large body of research literature now exists on all aspects of memory, few studies have included individuals in their late ninth and tenth decades of life. Of the studies which have included the oldest-old, many of them are directed toward memory deficits which are a result of pathologies such as Alzheimer's disease, Parkinson's disease, and so on. Few studies have been carried out on healthy people who have reached these advanced ages.

The main purpose of the present research is to examine six specific types of memory across the adult life span, with a particular focus on adults who have reached 85 years of age and over. The choice of the memory types to be studied was a difficult one. There are a plethora of memory aspects which could have been chosen. The final decision – verbal recall, nonverbal recall, short-term memory, working memory, face recognition, and prospective memory – was made because these memory types are integral to the continued independence and to efficient cognitive functioning in advanced old age.

The choice to incorporate both cross-sectional and longitudinal methodology in the research design was made in order to access a balanced picture of memory ability during advanced aging. Hartley, Harker, and Walsh (1980) note that a reliance on cross-sectional methods has resulted in research findings that describe age differences rather then age changes, and Schaie (1980) suggests that the role of cohort effects are likely to influence results when reliance is placed only on cross-sectional data, although cross-sectional investigation remains the most common method of investigating memory to date. To the present time, little investigation which incorporates cross-sectional and longitudinal data on the oldest-old has been carried out.

The inclusion of a longitudinal design brings its own difficulties when investigating individuals who are in their late 80s and 90s. An inter-test interval of two years was chosen. While this may be viewed as a short time for a longitudinal study, when life expectancy is reduced to single digits a balance needs to be drawn between an expected attrition rate due to declining health or death, and capturing memory change over time.

The mixed design of the current study, while allowing for a comprehensive observation of both differences and changes in memory across the life span, presented difficulties in the choice of statistical analyses. Analysis of covariance (ANCOVA), widely used in memory research, was chosen so that the main effects and interactions of the independent variables could be assessed after dependent variable scores were

adjusted for differences associated with the covariates (Tabachnik & Fidell, 2001). However, while this provided the necessary adjusted scores for the six types of memory, it did not answer the question of how much unique variance was associated with each of the chosen covariates. Thus, the decision was made to run a second analysis, multiple regression. These two analytical methods nicely complement one another, and together allowed for an in depth examination of certain memory changes across ages and across time.