CHAPTER I

INTRODUCTION
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"O Memory! Thou fond deceiver!"

Oliver Goldsmith

Memory is the crux around which all life gets organised. Without memory, life is just vegetative existence. In his commerce with the environment man stores his experiences in the intricacies of his brain only to retrieve them at a later period and use them to his own advantage. Insights into the events of life and their interpretations are also incorporated into memory. Memory has a survival value.

As man ages into frailty and as his brain deteriorates, his memory starts failing as a result of "normal" degenerative change. This sort of decline is termed as "Age Associated Memory Decline" (AAMD). This apart, certain disease conditions of the brain e.g., Alzheimer's disease, multi infarct dementia, induce a pathological decline in memory. In studies on memory this distinction is always made between normal and pathological memory loss.

One of the common complaints of many elderly is the inability (on and off) to retrieve the information from their memory. A large number of empirical studies have demonstrated that younger subjects perform better than the older subjects with regard to memory. While accepting the fact of significant age differences in memory performance, one must understand the complex nature of memory and the multifarious factors determining the size of the age differences. Due to its complexity, scientists continue to strive to unravel the intricacies of human memory. The study of memory is considered as one of the important and fascinating areas of Gero psychological research as evident from the observation that 34 percent of the published articles in the two journals viz.,
Psychology and Aging, and the Journal of Gerontology: (Psychological Sciences), were in the area of memory and ageing (Birren & Schaie, 1996).

Memory is a function which bears many facets. Empirical evidence is plenty that points to the differential decline in these facets of memory. Though many elderly experience relatively little difficulty in remembering some of their early life events (e.g., events of their childhood) yet they may find it difficult to learn and retain new material. Bromley (1958) and Gilbert (1941) reported that learning and memory of recent material is complex and a marked decline in memory occurs especially in those aspects calling for the formation of completely new associations, the interpretation of new inputs as well as in retention of newly learnt material.

Enquiring into the process of memory and evolving strategies to master them is age old in the Indian culture. Specific drug interventions towards memory enhancement were quoted long back in the ancient medical literature of India, i.e., in "Ayurveda", the indigenous Indian medical system (cited in Priyadaranjan, Herendranath & Miray, 1980). In 1700 A.D. Annambhatta in his book "Tarka Sangraha" (commentary on Nyaya & Vaisesika Systems of Philosophy) mentioned the importance of Smriti (memory) and its significance in dealing with day to day affairs of the world (Varadachari, 1952). He described that memory and life experiences are the two components essential to maintain life integrity. Remembrance was referred to as cognition of a thing which is accompanied by a previous cognition (Junankar, 1978). This memory was considered as a spiritual force. The most common method prevailing in India even today is the use of certain mnemonics to orally recite the strict poetic structures and versification of the Rig-veda. It is because the exact verbatim reproduction is highly valued.
Plato, in the 4th century BC, suggested that memory was like a wax tablet on which our experiences of the outside world could be etched but were also easy to erase (Spear, 1978). In the 17th Century Descartes suggested that memory traces are located in the brain and these traces were controlled by animal spirits that entered through the pores of the brain. He further mentioned about the unconscious evocations of memory traces in his book "The Passion of the Soul" (Descartes, 1649). One of his observations was that any repugnance or aversive early childhood experiences leave deep traces and may remain intact in the child's brain till the end of his life without any memory remaining of it afterwards. Leibnitz in 1704 further explained the significance of unconscious perceptions and ideas which continuously influence our behaviour. (Leibnitz, 1704)

William Carpenter, the British Physiologist in 1874 used the term "Unconscious cerebration" to explain memory. Hering (1920) stated that the term "memory" is often understood as though it meant nothing more than our faculty of intentionally reproducing ideas or a series of ideas (Schacter, 1987) and emphasized the significance of "Unconscious memory".

The theories in the 18th and 19th centuries focused mostly on the "conscious" aspects of memory but a few reports discussed the "unconscious" aspect of memory. The "unconscious" aspect of memory gained its importance when it was supported by an unusual area of research - psychical research, at the end of the 19th century. One such landmarks of unconscious memory was Korsakoff's observation on the amnesic syndrome. His classic articles in 1889 on the amnesic syndrome indicate that "although the patient was not aware that he preserved traces of impression that he received, those traces however, probably excited and had an influence in one way or another on the cause of ideas, at least in unconscious intellectual activity". He suggested that amnesics had "weak" memory traces that were not strong enough to enter conscious memory but they influence behaviour. Almost a couple of decades
after Korsakoff's announcement of his work on amnesics, Claparede, a French Neurologist in 1911 reported similar observations on "unconscious memory" in amnesics (Shimamura, 1989).

Ebbinghaus (1885) did pioneering work on learning and memory and Ribot's (1882) and James's (1921) theoretical perspectives on working memory opened new vistas in memory research with a shift in understanding and emphasis on "Conscious memory". James's usage of primary and secondary memory provided a precedent for later theorists to make distinctions between the two systems of long term and short term memory (James, 1890).

Psychologists of different schools have examined how we remember different types of information, and also analysed the impact of our remembered interpretation on our behaviour. But their conclusions are by no means restricted to scientific discourse. Around the turn of the 19th century Freud, Janet and Bruer in the field of Psychiatry provided valuable new insights into the ways in which the unconscious mind and its mechanisms operate. They observed that patients with hysterical amnesia had no "conscious" recollection of traumatic events although these were expressed in various ways (Freud, 1938). Thus, the early experiences in life leave deep traces in the individual's psychical life, acting as significant determinants of future development.

The earlier reports and studies described memory in terms of conscious and unconscious types. It was William McDougall (1924), who referred different types of memory expressions in his book "Outline of Psychology" and named them as Explicit and Implicit memory. He differentiated these two by stating that explicit memory requires a conscious recollection of a past event and an implicit memory invokes a change in behavior that can be attributed to a recent event that contains no conscious recollection of it (McDougall, 1924). This distinction referred by McDougall was unnoticed in view of the mushroom
growth of studies focusing on explicit memory during the middle of the 20th century.

One of the significant early findings on the neurobiology of memory was that of Penfield (1930), the famous Neurosurgeon, who based on his case studies of Neurosurgery patients provided valuable insights and demonstrated how memories could be activated by electric stimulation of the brain. Many scientists in the 19th century fired by the ambition to study memory as an academic pursuit attempted to understand how learning, reasoning and forgetting take place and how our day-to-day experiences are formed in terms of "memory traces" in our brain. From that time onwards, interest was aroused in many scientists to try to unravel the mysteries of memory functioning.

Scientific developments in the area of memory have taken place along two relatively independent lines. On the one hand, there were the studies in Neurobiology, dealing with structural organization of the neural network systems involved in human memory. On the other hand, there was the perspective of Cognitive Psychology and Neuro-Psychology centering their interests on evaluating the functioning of these networks in normal and memory impaired subjects. One of the major breakthroughs of memory research has been the discovery of different forms of memory.

It is evident from the above that the explanations on memory from varied perspectives (over the decades) have ranged from the material to the spiritual, exploring vital connections between the physical and the psychological, the fictional and the factual and the individual and the cultural. These polar perspectives only reflect different facets of the complex states that constitute memory. In the early decades of the 20th century, interest was aroused among the Scientists in defining and understanding the mechanisms of explicit memory. This was the era of "Information - Processing Theories".
The later part of the 20th Century was dominated by intense longitudinal research studies, where memory and age differences were the main focus. More recent studies shifted their emphasis to memory impairments and interventions.

TYPES OF MEMORY

Memory researchers over the years, based on their observations in memory functioning, have conceptualised different categories of human memory. Some of the distinct types of memory are mentioned below.

Sensory Memory: It refers to the shallowest level of the memory system, a basic mechanism which holds information (like sounds, sights, touches, smells, and tastes) for a very brief period (a few seconds or so). For young adults, the span has been known for many years (to be four or five letters) and its modest decline was discovered in late adulthood (Woodworth, 1938; Schonfield & Wenger, 1975). It appears that the visual system retains information briefly, with the information being in the form of an image or icon of a just terminated stimulus. This form of sensory information has been labeled as iconic memory. The auditory memory is known as echoic memory, which refers to the persistence of an image of the physical stimulus. The image appears to present the sound features of an originating auditory stimulus (Neisser, 1967). Gilson and Baddeley (1969) mentioned the existence of a sensory store for the sense of touch.

In general, many psychologists accepted the two distinct types of memory viz, short term memory and long term memory. The contemporary trends in memory suggest some alternative memory types under these two categories.
Short Term Memory: - William James (1890) in his classic book on "Principles of Psychology" described the existence of two forms of memory, Primary and Secondary (James, 1890) According to him primary memory is immediate memory, the memory of events that are in current consciousness. Secondary memory consists of memories that are no longer in immediate consciousness, but they are stored permanently and may become accessible to consciousness with effort. Waugh and Norman (1965) made the distinction between short term memory (STM) and long term memory (LTM). Accordingly, the STM is the temporary storage of events and information of events in the very immediate past (i.e., those that occurred in the last few seconds). STM apparently holds about seven (± 2) items and anything over that amount must be retrieved from the long term memory (Miller, 1956). Short term memory seems to slow with age. Although older subjects can retrieve as many items from the STM as younger people, it takes them longer time to perform (Anders, Fozard & Lillyquist, 1972)

Working Memory: - This refers to the processes and structures involved in holding information in the mind and simultaneous use of this information in connection with incoming information to solve a problem or make a decision or learn. Due to the retrieval problems older adults experience changes in working memory. Studies indicate that older adults take more space by keeping irrelevant information in working memory which prevents them to use it for relevant information than younger adults (Hasher & Zacks, 1988)

Long Term Memory: - It refers to permanent store of information with unlimited capacity; which is the storehouse of our past experiences holding the memories of early life, our knowledge about the world etc. It is evident that the retention of information is not affected by age, if once the material has been kept in long term storage. It is placed as efficiently by 80 year olds as by 20 year old
(Poon, 1985) Even if there is a difficulty in retrieving the information, once it is stored, it is believed to be in the LTM but inaccessible. Many studies of memory do not assess the contents of long term storage but reflect the efficiency of the processes used to enter and retrieve material (Perlmutter et al., 1987).

The research on memory types indicates that long term memory was interchangeably referred to (with minor modifications) as tertiary memory in some studies and as remote memory in some investigations which include autobiographical memory and episodic memory. Also included were flash bulb memories, procedural or implicit memory and semantic memory, prospective memory, meta memory, spatial memory. They were defined as follows.

**Tertiary Memory:** Poon (1985) states that the information which needs to be kept for a very long time is housed in tertiary memory. The information stored in tertiary memory is very similar to the information that relates to crystallized intelligence.

**Remote Memory:** The non-autobiographical events that have occurred in a person's life are stored in this form of memory. Ribot's hypothesis suggests that fresh memory inputs are more likely to displace recent than distant memories (Ribot, 1882).

**Autobiographical Memory:** It is one of the important types of tertiary memory which involves remembering information and events from our life. The major problem often cited in this memory is the issue of reliability and accuracy of recollection.
Episodic Memory:- The events that happen to us some times are linked with a time and place. Memory of this type is known as episodic memory. The essence of episodic memory is that it recaptures the temporal and spatial context of a person's past experience (Lachman, Lachman & Butterfield, 1979) Laboratory studies may over estimate the magnitude of age-related deficits in episodic memory. The age normative signs of modest to moderate memory problems were denoted as "Benign Senescent Forgetfulness" (Kral, 1962) and the current preferred category of this kind of memory is "Age Associated Memory Impairment" (AAMI) (Crook et al, 1986)

Flash Bulb Memories:- The memories which are very vivid that it seems as if we have a photograph of the event (Brown & Kulik, 1977). Events which have considerable personal relevance, very unusual or novel events that are highly emotional are considered under flash bulb memories. Research indicates that these memories are affected by age. Elderly experience fewer flash bulb memories than younger subjects (Cohen, Conway & Maylor, 1994)

Procedural or Implicit Memory:- The skills we learnt in our life usually show little change with age. The type of memory that is related to the practice and automation, that are primarily cognitive (eg, reading) or involve a motor component (eg, driving, typing etc.) is referred to as procedural memory. The large part of this memory can not be expressed in words, but this can be demonstrated. In day to day living older people exhibit procedural memory, for e.g., older typists are as efficient as younger typists and do not lose their skills and often are unaffected by brain damage. This sort of expression of procedural memory is known as declarative memory. The organisation of contents of declarative memory is similar for both young and old subjects. Irrespective of age, the storage in this takes place in two major kinds of knowledge viz., episodic and semantic memories.
**Semantic Memory:** Organised factual knowledge refers to semantic or generic memories. This involves learning, remembering the meaning of words and concepts that are not tied to specific occurrences of events in time. Studies indicate that in situations where world knowledge is involved, older adults may perform similar to the young (Dunn & McIntosh, 1984). When persons are asked to learn a word list and recall it spontaneously, the number of words recalled begins to decline as people enter their thirties and becomes narrow with each passing decade. The decline of performance may not be evident when the words that are related to their knowledge are recalled (Poon, 1985).

**Prospective Memory:** It is one of the forms of long term memory. The main function of this memory is not to remember the past but to plan for the future. It means that learning from one's experience and mistakes in order to cope better with situations when it happens in the future. In prospective memory, the item can be recalled any number of times, but it is only successful if a person remembers to do it at the right time and acts upon it (West, 1989). Studies in laboratory conditions show that older peoples' prospective memory performance is well preserved (or) even better than younger subjects. Thus, prospective memory refers to remembrance to remember on the basis of two distinctions viz., event-based and time-bound (Harris, 1984).

**Meta Memory:** Knowledge about how memory works and what we believe to be true about it is known as metamemory. Metamemory may be more important in understanding how people formulate initial predictions, analysing one's previous performance may be more important for subsequent predictions.
**Spatial Memory:** Refers to people's memory for location e.g., remember where we left our key, locating a prominent building etc. Performance of spatial memory indicates that performance peaks by middle age and decreases steadily thereafter.

The schematic representation of human memory system as mentioned by Kausler (1994) is given in Figure 1.

**Figure 1: Human Memory System**

Several studies on memory and aging have reported age related decline, whereas other studies have failed to find unambiguous age related changes (Park, 1992). Age related differences in memory are influenced by an interaction of multiple factors (Salthouse & Skovornek, 1992). For instance, the researches in the area of memory have interpreted the findings on age differences in working memory as being due to greater susceptibility to interference as a function of age (Kausler, 1994; Perlmutter, 1992). Such
interference may have a direct effect on the storage and retrieval stages of information processing. Despite these observations, the attempts to demonstrate directly the effects of interference on memory have not given consistent results. Despite these observed inconsistencies it is generally believed that there is a decline in memory function in many subjects as measured through various tests, with advancing age. But nature and quantum of change differs with the test being used.

The review of studies on memory and ageing (reported in chapter II of this thesis) indicate memory processing as a potential source of age differences (Park et al., 1996, Salthouse, 1996). Due to paucity of evidence on age differences on how information is organized in storage, most researchers have examined encoding and retrieval as sources of age differences. Regardless of whether the cause is physiological, biochemical, motivational or due to other non-cognitive factors, there are differences in memory functioning among the young and the old. The very brightest older person seems to show both relatively and absolutely less loss, but, in time, even these individuals perform less well than when they were young. Since the amount of loss occurring with progressive age depends upon the type of material used and the kind of learning and memory involved, it is difficult to conclude in a general way of presence or absence of memory impairment with growing age. Neither using a single test nor a combination of various tests is adequate to draw generalised inferences on memory in the aged. There appears to be some specificity of age change. This suggests a need to use tests for specific functions.
The volume of research output on various aspects of memory carried out on western population is amazing. In recent years there has been a shift in emphasis among Western researchers, to the study of memory deficits especially age associated dementia’s and interventions to deal with them.

The review of researches in the area of geropsychology shows that very few scientific studies are available on cognitive aspects of ageing in India and virtually few studies are there on memory and aging (Ramamurti & Jamuna, 1984, 1993, 1995). This only emphasizes the need for systematic scientific research in the important area of memory in the sample of Indian aged.

Demographic trends indicate that India has joined the club of ageing countries with 7 per cent of its population being, 60 years and above. The life expectancy both at birth and at 60 years has been pushing upwards leading to marked changes in the population age structure. Increased years of life should be meaningful, healthy and active i.e., without much functional dependency and increased susceptibility to diseases and physical and sensory impairment. Elderly could then be an asset to their families and community rather than being a burden.

Most elderly worry when they experience failing memory or inability to learn and remember. These often lead to feelings of helplessness, anxiety, awkwardness and depression. It is important to realise the fact that among other factors, one of the key factors in leading active, healthy and functionally independent lives is the efficiency of memory functioning. Factors within the person might affect the ability to learn and remember at any age, but some of them seem to affect
memory increasingly in the older person. There are studies indicating the effect of age, physical health, education, self perception of memory, motivation and positive attitude on memory performance among elderly. But few studies are found on how directly or in directly certain factors like social supports, self esteem, locus of control, life events of an individual, self reported physical health and psychological health influence memory performance among the aged. This is particularly so with regard to India.

In the context of the foregoing an attempt is made herein to study certain aspects of memory performance in working memory, semantic memory, verbal memory, pictorial memory and remote memory in the Indian elderly. In view of certain inherent difficulties in carrying out a longitudinal study within a temporally restricted period (as in this Ph.D work) the present investigation is aimed at assessing memory in a cross-sectional sample. Both verbal and non-verbal functions in persons of somewhat comparable background, among three age groups viz., 60-69, 70-79 and 80-89 years are studied. In the light of the dearth of studies on both long-term and short-term memory in the Indian elderly, this study is being undertaken with the following objectives (detailed further in Chapter III):

1. To assess the performance in certain facets of memory viz., Working memory, Semantic memory, Verbal memory, Pictorial memory and Remote memory in Indian elderly men and women.

2. To compare different socio-demographic groups such as age, gender, locality, education, economic status and marital status with regard to memory performance in elderly men and women.
3. To examine the association of different facets of memory with psychological variables viz., self rated memory, self reported physical health, self reported psychological health, self perception of social supports, life stress, self esteem and I-E locus of control in elderly men and women.

4. To test the efficacy of intervention in improving memory performance in a select sample of elderly.