The Effect of Age on Memory

Abdulkhaleq A. Al-Qahtani[1]
[1]*Department of English, King Khalid University, Abha, Saudi Arabia*

Keywords: Memory, Learning, Aging.

Abstract: This paper presents an overview of the memory system and how it's affected by age. Each type of memory is also explained and divided into their sub-memories; for sensory memory, there are three types namely: iconic memory for visual stimuli, echoic memory for aural stimuli and haptic memory for touch; for long-term memory, there are procedural and declarative memories. After each memory type, the paper presents information found in the literature as to how some aspects of memory are influenced by age. The conclusions are as follows: memory is not affected by age as a whole system, what is affected are certain functions of memory subcategories. For example, little evidence shows that semantic memory, procedural memory and episodic memory are affected by age. In addition, encoding and retrieving information from and to long-term memory are found to be influenced. The paper concludes with an assertion that most if not all age-related deficiencies can be overcome.

1 INTRODUCTION

Aging has been perceived to have a direct impact on memory loss. This perception is not grounded on research findings but was rather associated with anecdotes of aging people. As people age, they become sensitive as to what abilities they have lost and what they have retained over the passing years; memory is one of those abilities. The observations of aging adults are not fully refuted by research on memory and aging. There seems to be a fair amount of correlation between aging and a certain number of memory functions (Merriam & Caffarella, 1999).

In order to understand how age affects memory, one needs to know how memory works in the first place. There are three main types of memory. i.e., sensory memory, short-term memory (sometimes referred to as the working memory), and long-term memory. Each type has its own constituent parts that may or may not be affected by age either entirely or partially. This paper will attempt to outline the main types of memory and their subsections and explore in the light of research findings how each and every type might be affected by age.

2 SENSORY MEMORY

This type of memory is the first part of the memory system where information is first perceived. The name sensory is connected directly to the function of this type of memory, the senses. A sensory memory is available for every sensory channel: iconic memory for visual stimuli, echoic memory for aural stimuli and haptic memory for touch. Here is how it works; information is first encountered by the senses sight, hearing, touch, taste, or smell. Then the information is saved for a very short time from 1 – 5 seconds. Then the selected information is sent to the next memory (the short term memory). Then the function of this type of memory stops. The place in the human brain in which information is saved is called sensory registers. The information at this stage is not processed (Matlin, 1998). At this point a person decides which part of information is worth further processing and which part is not through the process of attention. It is worth noting that most of the information received in the sensory registers is filtered out of the system (Ormrod, 1995).

An example of sensory memory would be a key word heard in a lecture after losing attention to what the lecturer had just said that triggered a person's mind to get back to the lecture. Remembering the word right before that key word is locating that word in the echoic memory. Another example would be a hearer's attention to someone reading a sentence when the hearer holds the words at the beginning of the sentence until the speaker finishes to make sense of the whole utterance. These words are held in the

Al-Qahtani, A.
The Effect of Age on Memory.
DOI: 10.5220/0008682601730177
In *Improving Educational Quality Toward International Standard (ICED-QA 2018)*, pages 173-177
ISBN: 978-989-758-392-6

echoic memory and are not processed until the sentence is uttered in full. A third example would be watch someone/something move; the iconic memory saves each snapshot of the moving picture and connects it with the next before processing the whole scene into a meaningful thought. It is just like the pictures on a cartoon film where every picture is fixed alone and then connected to the others to form a motion on the film. Iconic memory retains unprocessed pictures for a short while to connect them to the rest and ultimately move on to the next step in the memory system (the short-term memory).

The capacity of the sensory memory is not that large (Ormrod, 1995). The fact that our brains can take in large amount of information fairly accurately, the length of time allowed in the sensory registers is very short; and therefore, the maximum amount allowed in this memory is almost one unit of information at a time (Matlin, 1998). To be more specific, iconic memory can only last for less than one second, and echoic memory can only hold up to five seconds. It is interesting to observe that the capacity of sensory memory is measured by time not by space or quantity (Salthouse, 1996).

From what is said about sensory memory thus far, it is quite obvious that age could have a fairly strong impact on at least two types of the sensory memories namely the iconic and the echoic, but with lesser impact on the haptic memory. Contrary to Merriam & Caffarella (1999)who argue that sensory memory is not affected by age, as people age, they lose vision and hearing more than other senses (touch, smell, and taste). Thus, the amount received into the iconic and echoic memories will be increasingly reduced, as people grow older. On the other hand, the other senses will remain intact, in most part, well into late adulthood; and therefore, very little negative impact may be ascribed to the haptic memory as well as the registers for the smell and taste.

In sum, we cannot assert that the sensory memory is affect by age because it is divided into sub-memories, which are not all affected in the same way or manner. Nevertheless, older people could make up for such deficiencies by checking up their vision and hearing and use aids to sharpen up these senses and reduce aging consequences to this type of memory.

3 SHORT-TERM MEMORY

Short-term memory, sometimes called the working memory, is the next step in the memory system right after the sensory memory. What is working memory? It is a limited-capacity store that can hold entering information for a few seconds – it is what is in your thinking at the present moment. This store works in the following manner: through selective attention, information move from sensory memory to short-term memory; here, two factors are crucial: the amount of information and the duration. The maximum normal amount of information that an adult can hold in a single time is seven items of information, and the duration is roughly from 20 to 30 seconds. The items of information could be isolated units like one digit number or chunks where a group of related smaller units are lumped together to form a one-item chunk. The items are maintained in short-term memory by means of rehearsal.

The process of chunking is proved to be valuable for enhancing the performance of sort-term memory (Salthouse, 1996). One chunk, or example, could include the three digit numbers of an area code in a telephone number instead of storing the same chunk as a three different digits. The one chunk in this case counts as a single unit for the possible seven units mentioned earlier in the maximum capacity of short-term memory. Consequently the maximum duration for normal adult could also expand as a result of chunking.

Short-term memory has been proven to have direct impact on language learning (Gathercole and Baddeley, 1993), and people who have problems in this type of memory exhibit learning disabilities. Reading, for example, engages short-term memory directly in the process. The reader needs to hold chunks of read words for a short time to connect them to the words following them and the words before them. Any disturbance in the short-term-memory, therefore, would result in reading difficulty or even disability (Hulme and Mackenzie, 1992).

The influence of aging on short-term memory is found in literature. The speed by which young vs. older adults process information varies. Older adults tend to process information in their short-term memory slower than that of younger adults (Bors and Forrin, 1995). Salthouse (1991) conducted a study in which he employed the most common way of assessing short-term memory, which is the digit-span test. In this test informants are given a sequence of numbers or letters and then asked to recall them. Older adults perform well in the recall as well as younger adults but when the older ones were asked to manipulate the information in other ways like recall them in refers order, younger adults outperformed the older. Salthouse explained this phenomenon as an indicator that older adults have a fragile short-term memory.

Another research conducted by Swanson (1999) found that there are differences between older and

younger adults in the general capacity of two different processes: accessing new information and maintaining old information. In this study, older adults are found to have more problems accessing new information than younger adults. As for the efficiency of the maintenance of old information, the study did not support a significant difference between young and older adults. Thus, age affects only certain tasks of short-term memory but not the whole function. Older adults have problems accessing new information but once the information enters the system, older adults seem to keep the new information as well as the younger adults (Swanson, 1999).

In short, age-related issues found in the literature suggest that only two aspects are found to be relevant: the speed of performance and the difficulty of accessing new information. As for the speed of performance, researchers like Salthouse suggest that the slow performance of adults might have to do with the physiological aspect of aging rather than a cognitive process. As for the difficulty of accessing new information for older adults, Swanson and others argue that that older adults experience a strict intake of new information due to two reasons: poor sensory registers' input and fixed expectations of what should be processed. It stands to reason, as I see it, that people lose increasing amount of their vision and hearing as they grow older and this process affects the amount of input to shot-term memory. Also, people develop expectations of the world and what to encounter as they grow older and novel input might be overlooked because it was not expected. In other words, the new information did not fit in the established pattern/framework that has been established over the years.

4 LONG-TERM MEMORY

The third and the last type of memory is long-term memory. Long-term memory is the final destination for the information input. As the name suggests, long-term memory saves information taken in from one minute to many years for later retrieval. Unlike working memory/short-term memory, information in the long-term memory is not there in a person's present thinking. Information is organized in files based on meaningful connections between units of information.

The long-term memory works in two-ways directions: storing/depositing new information and retrieving information from the store. As for depositing information process, information is transferred to long-term memory from short-term memory by means of encoding and/or elaboration. The key component of encoding and elaboration processes is the meaningfulness of information and its relations to what the person has already established (schemata). For example, one piece of information would be much more easier to encode and/or to elaborate if the person can relate that new information to prior experiences/memories he/she had stored before. The second process, which is the retrieval process, acts in two processes either by recognition or by recall. In both processes, the person has to attend to what is really needed and where to find them among the meaningful files. Recognition is less troublesome because the person is given clues, but recall demands more efforts to retrieve the needed information.

Long-term memory is divided into sub-memories based on the type and function of different kinds of information. The known categories are as follows: declarative memory or explicit memory, which is the memory that people actively retrieve (recall and recognize) and procedural memory or implicit memory which we learn over time and then perform tasks as needed without much conscious effort, like reading and swimming (Anderson, 1996). Skills learned/deposited in the procedural memory are hard to learn and hard to forget like the example of reading.

Declarative memory in turn is divided into two subcategories based on the functions of these memories: semantic memory and the episodic memory. Semantic memories are those memories of general knowledge and subject matter knowledge we learn at schools and in life at large. It contains concepts, verbal information, rules, and problem-solving abilities. Semantic memory stores information in a form of schemata rather than images. Episodic memories are those memories related to life events that people experience as they live. Usually this type of memory is organized around episodes of our lives in a form of images. Usually it helps us remember related information around events and make sense of what had happened.

Having presented the major components of long-tem memory, one would wonder how would age affect this type of memory and which part is more affected than the other. Research findings suggest that not all types of long-term memory are affected in the same way and at the same level. Procedural memory, under normal circumstances, for example, is not affected by age as the declarative memory. And semantic memory is not affected by age as the episodic memory. Episodic memory, in fact, is the one that is found to be more endangered by age more than any other memory type (Bee, 1996).

Shinkeigaku (1994) conducted a study to measure the affect of age on episodic memory. The subjects of this study were two groups of Japanese, aged forty to seventy-five years. They were asked 85 questions about public events that are familiar to their Japanese culture. The events were scatted over four decades. The researcher found that as age goes up informants' performance went down (missed correct answers). Older informants did not do as good as the younger ones in both old memories – thirty years old events and recent events – ten and fewer years old events. The results of this study confirm that episodic memory is significantly affected by age. Semantic memory, on the other hand, is less affected by age because older people exhibit better or equivalent knowledge as younger adults (Bee, 1996). As a matter of fact, older people have more robust schemata than younger adults due to longer experiences and accumulating meaningful input.

In sum, the two main problems usually experienced by older adults due to age, as it applies to long-term memory, are the two processes of encoding and retrieving information. As for the encoding issue, researchers have detected problems in the process of encoding new information. They ascribed such observation to the fact that older adults cannot fit first-time new information in any existing schemata; here the well-established schemata resist encoding the new information for lack of finding a suitable place for it within the space already organized (Swanson, 1999). Also, retrieval process is problematic for older adults. This process is either recognition or recall. If the task requires recognition, the age variable is not found significant: older adults and younger adults function relatively equally. However, recall process is found to be more difficult for older adults (Bee, 1996).

5 CONCLUSION

In this paper, I presented the way in which memory works as a means to understand age's impact on memory. In the light of recent research reviewed in this paper, age does not affect all types of memory in the same ways. As a matter of fact, there are certain aspects of memory that are not affected at all, like the procedural memory. However, age's impact is detectible in other types of memories in different ways. For example, in sensory memory, people experience decline in the perception system (sight and hearing), which would affect the amount of input saved on the sensory register.

Working memory is affect by age as a result of the slowing down of the processes of receiving and sending information to the long-term memory. Also, it is affected by the fact that information in short-term memory tends to decay more rapidly in older adults. Long term-memory is more affected in the area of episodic memory more than the two other types. The explanation given in the literature ascribed such observation to the two processes of encoding and retrieving to and from the long-term memory. At the encoding level, older adults are inclined to deposit/encode new input in well-established manner by which new information get subsumed under certain existing category; if the category is not there, then the encoding process becomes more difficult. As for the retrieval process, older people tend to exert more effort to recall information due to confusion, interferences, and ill categorized information.

The good news is that most of the difficulties cited in the research on the effect of age on memory are not fatal. As a matter of fact, people can overcome such difficulties by employing certain techniques. For example, at the sensory memory stage, older adult could sharpen their vision and hearing by using prescribed aids. Working memory could be saved by rehearsing and chunking items of information. And long-term memory processes of encoding and retrieval could be maintained by practicing recall and connecting new ideas to existing knowledge. Other suggestions to improve long-term memory retrieval and encoding may include focusing attention on the tasks, avoiding distractions, intending to put effort, avoiding tension, and using external aids like a paper and a pencil.

REFERENCES

Anderson, J. 1996. "ACT: A simple theory of complex cognition", *American Psychologist*, 51(4), 355-365.

Bee, H. 1996. *The journey of adulthood* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Bors, D. A., & Forrin, B. 1995. Age, speed of information processing, recall, and fluid intelligence. *Intelligence*, 20, 229-248.

Gathercole, S. and Baddeley, A. 1993. *Working memory and Language*. Hillsdale, NJ: Lawrence Erlbaum.

Hulme, C. & Mackenzie, S. 1992. *Working Memory and Severe Learning Difficulties*. Hove: Lawrence Erlbaum Associates, Publishers

Merriam, S. & Caffarella, R. 1999. *Learning in adulthood* (2nd addition). San Francesco, CA: Jossey-Bass.

Matlin, M. 1998. *Cognition* (4th edition). Harcourt Brace College Publishers, Orlando: FL.

Ormrod, J. E. 1995. *Human Learning* 2nd edition. Columbus, Ohio, Merrill.

Salthouse,T.A. 1996. The processing-speed theory of adult age differences in cognition. *Psychological Review*,103, 403 –428.

Salthouse, T. A. 1991. *Theoretical perspectives on cognition and aging*. Hillsdale, N.J.: Lawrence Erlbaum Press.

Shinkeigaku, R. 1994. Influence of age on long-term memory. *PubMed*, 34 (8), 777-781

Swanson, H. L. 1999. What develops in working memory? A life span perspective. *Developmental psychology*, 35(4), 986–1000