



Notes

## HUMAN MEMORY

As a student does it ever intrigue you that what mental processes are essential for good academic performance?

How do you remember the birthday of your close friend?

Has it ever happened with you that you failed to recognize a known person?

Think about the above questions and many more daily based experiences of human life. These situations demand coordination among various mental processes such as perception, learning and memory. For example, a good score in exam is the result of learning the study material well and retrieving the learned information during exam without failure or forgetting. So let us try to understand what these mental processes really are.

As you have already studied, learning refers to a relatively permanent change in behavior due to training or experience. Learning plays a central role in every sphere of life either social or personal. But learning is not the only mental processes essential in maintaining and performing daily life tasks, memory also plays an integral function. Memory is a central cognitive process which plays vital role in human life. Memory helps us to retain the learned information, experiences of past, present which contributes in performing future plans and actions. Memory facilitates the process of learning. We have to be dependent on memory to recall the facts, events and experiences. For example, if an individual knows how to drive a car but does not drive on an everyday basis. Yet when an occasion comes when s/he needs to drive her/his loved one to hospital s/he will immediately recall the learned rules and perform the skill to fulfil the need of that particular moment. This represents the importance of memory. This chapter aims to provide understanding about the process of memory and technique to enhance one's memory.

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### LEARNING OUTCOMES

After studying this lesson, learner :

- discusses the nature of memory;
- explains the underlying processes of memory;
- illustrates the nature and causes of forgetting;
- states the application of mnemonics in enhancing memory; and
- employs different techniques to augment one's memory.

### 8.1 NATURE OF MEMORY

The word “Memory” originates from the Latin term ‘*memoria*’ and ‘*memor*’, meaning “mindful” and “remembering” respectively. The term memory can be better understood as the process of maintaining information over time. It can also be understood as the means by which we draw on our past experiences in order to use this information in the present.

Memory involves processing of vast amount of information in different forms, such as echoic, iconic and meaning. Memory serves several functions. First, memory provides continuity for consciousness. Second, it helps in effectively dealing with situations at hand by utilizing essential skills. Third, it helps in enriching our social and emotional experiences by effective planning and performance. How this exactly happens will be clear by understanding the processes or stages of memory.

### 8.2 MEMORY PROCESSES

Memory processes can be understood in three stages. They can be easily memorised as 3R's of memory (register, retain, retrieve):

- **Encoding (or registration)**

Encoding is the process of converting the sensory information coming from the environment that can be registered in the memory system. There are three steps involved in the encoding process: receiving, processing, and combining information. For example, you listen to a song in a party, and you liked this song so you try to understand its lyrics. When you convert this auditory signal

into echoic unit so that it can be stored into the memory system, it is called the process of encoding.

- **Storage (retention)**

Storage is the process of converting the incoming information into permanent records so that it can be accessed later when needed. To take the example forward, once you understand the lyrics you try to store it in memory either through maintenance rehearsal (by mere repetition of the song) or through elaborative rehearsal (when you comprehend the meaning and associate it with your own feelings). This is called the process of storage.

- **Retrieval (recall, or recognition)**

Retrieval is the process of locating and leveling the stored information from the storehouse to the consciousness at the time of need. Now imagine that you are enjoying some leisure time and feel like singing a song so you would perhaps recall the song you encoded and stored. Once retrieved you would play it and probably sing along it. This represents the process of retrieval of memory.



Fig8.1: Stages of Memory

Interruption at any stage will affect forthcoming stages of memory and may also result in forgetting of stored information.



### INTEXT QUESTIONS 8.1

**Notes:** Write your answer in the space given below and compare your answer with those given at the end of this unit.

1. An individual's record of past events and experiences is:
  - (a) Learning
  - (b) Perception
  - (c) Memory
  - (d) Sensation



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2. Which one of the following is not included in the stages of memory?
  - (a) Encoding
  - (b) Rehearsal
  - (c) Storage
  - (d) Retrieval
3. Recall and \_\_\_\_\_ are the two types of retrieval.

**8.3 MODELS OF MEMORY**

There are different models of memory which helps in understanding the underlying process of memory.

**8.3.1 Atkinson and Shiffrin model:**

This model is also known as information processing model as well as modal model. Atkinson and Shiffrin noticed that human memory and computer systems process information in similar fashion where information passes through the three stages of memory: encoding, storage and retrieval. This model proposes three systems of memory and therefore is also sometimes called stage. These systems are Sensory Memory, the Short-term Memory and the Long-term Memory. Each of these systems have different features and perform different functions in relation to memory.



Fig 8.2: Human memory system and its three components.

**Sensory Memory:** Information from the environment first enters the sensory memory through the senses. There are various incoming sensations at a given point in time therefore sensory memory has a large capacity. However, it stays for a very short duration, i.e., less than a second. For example, at present, you can hear the sound of traffic at distance, or air coming from the fan or the lecture of the teacher or the sound of the pages turning. All this information is entering your sensory memory but it is further processed into short term memory only if you pay attention to it.

**Short-term Memory:** Information that is attended by the sensory system enters the short-term memory (STM). Short-term memory holds limited information for a brief

period of time which is more than sensory memory but less than long-term memory, i.e., less than 30 seconds. If the information is not rehearsed at this stage, it faces difficulty in proceeding the information to the next stage of memory. There are two types of Rehearsal: maintenance and elaborative rehearsal. Maintenance rehearsal is also referred as rote learning wherein constant repetition of information helps in retaining the information in consciousness for some time. Whereas the elaborative rehearsal is more detailed in nature. In elaborative rehearsal the information is retained through forming connections of new information with previously learned material.

**Long-term Memory:** Information enters the final stage of memory which is long-term memory through elaborative rehearsal. It has a vast capacity for an unlimited period of time as it is a permanent storehouse of all information. Once the information enters the long-term memory store it is never forgotten because it is encoded semantically or based on the meaning of the information.

#### 8.4 TYPES OF MEMORY

Memory can be classified based on different criteria such as nature of material, span of time, amount of information etc. The classification given below is widely accepted amongst the scientific community and is easy to grasp. Based on this classification, memory can be divided into two types i.e., implicit and explicit memory.

- **Implicit memory:** It is also referred as unconscious memory or automatic memory. Implicit memory is the type of memory wherein the task is performed without putting conscious efforts in processing or recalling of previous experiences or information. For example, walking is the function of implicit memory because the process of walking happens automatically or without mental efforts.
  - ❖ **Procedural memory:** Is a subtype of implicit memory. It is required for those tasks where motor skills are required. For example- while riding a cycle, cyclist does not need to recall the steps of riding each time.
- **Explicit memory:** It refers as declarative memory which requires conscious efforts in recalling the previous experiences and information. Declarative memory involves both episodic and semantic memory.
  - ❖ **Episodic memory:** It is a type of memory which stores the information related with events and connections between those events. It refers to personal experiences. Example: I have a Psychology class tomorrow at 9:30 A.M.; My birthday comes on 20<sup>th</sup> December every year.



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- Semantic memory: In contrast to episodic memory, semantic memory includes the organized knowledge which is general in nature. Example: Indira Gandhi was the first women prime minister of India, or Hg is the symbol of Mercury.



### INTEXT QUESTIONS 8.2

**Notes:** write your answer in the space given below and compare it with the answers given at the end of the unit.

1. Information processing model was proposed by \_\_\_\_\_ and \_\_\_\_\_.
2. Sensory memory has \_\_\_\_\_ duration and \_\_\_\_\_ capacity.
3. Elaborative rehearsal is used to transfer the information from sensory memory to short term memory. (True/False)
4. Procedural memory is a subtype of implicit memory. (True/False)

### 8.5 FORGETTING

Have you experienced the blankness during exam for which you were well prepared or have you had that moment when you forgot the things your mother asked you to get from the grocery shop? Hermann Ebbinghaus was the first psychologist who systematically studied the nature of forgetting. He utilised nonsense syllables or Consonant Vowel Consonant (CVC) trigrams in his experiment, where he attempted to measure the nature of forgetting in terms of number of trials a participant took to relearn the same list at varying time intervals. Based on this experiment, Ebbinghaus proposed the model of forgetting which states that the rate of forgetting is maximum in the first nine hours, particularly during the first hour. After that the rate slows down and not much is forgotten even after many days. It can be well understood by observing Ebbinghaus's Forgetting Curve in figure 8.3.

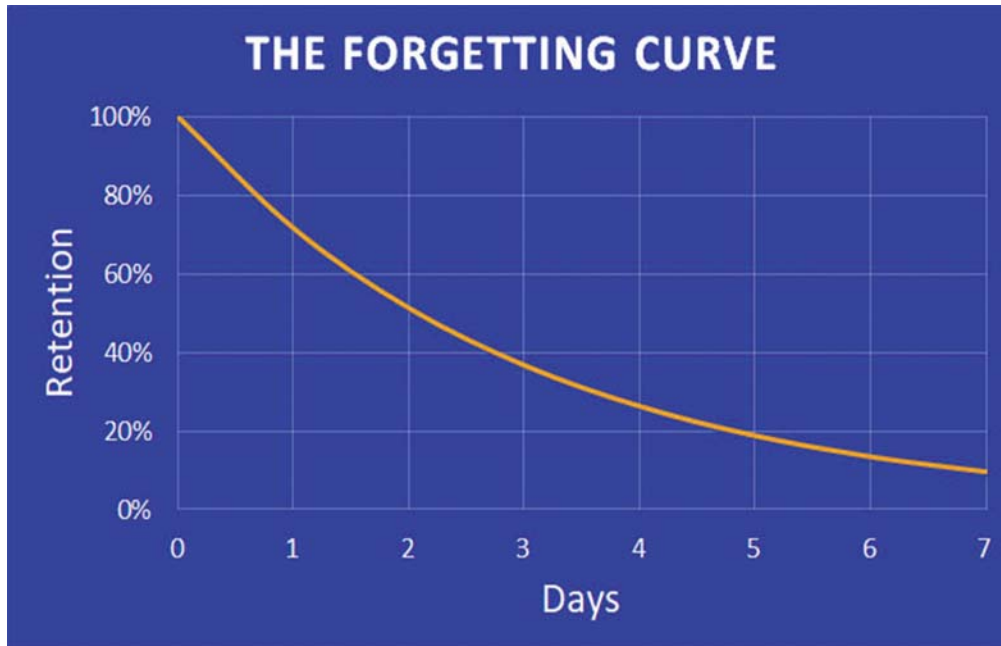


Fig 8.3: Ebbinghaus Forgetting Curve

### 8.5.1 Causes of Forgetting

Though forgetting is an everyday human experience but it is difficult to state what causes forgetting. There are several theories that state the cause of forgetting in their own unique style.

- **Trace decay:** One of the oldest theories of forgetting is trace theory or also known as disuse theory. This theory states that memory leads to relatively permanent physical change in our central nervous system. These changes in brain are referred to as memory traces. Memory traces stay in brain if constantly used but they tend to disappear or fade away if not used for a long period of time. Fading away of these memory traces causes forgetting of learned material or information. Although this sounds simple but this theory has been criticized on several grounds. Based on this theory it can be safely assumed that if we memorize a list of words before going to sleep we will forget it after waking up but in reality, the opposite holds true.
- **Interference theory:** It states that forgetting occurs due to the interference between learned or memorized information. This theory assumes that learning or memorizing occurs due to formation of association between old and new information. Forgetting according to this, occurs when either the new information interferes with the recollection of old information or when old information



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interferes with the learning of new information. However, interference plays a critical role at the time of retrieval when these various sets of associations compete with each other for retrieval. Two of the most referred types of interferences are:

- **Proactive interference:** (Forward moving) means when the old information interferes with the successful recollection of new information. For example: Imagine that your old car number was 2333 and your new (present) car number is 4535, when asked by the traffic officer you say the old car number. This immediate recollection of old information and blocking of new information by old information is called proactive interference.
- **Retroactive Interference:** :(Backward moving) means when the old information is difficult to recall because it is blocked by the new information. For example: Imagine you have changed your mobile number. After sometime when asked about the old number you were using, you are unable to recall it. This is an example of retroactive interference.

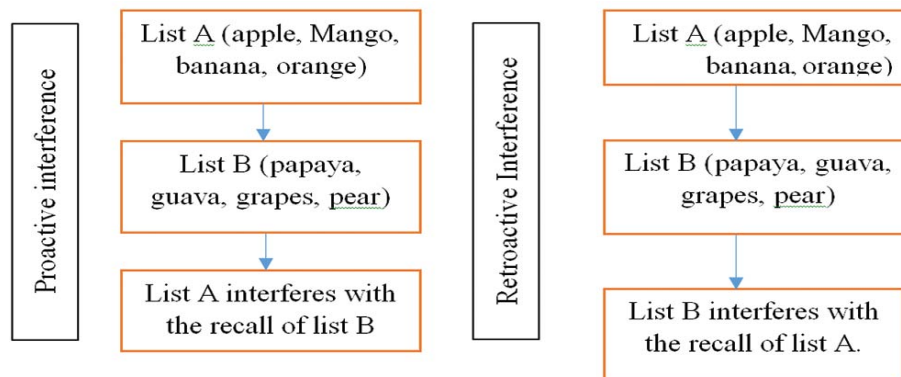


Fig 8.4: Diagrammatic representation of retroactive and proactive interference

8.6 TECHNIQUES OF ENHANCING MEMORY

Humans are heavily dependent on their memory for their day-to-day tasks. Therefore, it has been an agenda for psychologists to figure out strategies to enhance memory. Some of the famous strategies are:

- **The Keyword Method:** In the keyword method, we try to learn or memorize the new information by forming connections with old information. Suppose you are learning a new or foreign language. To be able to learn the new language faster and better you use similar sounding words of your mother tongue or old already learned language. This similar sounding world helps you in retaining the new language better. This technique is better than rote learning. For example, VIBGYOR is abbreviation of 7 colors of the spectrum i.e., violet, indigo, blue, green, yellow, orange and Red.





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- **The Method of Loci:** In order to use the method of loci, items you want to remember are placed as objects arranged in a physical space in the form of visual images. This method is particularly helpful in remembering items in a serial order. It requires that you first visualize objects/places that you know well in a specific sequence, imagine the objects you want to remember and associate them one by one to the physical locations. For example, suppose you want to remember bread, eggs, tomatoes, and soap on your way to the market, you may visualize a loaf of bread and eggs placed in your kitchen, tomatoes kept on a table and soap in the bathroom. When you enter the market all you need to do is to take a mental walk along the route from your kitchen to the bathroom recalling all the items of your shopping list in a sequence.
- **Mnemonics using organization:** Organization refers to imposing certain order on the material you want to remember. Mnemonics of this kind are helpful because of the framework you create while organization makes the retrieval task fairly easy.
- **Chunking:** Under this, several smaller units are combined to form large chunks. For creating chunks, it is important to discover some organization principles, which can link smaller units. Therefore, apart from being a control mechanism to increase the capacity of short-term memory, chunking can be used to improve memory as well. For example, the large number 1947195019841962 can be better learned in four different chunks 1947- year of independence of India, 1950 year of implementation of the Indian constitution, 1984- assassination of Smt. Indira Gandhi, 1962- year of Indo-China war.
- **Minimize Interference:** Interference, as we have read, is a major cause of forgetting and therefore you should try to avoid it as much as possible. You know that maximum interference is caused when very similar materials are learned in a sequence. Arrange your study schedule in such a way that you do not learn similar subjects one after the other. Instead, pick up some other subject unrelated to the previous one. If that is not possible, distribute your learning/practice. This means giving yourself intermittent rest periods while studying to minimize interference.
- **Give Yourself Enough Retrieval Cues:** While you learn something, think of retrieval cues inherent in your study material. Identify them and link parts of the study material to these cues. Cues will be easier to remember compared to the entire content and the links you have created between cues and the content will facilitate the retrieval process.

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- **PQRST:** Thomas and Robinson have developed another strategy to help students in remembering more which they called the methods of PQRST. This acronym stands for Preview, Question, Read, Self-recitation, and Test. Preview refers to giving a cursory look at the chapter and familiarizing oneself with its contents. Question means raising questions and seeking answers from the lesson. Now start reading and look for answers of questions you had raised. After reading try to rewrite what you have read and at the end test how much you have been able to understand.

There is no one method that can solve all problems related to retention and bring about an overnight memory improvement. In order to improve your memory, you need to attend to a wide variety of factors which affect your memory such as your health status, your interest and motivation, your familiarity with the subject matter and so on. In addition, you must learn to use strategies for memory improvement depending upon the nature of memory tasks.



### INTEXT QUESTIONS 8.3

**Note:** write your answer in the space given below and compare it with the answers given in the end of the unit.

1. Hermann Ebbinghaus utilised the concept of nonsense syllables or \_\_\_\_\_ trigrams in his experiment on forgetting.
2. When the old information is difficult to recall because it is blocked by the new information, it is called \_\_\_\_\_ interference.
3. The acronym PQRST stands for Preview, Question, \_\_\_\_\_, Self-recitation, and \_\_\_\_\_.



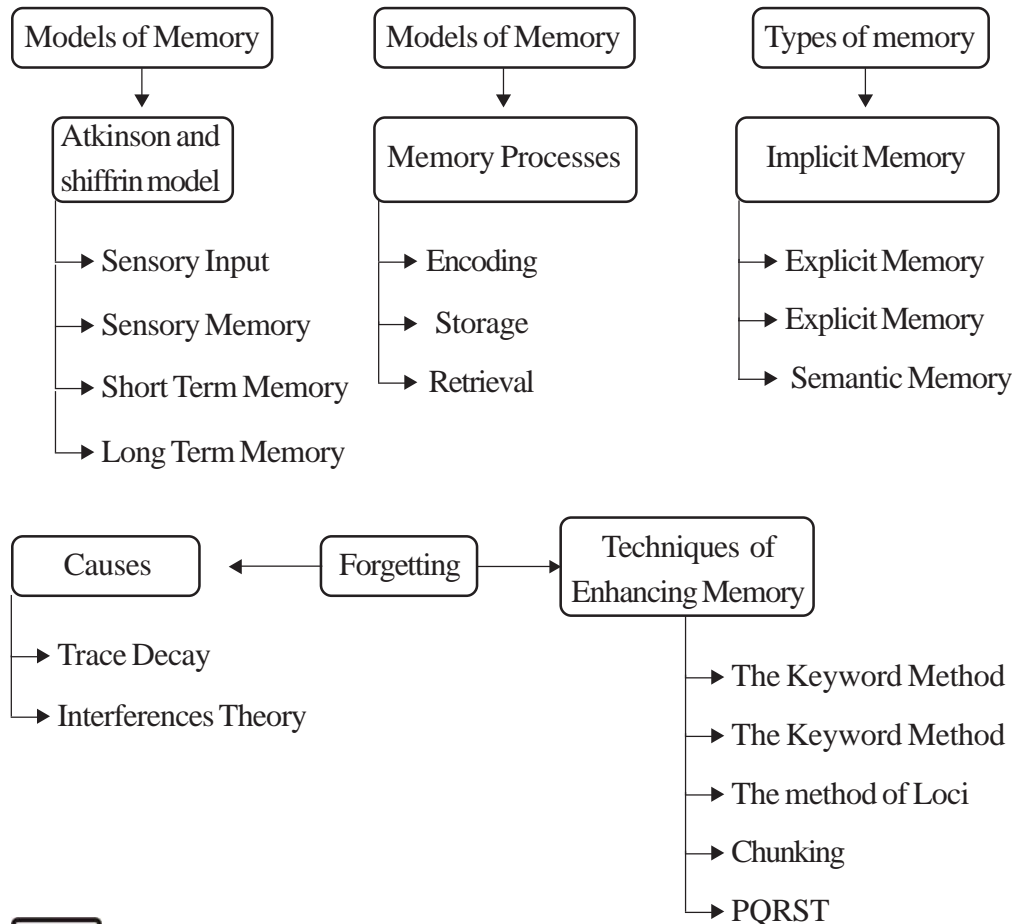
### ACTIVITY

- 8.1. Prepare a list of tasks you have carried out throughout the day and then try to classify the type of memory it is, e.g., driving is procedural memory whereas wishing a friend on his/her birthday is an example of episodic memory.
- 8.2. Conduct an experiment with your friend wherein give him/her a list of words to remember and which technique of remembering has s/he used.

8.3. Try to remember the list of the grocery items using the method of loci and find its effectiveness.



**WHAT YOU HAVE LEARNT**



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**TERMINAL QUESTIONS**

1. Define the nature and processes of memory.
2. Elaborate on Atkinson and Shiffrin’s model of information processing.
3. Describe forgetting and its causes.
4. Discuss the various techniques of enhancing memory.
5. What is the role of learning and memory in daily life tasks and why are they essential mental processes for good academic performance?

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6. What are three stages of memory processes and how do they work?
7. What are the two types of memory and their subtypes, as classified based on different criteria? What is the difference between implicit and explicit memory and their subtypes?
8. What are the two main theories of forgetting according to Ebbinghaus model of forgetting? How do they explain the cause of forgetting?
9. Draw and explain Ebbinghaus Forgetting Curve.
10. What are the functions of memory and how does it contribute to our conscious experiences and daily life activities?

**ANSWERS TO INTEXT QUESTIONS****8.1**

1. (c) Memory
2. (b) Rehearsal
3. Recognition

**8.2**

1. Atkinson and Shiffrin
2. Shorter and Large
3. False
4. True

**8.3**

1. CVC
2. Retroactive
3. Read and Test