

## HUMAN MEMORY SYSTEM

### 7.1 Introduction

*Do you remember your first day in the school ?*

*On what day did you go to the market last week ?*

*Can you name your friends ?*

In our everyday life almost all activities in one or the other way deal with memory. Loss of memory means loss of one's self. Learning will make no sense if it is not retained by the individual. It is only through the capacity of memory that we are able to relate different events, experiences, conditions, people and objects. Also, we use these relations in different contexts and on different occasions. A child learns something in class and uses it in market or in some other place. Memory establishes links across diverse experiences. Its a great mental capacity—a real great magic. It is needed in making social relationships, mastering cognitive competencies (mental capacities) and solving various problems. In this lesson we are going to see how our memory works and its components ? The factors which increase or decrease our memory capacity, and what can be done to improve memory.

### 7.2 Objectives

After reading this lesson you will be able to:

- describe the nature of human memory system;
  - differentiate between short-term memory and long-term memory;
-

- describe important factors influencing memory and forgetting;
- describe the ways of enhancing memory.

### 7.3 The Human Memory System

Memory is a remarkable mental process and a mental system which receives information from (external or internal) stimuli, retains it and makes it available on a future occasion. It provides continuity to our experiences across different time points. This simple characterization of memory, however, does not mean that our memory is like a tape recorder which records a song or music and plays when ever we demand. Our memory system does perform this but it is more dynamic and versatile than that. When some one asks us to sing a particular song and we sing then we are working like tape recorders. But a moment's reflection will reveal that human memory differs from a tape recorder in many important ways. For instance we remember not only verbal material but visual experiences, tactile impressions, feelings of pain and joy, motor skills, events, activities and so on.

Secondly, retrieval of information can be exactly in the same way or in a different form.

Third, the reception depends a lot on what information we already have.

Fourth, we neither receive nor retain all the information presented to us because there is great deal of selectivity in receiving the information.

Fifth, all tape recorders have some limit to record but human memory can retain extremely large amount of information. Finally, our memory system is an active system. It works on the information received. It may integrate, add, modify, omit or reorganize the information. It is not passive like a tape recorder which reproduces the information in its original form.

Memory is treated as a perceptually active mental system. It receives, encodes, modifies, retains and retrieves information.

*Encoding* refers to the translation of incoming stimulus into a unique neural code that a person's brain can process.

*Storage* is the retention of the material encoded over a period of time.

*Retrieval* is the recovery of the stored or retained information at a later occasion. These ideas can be seen in given Figure.

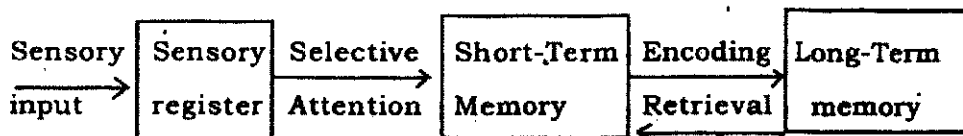


Figure - 1 : A General Model of Human Memory System.

We gather information through our senses. Each sensory modality has its own sensory register (or sensory memory). It holds information for a very short duration, then it passes the information for further processing.

**Sensory Memory** - Hold a picture in front of you and look at it steadily for a while. Now close your eyes and notice for how long can a clear image of that picture last. A clear usual image of any object will last in our sensory memory for about-1/2 a second, after the stimulus is no longer received. Sensory memory is the type of memory that occurs within the senses while it is being transmitted to the brain.

What we are able to memorize depends to a large extent on what happens to the information after sensory memory. We are continually bombarded by sensory stimulations of various kinds. As we can not respond to all of them it is important that we must selectively focus on those things which are significant. This kind of selectivity is possible on the basis of attention. The process of attention limits our input of information from the environment. Thus through selective attention information enters short-term memory. It holds information for few seconds. Then we encode the information and it goes to long-term memory. Long-term memory has very large capacity to retain information.

\* The human memory comprises of three interrelated sub-systems. They are

- Sensory memory
- Short term memory
- Long term memory

\* Sensory memory occurs within the senses while the information is being transmitted to the brain.

\* A clear image in our sensory memory will last for about  $\frac{1}{2}$  a second.

### Intext Questions 7.1

Chose the correct alternative :

1. Memory is thought to be made up of \_\_\_\_\_ stages.
  - a. One
  - b. two
  - c. three
  - d. four

2. If you were to trace information from the outside world into your memory system, which memory store would the information enter first.
    - a. short-term memory
    - b. sensory memory
    - c. long-term memory
    - d. permanent memory
  3. Approximately how long does it usually take for visual information in the sensory register to fade?
    - a. about a second
    - b. from several seconds to a minute
    - c. several minutes
    - d. generally an hour or more
  4. In the memory model, in order for information that has just been sensed to enter short-term memory, it must first be
    - a. attended to
    - b. stored
    - c. extensively processed
    - d. retrieved
- 

#### **7.4 Differences between short term memory and long term memory**

We have seen that human memory comprises of three interrelated subsystems namely sensory register, short-term memory (STM) and long-term memory (LTM). The sensory register as the name implies makes the environmental input or information available for a very short period consisting of milliseconds. The retention which forms the basis for the use of information in future is largely related to the systems of STM and LTM. Now let's find out what is STM and LTM ?

The nature and functioning of STM and LTM are different .The distinction may be made in terms of capacity, duration, type of information retained, and the causes of forgetting. These differences are given in Table - 1.

Sensory memory is the type of memory that occurs within the senses while it is being transmitted to the brain.

#### **Short-Term Memory**

While you are studying, look up for a moment and see around you ?

What are the thoughts that are occurring to you at this moment ?

---

Do you know what you have just done ? You have identified the contents of your short-term memory. Short-term memory can also be called as "working memory". For example (d) you look for a telephone number from the diary and after you finish talking, keep the diary back in your pocket for later use. Looking for and using the telephone number is an example of short term memory. You forget it again after dialling.

Short-term memory as the name implies stores memories for a short duration.

### Long Term Memory

Can you remember the name of your childhood friend ?

Have you ever thought that how can you remember things/events which happened with you a long time ago. It is possible because of Long-Term Memory. Unlike the sensory memory and short term memory, long-term memory is not limited in capacity or duration. Information in LTM can last as long as we live.

Long-Term Memory is a relatively permanent memory in which information is stored for use at a later time.

Characteristics	Short-term Memory	Long-term Memory
Capacity	Limited. up to 7 items or chunks	Unlimited
Duration	Usually up to 30 seconds but varies under different situations	May range from days to a life time
Type of information	Visual images, sounds, words, sentences	Meaningful verbal material life events,
Causes of forget-	Displacement of old information by new one	Interference, inadequate organization of material

**Table-1 Comparison of Short-Term Memory (STM) and Long-Term Memory (LTM)**

It is clear from Table - 1 that while short-term memory has limited capacity and exists for short durations, long-term memory has no known limit. People show large scale variation in memorizing stories and poems. The Vedas have been received from one generation to the other in an oral tradition. There are scholars who still retain and recite Vedas, epics and the life stories of Lord Rama and Krishna.

We also find that short-term memory has pieces of information which are simple and relatively less organized. In contrast, long-term memory consists of a broad range of information and experiences.

They are often meaningfully organized and refer to a wide spectrum of information ranging from concrete personal life events to abstract theoretical knowledge.

Finally, the causes of forgetting in these two memory systems are also different.

In short-term memory, forgetting takes place because of the entry of new information in the system. New information displaces the old information. This leads to forgetting of the old information.

In Long-Term memory various kinds of events, experiences and stimuli are retained. The forgetting is caused by numerous factors including interference from one information to other, lack of organization in the material retained and or unavailability of appropriate cues at the time of retrieval.

### **7.5 Factors Influencing Memory and Forgetting**

Memory is a very complex psychological process and any kind of mechanical analogy in terms of storage, processing and retrieval (e.g., tape recorder, computer) falls short. In this active process in which information are retained not only as it is but it may be subjected to construction and reconstruction depending on a variety of factors. Understanding these factors is helpful to clarify the nature of memory and making it more effective. Let us examine some of the important factors which have been found critical to retention.

- (i) **Decay of Memory Traces:** It is a common experience that memories of many events and experiences become "dim" over time, like the colours of a picture bleached by the sun. This notion was proposed by many early psychologists as a general explanation of forgetting. However, people remember many events of early childhood during old age without distortion. [Therefore decay can be considered as general cause of forgetting however, studies have shown that decay is an important factor in sensory memory and in STM when there is lack of rehearsal.]
  - (ii) **Interference:** Whatever we learn we learn in some context. Thus every experience of learning is preceded and followed by some other experience. These experiences are often interrelated and influence each other. When such influences are adverse we call them interference. When earlier learning influences present learning it is called proactive interference and when present experience influences previous learning then it is termed retroactive interference. It has been noted that greater the similarity between two sets of materials to be learned, the greater will be the degree of interference between them.
  - (iii) **Motivation :** According to Freud forgetting is caused by a motive of displeasure. We forget because we do not want to remember something. We may exclude memories or push them out of
-

consciousness. Freud called it repression. Its a common experience that we usually remember pleasant events more often than unpleasant ones. Also, we find a strong tendency to remember incomplete tasks more than completed tasks.

- (iv) **Retrieval Failure:** Recent studies have revealed that a lot of forgetting particularly in long-term memory, is due to absence or non-availability of retrieval cues at the time of recall. The changes in context associated with physical and mental states from the occasion of learning (encoding) to recall (retrieval) often result in poor retention scores. We often "blank out" during examinations.
- (v) **Reconstruction:** The meaning of forgetting in terms of failure to retrieve gives the idea that memory storage is static. This, however, is not the case. Memory and remembering in particular has been shown to be a constructive process. In fact rumours often show our tendency to highlight of certain details and assimilating some. It seems that recall is always a combination of retrieval and reconstruction.

## 7.6 Ways of Enhancing Memory

It is obvious that forgetting is usually a source of trouble for people. Everyday conversation, class room participation, examination, interview, presentation and communication in meetings often involve remembering information. Failure in doing so has negative consequences which all of us experience in different degrees in our lives. As a result most of us are interested in improving memory. The study of memory aids and related techniques is called *mnemonics*. Some of the techniques used in improving memory are listed below:

1. **Organization:** While preparing for learning a learner needs to pay attention to organize the material in some form. Such an organization may help by creating a natural context and provide relevant cues while retrieving the learned material. If the material lacks natural organization, an artificial organization may be created by the learner.
2. **Concentration:** One of the main reasons of forgetting is lack of proper allocation of attentional resources to the material while processing the same. As a result the material is not stored and we fail to recall when we need it. Thus by focusing attention on the material while processing we can increase the probability of storage and recall.
3. **Method of loci:** As the name implies this technique uses associations with place or task. The visualization of the same provides cues for recalling the task. By choosing any action properly one can use memory at any point in the day. Use of such mnemonic codes

allows one to have vivid and distinctive associations between new information and prior knowledge. Being related to context the cues become very effective. For instance one may have a clear visual image of a building, its rooms, furniture and other details. These may be linked to different ideas and using these linkages memory of those ideas can be enhanced.

**4. Recoding:** While dealing with non-meaningful material one may recode the items to be remembered in a more meaningful manner. Recoding may take many forms. For example people may use the first letters of all the items and make a sentence. This kind of narrative structure works as a cue. Acronyms (e.g. U.N.O., TV) are also used for this purpose in which all the first letters are used. Using elaboration one may add more information which makes the material distinctive. *Chunking* is a good example of recoding. If a large series of numbers is presented it becomes difficult to remember. The same, however, may be divided in two or three chunks in some meaningful way using ingenuity. Using elaborative coding one may put many items in a story form and recall the same easily.

---

### Intext Questions 7.2

---

Chooosen the correct alternative :

1. Under ordinary conditions, short-term memory seems to be able to hold \_\_\_\_\_ items at a time.
    - a. about 2
    - b. about 7
    - c. about 17
    - d. about 100
  2. Which of the following items is most likely to act as a single "chunk" of information in STM ?
    - a. 843348
    - b. CKNUH
    - c. I like you
    - d. Mohan, river, bag
  3. Radha and Nishi are studying together for a test. Radha's strategy is to read her book over and over. Nishi tries to link what she reads to other concepts she knows. What will be the likely result?
    - a. Radha will remember more
    - b. What Radha learns will stay with her for a longer period of time
    - c. Nishi will become confused
    - d. Nishi will remember better
-

- 
4. When you are reading a textbook, what technique will facilitate recall of the information?
    - a. asking yourself questions about the materials you read
    - b. having other people ask you questions
    - c. using your powers of concentration to focus on each word individually before moving on to the next
    - d. remaining relaxed and trying not to get too involved with the material
- 

### What you have Learnt

Human memory is a dynamic system. It helps us to retain information and make the same available for future use. We receive information through various sense modalities. The information is registered in the sensory memory and through selective attention it goes to short-term memory (STM). Then it is encoded and enters into the long-term memory. Sensory memory lasts for one second. The STM has limited capacity and lasts for few seconds or minutes. The LTM has unlimited capacity and persists for hours and months or even life time. The three sub-systems of memory differ in terms of capacity, duration and mechanisms of forgetting, interference, motivation, retrieval failure and reconstruction. Capacity for retention can be enhanced through organization, of material, concentration, using method of loci and recoding.

### Terminal Exercises

1. Describe the main types of human memory system.
2. What are the main properties of short-term memory ?
3. Enumerate the factors which cause forgetting.
4. Try some mnemonic devices and write your experiences.

### Answers to Intext Questions

- | 7.1  | 7.2  |
|------|------|
| 1. c | 1. b |
| 2. b | 2. c |
| 3. a | 3. d |
| 4. a | 4. a |

### Hints to Terminal Exercises

1. Consult section 7.3
  2. Consult section 7.4
  3. Consult section 7.5
  4. Consult section 7.6
-