

Chapter 4

Memory and Forgetting

Objectives of this Chapter

- On completing this chapter the students will be able to:
 - define memory in their words
 - identify the stages of memory
 - explain the processes at each stage of memory
 - list down factors affecting memory
 - identify the methods of saving memory and explain how to
save memory
 - define forgetting
 - enumerate and describe the causes of forgetting
 - explain the differences between memory and forgetting.

Introduction

- In chapter 4, we have seen what learning is and major learning theories about how learning occurs in human mind.
- In this chapter we consider factors that are strongly associated with learning.
- These are memory and forgetting

- Memory and forgetting are the two mental processes always occurring after learning a new piece of information.
- The major points focused in analyzing these two factors in this chapter include the:
 - meanings of the two terms,
 - stages of memory,
 - factors affecting memory, and
 - factors that cause forgetting.

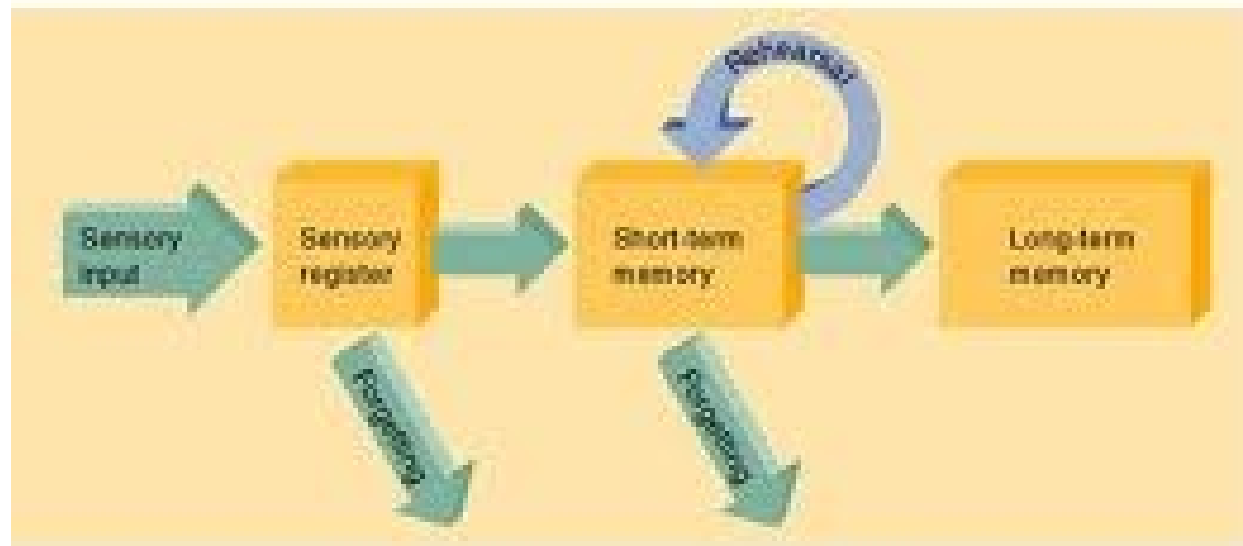
Memory: Information Processing Model

Definition

- Memory refers to the process of:
 - acquiring a new information (knowledge),
 - short retention in short term store,
 - rehearsing it by different ways,
 - retaining it over long period of time and,
 - retrieving the retained information in the form of recollection

Stages of Memory

- A number of models of memory have been proposed by different people.
- In this discussion, the model developed by Atkinson and Shiffrin (1968) is adopted



- ***The Sensory Register***
- Sensory register is associated with the sensory channels like vision, hearing, touch etc.
- In this compartment information can be held for a very brief time (several seconds at most)
- Most of the information in the sensory register is lost (decayed from the register).

- However, we pay attention to some of the information,
- when we do this the attended to information is passed on to the short-term store for further processing.
- Thus, the transfer of information from the sensory register to short term store depends on attention

- ***The Short Term Store***

- This is a separate store for short-term memory,
- It holds information received from sensory register for up to 30 seconds (on average).
- ***Its property:***
 - This store has a very limited storage capacity
 - That is, it stores only limited number of information items.
 - As the capacity of this memory stage is so small, much information is lost because it is displaced by newly incoming items of information.

- However, some of the information can be retrieved and used.
- But it is possible to increase the storage capacity by the process known as chunking.
- *Its contents:*
 - The information items in the short term store is usually said to consist of:
 - speech sound,
 - visual image, and
 - words;

But recently it was found that some meaningful sentences can also be stored.

Processes in the short-term store

- We rapidly scan through the store when we are searching for an item of information in the short-term store.
- We examine everything in the store when we try to retrieve an item from the store and hence it (scanning) is said to be exhaustive.
- The scanning does not stop when the searched for item is located.
- Finally some of the information is passed along to what is known as rehearsal buffer for further process

- **Rehearsal Buffer**
- Rehearsal buffer is a special part of the short term store where rehearsal takes place.
- Rehearsal refers to the process of focusing attention on an item of information

Types of Rehearsal

- ***Maintenance Rehearsal:***
Maintenance Rehearsal is a kind of rehearsal in which the information items in the short term store are simply repeated over and over
- ***Elaborative Rehearsal:*** Elaborative Rehearsal is the one that involves giving information in the rehearsal buffer organization and meanings as it is rehearsed.

- This kind of rehearsal seems to be more effective.
- Both type of rehearsal lead to the transfer of information to the long term store.
- **N.B.** - The amount of rehearsal given to items in the buffer is important in the transfer of information from short term to long term store.
 - the more items are rehearsed, the more likely it is to become part of the long term store.

The Long Term Store

- This is a store where processed information items are permanently stored
- **I Properties of Long Term Store**
- In contrast to short-term store, the long term store:
 - has the capacity to store a huge amount of information and has no known limit.
 - stores the information items for a long period of time (days, months, years, or a life time).
 - has no true forgetting.

- That is, once stored in the long term store no information is lost from it apart from mis-displacement of the information the situation in which we face difficulty in remembering a piece of information.

Contents of Long-term Store

- *The information items in the long-term store are mostly about the meaning of:*
 - *words,*
 - *ideas,*
 - *sentences,*
 - *concepts,**and*
 - *life experiences we have had (episodes).*

Process in the Long-term Store

A. Encoding and Storage of Information

- Encoding refers to processing incoming information so that it can be readily stored.
- The process of encoding and storage involves the following processes.

Organizing or Arranging

- In this process the incoming information is organized or arranged so that it:
 - fits into existing memory categories
 - is grouped in some logical manner or arranged in some other way that makes sense.
- Such organization can be inherent in the material itself or given to it by

Forming Images

- In this process, the incoming information item (material) is put in certain form that helps the learner remember the learned material easily.

Encoding Retrieval Cue (reminder)

- In this case the information that is to be remembered is associated (encoded) with retrieval cue (reminder) so that this cue helps the learner remember the material (information) to be remembered.

B. Organization of Information

- The information in the long-term memory is:
 - organized,
 - categorized, and
 - classified in the following way.

- ***Procedural memory***
- This involves remembering principle, rule, and steps to be followed to do something.
- ***Semantic memory***
- This consists of our knowledge of:
 - what words mean
 - how they are related to one another and
 - the rules for using them in thinking and communication.

- ***Episodic memory***
- Episodic memory consists of memories of specific things that have happened to us at particular time and place – our life experiences
- ***C. Retrieval from Long- term memory***
- Retrieval from Long- term memory is a two-stag process.

- In the first stage, a “reminder” or retrieval cue triggers the generation of a search through the categories of long-term memory.
- The second stage is the recognition of the searched for item of information when it is contacted

Factors Affecting Memory

Meaning Level of the Material

- The material with clearer meaning is easily encoded and better retained than which is less meaningful.

Effect of Organization

- A well-organized material (when the learners read, hear, or observe it) is better retained.
- In this case, the organization is said to be objective organization.

The Role of Constructive and Reconstructive Processes

A. Constructive process:

- is the process of encoding in a shortened and modified form.
- In this process, if there is no considerable care, there is a possibility of committing error in retaining the original material

B. Reconstructive Process:

- A modification of information during retrieval.
- Since the only main points and outlines of the material are stored, it is likely that the individual will add plausible guesses and retrieve little bit modified material.

- ***The Role of Retrieval Cues***

- Retrieval cues are the reminders of information stored in LTM.
- Effective memory is achieved when a reminder or a retrieval cue is attached together with the to be remembered material (information) so that when the need arises to retrieve/recall the material, the cue will remind the learner.

- This principle of attaching reminder along with the material is called *Encoding specific principle*
- Sometimes the condition under which the to remembered material is encoded can also be used as reminder (retrieval cue)
- The devices, which help us remember better or ways of improving memory are called *mnemonic devices*.
- One of these devices is *Acronyms*, which are subjectively organized initial of terms or sentences to help us remind of the information to be stored.

- One of the examples is the *NASA*, standing for *National Aeronautics and Space Administration*
- Another example is AIDS standing for **acquired immunodeficiency syndrome**

Transfer of Training

- refers to the carry over of experiences to the present learning situation.
- It can facilitate or hinder the learning.
- It may be positive or negative.
- ***Positive Transfer*** : is when previously learned material (experience) facilitates the memory of the newly learned knowledge or skill, by the virtue of their similarities.

- E.g. Principles of typing may facilitate the memory of the principles in computer training, or riding a bicycle facilitates the learning of riding a motor cycle.
- Generally information can easily be encoded when there is a positive transfer of training.

Negative Transfer: Occurs when previously learned knowledge or skill hinders the memory of the present knowledge or skill.

- **The Effect of Serial Position**

- If there are a set of items or a list of words, the items at the beginning and at the end have the chances of being retained as compared to the items in the middle.
- This leads to the concept of *primacy* and *recency effect*

Primacy effect:

- We remember the items at the beginning better than those in middle do because these items have the chance of joining the long term memory.

- ***Recency effect***
- This is almost certainly a result of the ability of subjects to “read out” items from short memory.
- Therefore, if recall is delayed, and particularly if some other task is interpolated between presentation of the item and recall, the recency effect will disappear (Zekaria).
- It is also possible to change the relation between the order of recall and the probability of recall by instructions.

- For example, for the subjects who are given a set of items and told to recall them as they occurred to them (i.e. with no special instruction), there is a tendency to recall more items from the end of the list i.e., the recency dominate
- But if the subjects knew before hand that they must recall in the order of presentation, then they tend to recall more items from the beginning of the list i.e. the *primacy effect* dominate.

Methods of Measuring Memory (Retention)

A. Saving Method

- *Saving Method* is the procedure in which we test the amount of memory of the material learned earlier by seeing **how many trial** or **how much time** it takes the subject to relearn the material at several times after the original learning.
- The amount saved can be given as:

A/ In terms of trials,

$$\text{Savings} = \frac{\text{Tr}_1 - \text{Tr}_2}{\text{Tr}_1} \times 100$$

whereas:

Tr_1 = Number of trials at the first
(original) learning

Tr_2 = Number of trials at the second
learning

B/ In terms of time

- Savings = $\frac{T_1 - T_2}{T_2} \times 100$

Whereas:

T_1 = Time taken to learn the material
originally

T_2 = Time taken to relearn the material
already
learned

- *Example:* It took a rat to learn a maze 30 trials (40 minutes). The animal was allowed to relearn the maze and it accomplished it in 15 trials (20 minutes). What is the amount of memory saved?
- Given: $Tr_1 = 30$ trials, $Tr_2 = 15$ trials,
 $T_1 = 40$ minutes, $T_2 = 20$ minutes

- Saving = $\frac{30 - 15}{30} \times 100 = 50\%$

- Savings = $\frac{40 - 20}{40} \times 100 = 50\%$

Recognition Method

- Recognition method is the procedure in which we see whether the subjects can pick out, or recognize, previously learned items when they are presented with incorrect items.

Recall Method

- This is other way of measuring memory by having the subjects (people) try to recall what they have learned.

Forgetting

- Forgetting refers the apparent loss of information that has already been stored in long term memory.
- According to this definition, the loss of information from short – term memory, as a result of poor rehearsal, doesn't indicate forgetting because it is lost before transferring to long term memory.

The causes of Forgetting

- Again the memorization of distorted and modified information due to construction and reconstruction does not show forgetting because we remember what is originally stored.

Information Decay

- According to Decay Theory:
 - memory decays with the simple passage of time.
 - the longer the time interval between learning information and being tested on it the worse the memory would be.
- However, this theory was proved inadequate by various research results.

- One of the evidences was observed from reminiscence, which is the recovery of information that could not be recalled on earlier test, but retained on the later one.

- **Interference**

- refers to the fact that the learning of new thing interferes with the memory of things learned earlier or the prior learning interferes with the memory of things learned later.
- The former type of interference is called *retroactive*, while the later type of interference is called *proactive*

- Laboratory experiment results indicate that recall is better after sleep than after certain activities of the mind.
- It is found that recall is better even after sleep with no dream than with dream.

How does interference occur?

- Learning of something worth remembering is due to association between stimulus and response. - During learning, S-R bond is established.
- This established bond will not be weakened by the passage of time.
- Rather many S-R associations interact with each other during which the bond is unlearned and the responses are replaced by competing responses.

- **Research Results on Retroactive and Proactive Interference**

- i. Research design on Retroactive Interference***

<u>Group</u>	<u>Task 1</u>	<u>Task 2</u>	<u>Measure of</u>
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	<u>retention of A</u>		
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Con.gr.	Learn A		
	of A		

		Rest Retention	
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Exp.gr	Learn A	Learn B	Retention
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- N.B. “A” is critical (dependent variable) here
- The difference between the two groups is due to the learning of task B (independent variable) which comes after the learning of A.
- If retroactive interference occurs the control group would better recall task A than the experimental group

ii. Proactive Research Design

Groups Task 1 Task 2 Measure of retention of B

- Cont. gr. Rest learn B Retention of B
- Exp gr. Learn A learn B Retention of B

- Here the difference between the two groups is due the learning task A which comes before learning of task B
- If proactive interference occurs the control group would better recall B than does the experimental group

Encoding of Incoming Information

Poor organization of the incoming information,

- inaccurate image of the information, and
poorly encoded retrieval cue result in inadequate encoding of information.
- This, in turn, impedes the recall of that specific information

Organization of the Encoded Information

- Inadequate categorization of the encoded information according their similarity leads to the failure to retention.
- This categorization is also influenced by effectiveness of encoding retrieval cues along with the to be remembered information.

Retrieval Problem

- Poor association between retrieval cue and to be remembered information,
- factor present at the time of attempted retrieval (e.g. inability of recall it later on),
- emotional factors such as repression in motivated forgetting, all play roles in retrieval failure (failure to locate and with draw the already stored information)

- This, in turn, underlies much forgetting
- In summary:
 - interference,
 - inadequate encoding,
 - poor organization and difficulties with retrieval lead to failure to remember
- result in forgetting