# UNIT 7 MEMORY

**Content**



## 7.0 INTRODUCTION


**Fig. 7.1: Memory can be tricky sometimes!**

***Source:*** https://robekworld.com

It is not just the story of Garfield only, you might also have experienced a similar situation. Memory is tricky because it has mysterious nature. Psychologists have also tried to uncover its mystery and investigated how it affects human behaviour. In this unit, we are going to discuss various aspects of memory such as its nature, types and, different models to understand its structure. We will further see why sometimes our memory betrays us and what are the different ways to reduce these memory failures.

## 7.1 OBJECTIVES

After studying this Unit, you will be able to:

- Explain the concept of memory and its nature;
- Discuss the different types of memory;
- Evaluate the various models of memory;
- Discuss the concept of forgetting and different theories explaining it;
- Identify various strategies for enhancing memory; and
- Describe the autobiographical memory, false memory, and flashbulb memory.

## 7.2 NATURE AND SCOPE OF MEMORY

What did you eat in dinner yesterday? What is the name of your best friend? Do you know how to drive a car or a cycle? How did you feel when you got the highest marks in your high school? The mental process you used to answer all of these questions is known as **memory**. It refers to the ability to retain information and reproducing it over a period of time when required to perform a cognitive task. It has been conceptualised as a process comprised of three stages; (i) encoding, (ii) storage, and (iii) retrieval. All information received by our senses goes through these stages.

i) **Encoding:** It is the process of converting sensory information into a form that can be processed further by the memory systems.

ii) **Storage:** In this second stage, received information from memory systems are stored so that it can be used at a later time also, and

iii) **Retrieval:** It refers to locating and bringing the stored material information to one's awareness when required to complete a task.

However, any issue or hindrance in the completion of any of these stages can lead to memory failure.

## 7.3 TYPES OF MEMORY

There is no single region in the brain responsible for memory, instead different parts of the brain are responsible for memories of different types. In this section, we will talk about the different types of memory.

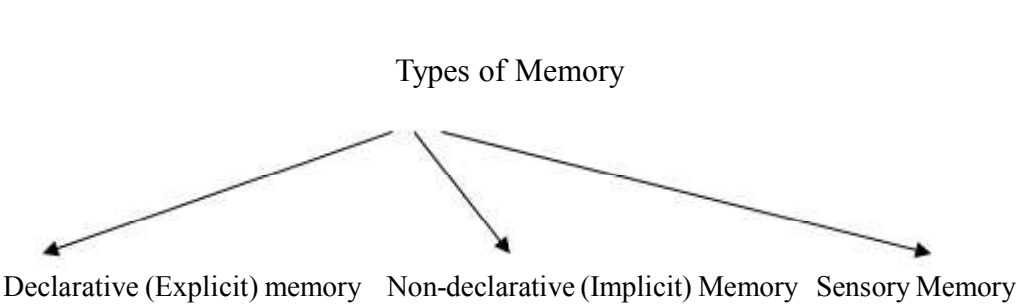


**Fig. 7.2: Diagram showing different types of memory**

### 7.3.1 Declarative or Explicit Memory

It refers to that memory system which can be controlled consciously and for which we are aware of in some form. It involves effort and intention, and it generally declines with the age. Recalling the name of a friend, remembering a contact number or ATM pin involves declarative memory. Following are its three subsystems:

1) *Working memory*

   It can be considered as a benchmark of consciousness. This system of memory is responsible for processing and storing of information needed for immediate use. Such as, remembering a phone number when dialling it on a landline, solving a mathematical problem involves working memory or listening to a speech.

2) *Semantic memory*

   The word semantic refers to meaning or logic. This subsystem of memory stores knowledge about the world, facts, concepts, logic, and meaning associated with the words or symbols.

3) *Episodic memory*

   The memory associated with our experiences or life events is called as episodic memory. It is used to recall past events, such as, how did you celebrate your last birthday? What did you eat at today's breakfast?

### 7.3.2 Non-declarative or Implicit Memory

That system of memory for which we pose no awareness. It works unconsciously and without any efforts and intentions. It is unaffected by aging. Following are its three forms:

1) *Priming*

   It is the process that works unconsciously and helps in speeding up the process of retrieving. This process suggests that memory can be activated unconsciously also.

2) *Conditioning*

   As already discussed in the previous unit, that this form of memory is responsible for learning an association between two stimuli.

3) *Motor/Procedural memory*

The process of learning a motor skill is slow but once it is well learned it becomes automatic in nature. That is, it does not need any further attention or conscious effort. Such as the motor process involved in walking does not need any conscious effort.

### 7.3.3 Sensory Memory

Sensory memory, which is also known as 'fleeting memory' sometimes, is closely related to the process of perception. It is responsible for keeping a record of our percept for a very brief period of time. It is important to note here that our sensory register works as a memory system. The information from the environment first reaches sensory memory and if required attention is given to the information, it moves to other memory systems. It can store information only for 200-500 milliseconds. Psychologists have argued that there is a visual sensory memory, an auditory sensory memory, an olfactory (smell) sensory memory, a gustatory (taste) sensory memory, and a tactile (touch) sensory memory. However, a bulk of literature is available on *iconic* sensory memory – the memory for visual inputs and *echoic* sensory memory – the memory for auditory inputs. George Sperling (1960) was credited for conducting classic experiments on sensory memory.

## 7.4 MODELS OF MEMORY

One can find several models of memory in literature. However, the following are the three most famous models to explain the process of memory that we are going to discuss:

### 7.4.1 The Traditional Model of Memory

Atkinson and Shiffrin (1968) proposed a model for memory, known as "Stage model of memory" or "Modal model". This model is greatly influenced by the working of the computer. If you ever had use computers, you must be aware of two types of memory used by it; RAM (Random Accesses Memory) and ROM (Read Only Memory) or memory available in the computer in the form of hard drive. RAM is the memory that you use while performing a task at hand whereas ROM is that part of memory where you can save all types of files as it has a vast storage capacity.

Atkinson and Shiffrin (1968) equated working of human memory to the working of computers. They proposed that similar to computers, we also possess different forms of memory systems, described as follows:

a) *Sensory memory*: In this, representation of sensory information is stored from a very brief period of time.

b) *STM (Short Term Memory)*: This system also holds information for a short duration of time. Studies have suggested that it can hold information for up to 30 seconds. Tasks such as dialling a phone number manually or writing in a dictation.

c) *LTM (Long Term Memory)*: It has been considered as a storehouse of all kinds of memories. You can remember things from last evening to since your childhood due to this system of memory.

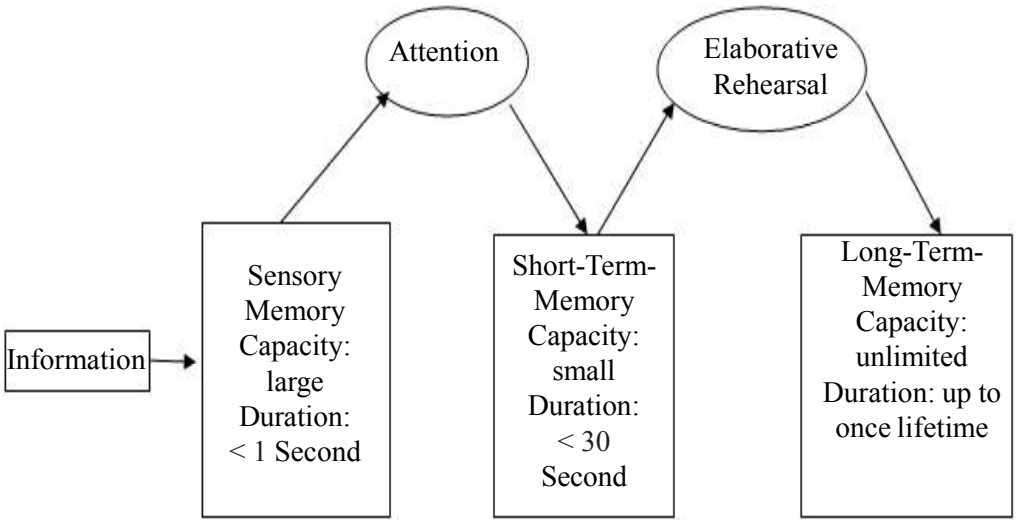


**Fig.7.3: Atkinson and Shiffrin (1968) model of memory**

How does information move from one memory system to another? According to Atkinson and Shiffrin, only that information which can grab our attention will move from sensory memory to STM. Whereas, information from STM can only be moved to LTM through *elaborative rehearsal*-thinking in terms of the meaning of the information and relating it to already existing information in LTM.

### 7.4.2 The Levels-of-Processing Model

This model refutes the claim of the Atkinson and Shiffrin model that memory consists of the different subsystem. According to the model of the levels of processing (LOP), whether the information will be retrieved successfully or not depends on its level of processing. LOP refers to the level at which information has been encoded.

Craik and Tulving (1975) have proposed three LOP:

a) Physical/Structural Processing: Encoding of information based on its physical attributes.

b) Phonological Processing: Encoding based on how it sounds. Such as, 'Hat' rhymes with 'Cat'

c) Semantic Processing: Encoding done based on its meaning and/or concept.

Studies on this model have suggested that deeper the level of processing, the higher will be its probability to be retrieved successfully.

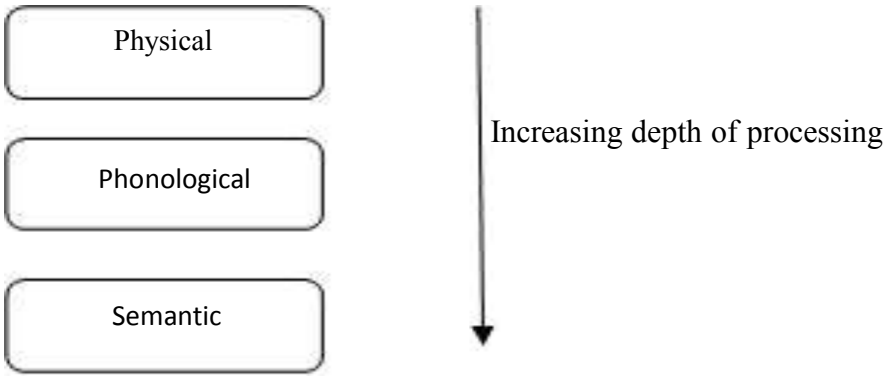


**Fig. 7.4:Level of Processing (Craik & Tulving, 1975)**

### 7.4.3 An Integrative Model: Working Memory

The concept of STM propounded by Atkinson and Shiffrin was very narrow. They considered STM only as a short-term memory storehouse but later studies disapproved it. Later studies suggested that STM is dynamic in nature i.e., it works not just as a storehouse of information but also responsible for manipulation of incoming information for the completion of a cognitive task. In 1974, Baddeley & Hitch, after incorporating the idea of the level of processing (LOP) proposed a new model for STM and termed it as working memory. Thus, working memory can be defined as "a limited-capacity system for temporary storage and manipulation of information for complex tasks such as comprehension, learning, and reasoning" (Goldstein book, pp. 131).

Baddeley's model of Working Memory (WM) consists of four components: the *central executive,* the *phonological loop,* the *visuospatial sketchpad,* and the *episodic buffer* (Figure 5).

- The **central executive**, as the name suggests it works as an executive in our working memory. It coordinates and regulates cognitive operation between sub-ordinate systems namely, phonological loop, visuospatial, and episodic buffer. It decides which of the memory will become part of long-term memory and which will fade away.
- The **phonological loop** is responsible for storing verbal and auditory information. The information stored in the phonological loop will decay within 2 seconds unless it is not rehearsed. It consists of two components: **phonological store**, which stores information for few seconds; and the **articulatory rehearsal process**, responsible for rehearsing the information in order to keep the information stored in phonological store from decaying. For instance, trying to remember a phone number, you have been just told by your friend, involves the phonological loop.
- The **visuospatial sketchpad** keeps visual and spatial information stored. For instance, the mental picture that comes up in your mind while listening to a story or solving a puzzle involves using your visuospatial sketchpad.

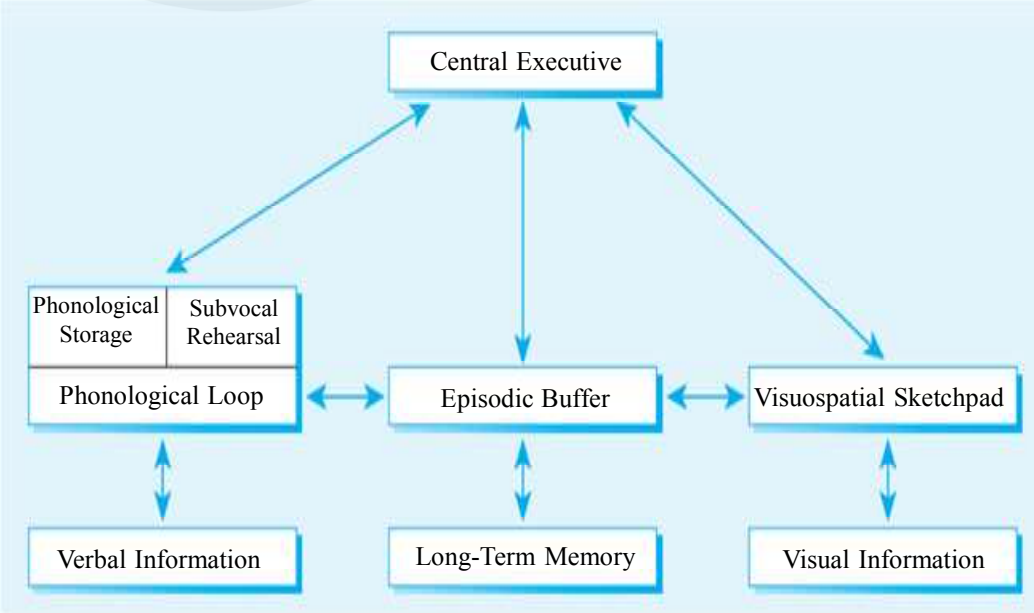


**Fig.7.5: Baddeley's Model of Working Memory**

**Source:** Sternberg (2012, pp. 204)

- The **episodic buffer** is responsible for combining information from the phonological loop, visuospatial, and long-term memory for generating a unitary episodic representation of information. Thus, this component helps us in making a sense of the received information.

**Self Assessment Questions (SAQ I)**

State whether the following are 'True' or 'False':

1) LTM (Long Term Memory) is considered as a storehouse of all kinds of memories. .....

2) The visuo spatial sketchpad is responsible for combining information from the phonological loop, visuospatial, and long-term memory for generating a unitary episodic representation of information. .....

3) Short term memory is also known as 'fleeting memory'. .....

4) Encoding is the process of converting sensory information into a form that can be processed further by the memory systems. .....

5) The memory associated with our experiences or life events is called as episodic memory. .....

## 7.5 CONCEPT AND THEORIES OF FORGETTING

Why do we tend to forget the names of the people we just met? Or why do we forget the phone number we just dialled a few minutes ago? We all have experienced forgetting in their day to day life, but what are the causes behind it? According to psychologists, forgetting is our inability to recall already encoded and stored information from our memory system.

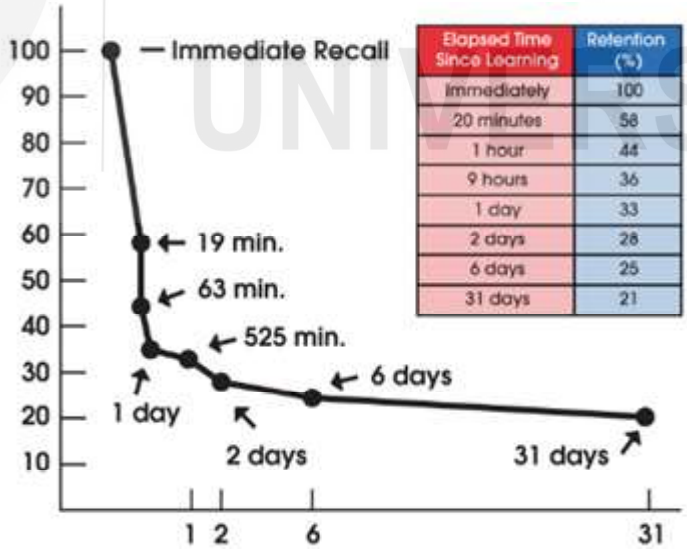


**Fig. 7.6: Ebbinghaus Forgetting Curve**
***Source:*** http://www.keyandparent.com

To understand the nature of forgetting, Hermann Ebbinghaus, a German psychologist, conducted the first systematic experiment in 1879. He created many CVC (constant vowel constant) nonsense syllabuses such as NAK or PUD and administered on himself. The method of conducting an experiment on oneself only and using your own experience is known as *the introspective method*. To

investigate the nature of memory and forgetting, first, he memorised lists of nonsense syllabus until he had reached pre-defined criteria and then measured the number of syllabi retained by him after a variable time interval. Further, he also noted the number of trials taken by him to relearn the same list of syllabus again at a variable time interval. Based on his observations, he came up with the following curve for explaining the nature of forgetting;

This curve is known as Ebbinghaus forgetting curve. You can see from the graph that the rate of forgetting is the maximum in the starting but after a few hours, it becomes slow. Recent studies have reported similar results.

There are basically following two classes of theories available in the literature explaining the causes of forgetting:

### 7.5.1 Theory of Interference

According to this theory, forgetting occurs due to interference with other memories. This interference can be of two types:

*Proactive Interference* (Pro=forward) - Forgetting of newly acquired information due to interference from previously learned information.

*Retroactive Interference* (Retro=backward) - Forgetting of previously stored information due to the learning of new information.

- ***Trace Decay Theory***

  Also known as disuse theory, trace decay theory proposes that learning causes change in the central nervous system leading to the formation of *memory traces*-physical change in the brain due to learning. When these memory traces are not used for a long time, they fade away leading to forgetting. Thus, the underlining mechanism of this theory is "use it or lose it", i.e., if you did not use your stored information at a regular interval of time then you may be at the risk of losing it.

- ***Cue-Dependent Forgetting Theory***

  According to this theory, forgetting can also occur due to the absence of an appropriate cue or presence of poor cue. Suppose you were given a list of objects to buy from the market. By mistake, you lost the list. Now, you are trying your best to recall all the items from the list, but there are good chances that you will forget many. Studies have suggested that if subjects were given a hint or clue about the category of those items, then it improved their recall. Studies have even suggested that the physical attributes of the environment also play positive role retrieval.

## 7.6 STRATEGIES FOR ENHANCING MEMORY

India's Shakuntala Devi, a child prodigy, had many world records on her name. She was a part of many psychological studies because of her incomparable abilities to solve mathematical problems within a few seconds. In 1977, at Southern Methodist University, she calculated the 23$^{rd}$ root of a 201-digit number in just 50 seconds. Interestingly, to verify her answer, a special computer program was written by US Bureau of Standards to perform such a difficult calculation (Jensen, 1990).


**Fig.7.7: Google doodle honouring Shakuntala Devi: The human calculator on her 84th birthday.**

***Source:*** https://www.google.com

All of us desire to have a memory like her but most of us suffer from some kind of memory failure. Having ability like Shakuntala Devi is very rare but we can definitely help you in improving your chances to memorise information effectively. In this section, we will discuss **mnemonics** (pronounced as ni-mo-nicks) - methods or techniques of enhancing memory. There are basically two broad categories of mnemonics; one category of mnemonics use images, while other uses principles of organization to memorise information.

### 7.6.1 Mnemonics Using Images

There are many strategies which use images to improve efficiency in retaining and retrieval of information. Following two types of mnemonics use images:

1) *Method of Loci: placing images at the location*

Loci (pronounced as low-sye), is the plural form of "Locus", which refers to position or place. This method uses the location of a familiar place as a cue to retrieve information. Now suppose, you want to learn a list of objects that you want to buy from a nearby grocery store. The lists contain items like egg, tomato, pen, washing powder and salt. Now to remember these items, first, visualise each of them to be located in some separate spatial location, such as, in different rooms of your house. Then, mentally go through your house visualising each item in a separate place. After reaching the market, all you need to do is to take another mental tour of your house and recall the items you have placed in the different location in a sequence.

2) *Keyword method*

The keyword method is considered appropriate for learning vocabulary and foreign language. In this method, any two pieces of information are linked using images. Now suppose, you want to extend your vocabulary for the English language. You come across a word "scowl" which stands for "an angry or bad-tempered expression". In order to learn its meaning first, you need to find a *keyword*- a familiar word that sounds similar to the *target word*- scowl. Now, using an image try to relate your target word to the keyword. Since the word 'scowl'

**Fig.7.8:An owl with an angry expression**
***Source:*** https://pixabay.com

sounds similar to owl; you can imagine a picture of an owl with an angry expression. Studies have suggested that this method of learning definition or vocabulary is far more superior than rote learning.

### 7.6.2 Mnemonics Using Organisation

It improves the ability to learn and retrieve information accurately by applying the principle of reorganization of the material to be learned. Under this section, we will discuss two types of mnemonics:

- *Chunking*

It is a method of combining smaller units into meaningful larger units, such as, if you were asked to remember the following series of number :

1-9-3-9-1-9-4-5

If you are well versed with world history, then, you can also group these numbers in the following ways;

1939-1945

Second World War started in 1939 and ended in 1945. In this way, you can memorise as well as recall these numbers more accurately. You can also chunk information by using it in sentences, songs or phrases.

- *First Letter Technique*

In this technique, the first letter of each word, you want to memorise, is taken to make a meaningful word or sentence. For example, the colour of the rainbow can be remembered using this technique.

**V**iolet

**I**ndigo

**B**lue

**G**reen

**Y**ellow

**O**range

**R**ed

The word VIBGYOR stands for all the seven colours of the rainbow.

## 7.7 APPLICATIONS OF MEMORY IN EVERYDAY LIFE

Till now we have discussed different models of memory, its characteristics, and reasons for forgetting information and methods to improve our memory. Now let us see, how psychologists have discussed our memory in the day to day life. We will discuss three topics to understand the role of memory in our daily routine: autobiographical memory, false memory, and flashbulb memory.

### 7.7.1 Autobiographical Memory: What has Happened in My Life

As the name suggests itself, it is the memory of your own past events or personal experiences. Our autobiographical memory (AM) is generally accurate but sometimes it is also influenced the constructive nature of memory. But, do we remember life events from all periods of life equally? Studies have suggested that people from middle age remember life events from their youth period and early-adult period more vividly than their recent past (Read & Connolly, 2007). Marigold Linton (1975, 1982) did a classic study on AM using Ebbinghaus method of introspection. She kept a diary for six periods, recording at least two events per day. She studied these recorded memories to understand the nature of AM.

**Fig.7.9: Our memories**

***Source:*** https://www.newscientist.com

### 7.7.2 False Memory

As the name suggests, it is the memory of an event that never happened. It can be defined as "a mental experience that is mistakenly taken to be a veridical representation of an event from one's personal past (International Encyclopedia of the Social & Behavioural Sciences, 2001). Also known as recovered memory or pseudo-memory, these memories are very vivid and emotionally charged. In a majority of the false memory cases, people were found to have a memory associated with the act of childhood sexual abuse or violence. Various studies have suggested that our memory is not fixed and it can be easily manipulated through effective suggestion, such as during a session of psychotherapy. False memory syndrome is very relevant in the context of psychotherapy and forensic witness. In a study, it was found that around 20% memory of the witnesses were false (Mazzoni, Scoboria, and Harvey, 2010).

### 7.7.3 Flashbulb Memory: Memories of Emotionally Charged Events

What were you doing, when you first heard about 9/11 attack? What was your first reaction? Many people still have very clear memories of the 9/11 attack. They could recall what they were doing when they first heard about it, from where they heard it, how they felt and other details vividly. So, what is so special about this memory? According to Roger Brown and James Kulik (1977), these memories are so vivid that it seems to be persevered as a film. In the context of

India, people old enough to recall the assassination of Prime Minister Indira Gandhi or Rajeev Gandhi may have flashbulb memories of these events.

**Fig. 7.10: 9/11 terrorist attack on world trade towers, USA**

**Source:** https://www.onthisday.com

What are the reasons for such vivid memories of an event? Studies have pointed out a number of factors like the emotional intensity of the event (Bohannon, 1988). Another view suggests that because of the significance we retell our experiences leading to frequent rehearsal and thus making those memories more accurate and vivid even after many years (Bohannon, 1988).

**Self Assessment Questions (SAQ-II)**

Fill in the following blanks:

1) .....refers to forgetting of newly acquired information due to interference from previously learned information.
2) .....is also known as recovered memory or pseudo-memory.
3) .....is a method of combining smaller units into meaningful larger units.
4) The .....is considered appropriate for learning vocabulary and foreign language.
5) .....is the method or technique of enhancing memory.

## 7.8 LET US SUM UP

In this unit, we discussed the nature of memory. Now we know that memory refers to the ability to retain information and reproducing it over a period of time when required to perform a cognitive task. We discussed different types and different models of memory. Further, we discussed why we sometimes fail to retrieve the required information, leading to memory failure. A number of theories explaining the cause of forgetting were also discussed. Lastly, the role of memory in our daily life was discussed in this unit.

## 7.9 UNIT END QUESTION

1) Write a note on the nature and types of memory.

2) What is the difference between short-term memory and working memory?

3) Briefly explain the Baddeley's theory of working memory.

4) What is forgetting? Explain the theory of interference in the context of forgetting.

5) Differentiate between autobiographical memory and false memory.

6) Write any three techniques to improve memory.

## 7.10 GLOSSARY

**Memory** : It refers to the ability to retain information and reproducing it over a period of time when required to perform a cognitive task.

**Explicit memory** : It refers to that memory system which can be controlled consciously and for which we are aware of in some form.

**Implicit memory** : The system of memory for which we pose no awareness. It works unconsciously and without any efforts and intentions.

**Forgetting** : It is our inability to recall already encoded and stored information from our memory system.

**Method of Loci** : It is a method of enhancing memory. It uses the location of a familiar place as a cue to retrieve information.

**Chunking** : It is another memory of remembering and recalling information correctly. In this method, smaller units of information are combined into meaningful larger units.

**Autobiographical memory:** It is the memory of your own past events or personal experiences

## 7.11 ANSWERS TO SELF ASSESSMENT QUESTIONS (SAQ II)

### SAQ-I

1) True

2) False

3) False

4) True

5) True

## SAQ-II

1) Proactive Interference
2) False memory
3) Chunking
4) keyword method
5) Mnemonics

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