## 1. Details of Module and its structure

| Module Detail | |
|---|---|
| Subject Name | Psychology |
| Course Name | Psychology 02 (Class XI, Part- 2) |
| Module Name/Title | Human Memory – Part 1 |
| Module Id | kepy_10701 |
| Pre-requisites | Basic knowledge of psychology, human development, bases of human behaviour and knowledge of learning |
| Objectives | After going through this lesson, the learners will be able to understand the following:<br>• Nature of human memory<br>• Information Processing Approach: The stage Model<br>• Memory System: Sensory<br>• Short term memories<br>• Long term memories<br>• Level of Processing<br>• Types of Long-term Memory<br>• Methods of memory measurement |
| Keywords | Chunking, Control process, Echoic memory, Encoding, Episodic memory, Elaborative rehearsal, Information processing approach, Maintenance rehearsals, Semantic memory and Working memory. |

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## 1. Introduction

All of us are curious about how memory plays a vital role in our lives.

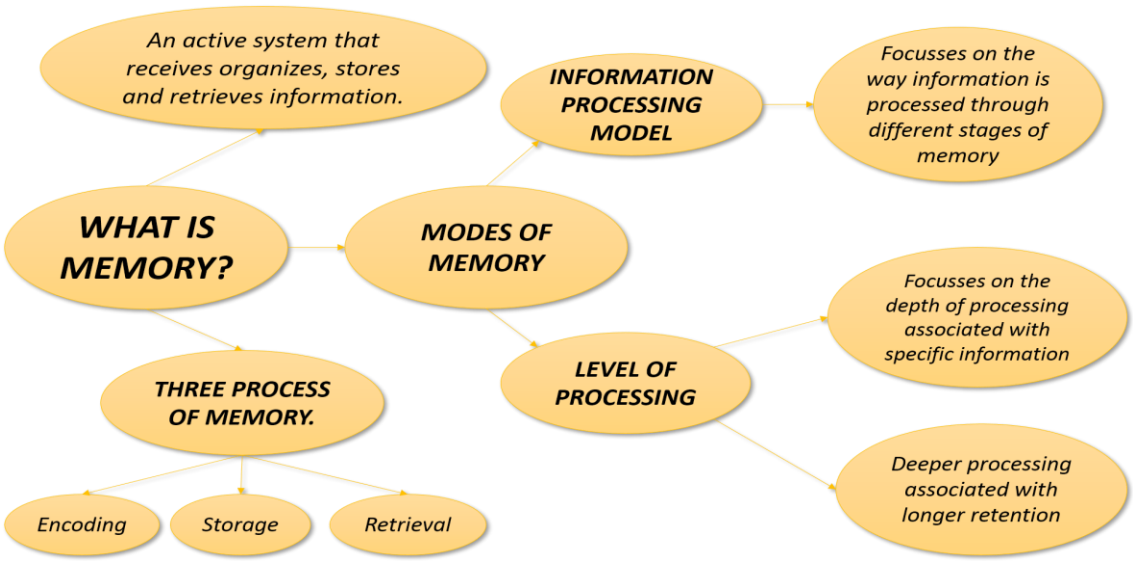
*Sometimes we are embarrassed because we can't remember the name of a known person.*

*suddenly in exam you forget everything you memorised last night and you become helpless?*

*sometimes we are excited about reciting flawlessly a poem of our child hood.*

- Memory indeed is a very fascinating yet intriguing human faculty.
- Memory helps to preserve our sense of our existence and helps in maintaining relationships and help in solving day to day problems and taking decision.
- Memory functions as central to all cognitive processes such as perception, thinking and problem solving. Psychologists have attempted to understand the manners in which any information is committed to memory.
- The first systematic exploration of memory is credited to Hermann Ebbinghaus, a German psychologist of late nineteenth century (1885). He carried out many experiments on himself and found that we do forget the learned material at an even pace or completely.
- Forgetting is faster initially and it stabilises eventually.
- Frederick Bartlett (1932) suggested another point of view about memory that it is not passive but an active process. He demonstrated memory as constructive process with the help of meaningful verbal materials such as stories and texts.

## 2. Nature of Human Memory




### Definition

Memory is retaining and recalling information over a period of time depending on the cognitive task to be performed. For example, we use our memory to retain an unfamiliar telephone number till we reached the telephone instrument to dial. Or we remember addition and subtraction techniques which we learned during our early schooling.

Memory is conceptualised consists of three independent interrelated stages:

- Encoding
- Storage
- Retrieval

### Encoding

This is the first stage which refers to a process by which information is recorded and registered for the first time so that it becomes usable by our memory system. Whenever an external stimulus impinges on our sensory organs, it generates neural impulses, which are received in different areas of the brain and meaning is derived.

### Storage

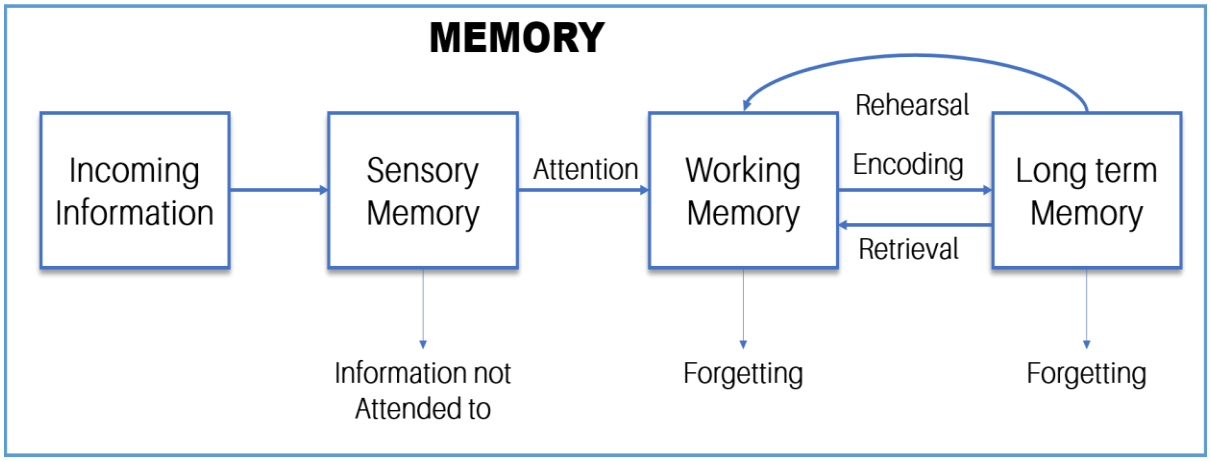
This is the stage in which the encoded information is retained and held over for a period of time. Encoded information must be stored so that it can be put to use later. Storage is the process through which information is retained and held over a period of time.

**Retrieval**

This refers to a stage of bringing the stored information to awareness so that it can be used for performing various cognitive tasks such as problem solving or decision making. It is very interesting to note that memory failure can occur at any of these stages. We may fail to recall an information because we didn't encode it properly, or the storage was weak so we could not access or retrieve it when required.

**Summary**

- Memory is seen as consisting of three processes of encoding, storage and retrieval.
- *Encoding* is registering the incoming information in a way, compatible to memory system.
- *Storage* and *retrieval* refer to holding the information over a period of time and bringing the information back to one's awareness.




## 3. Information Processing Approach

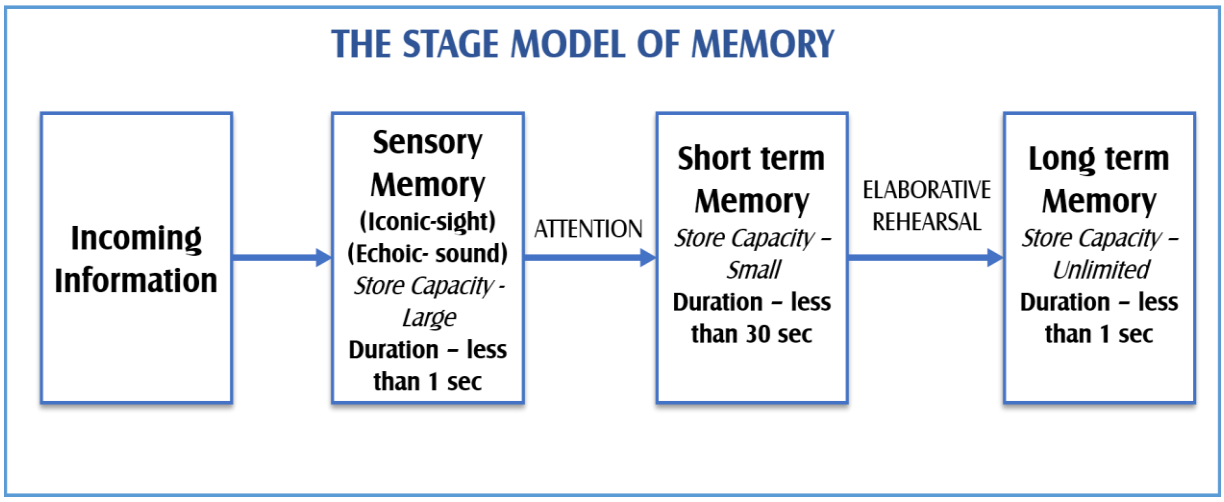
It is also known as the *stage model of memory*. This model was developed by Atkinson and Shiffrin in 1968 with the advent of computers where in the human memory was seen as a system that process information in the same way as a computer does. Both register, store, and manipulate large amount of information and act on the basis of the outcome of such manipulations.

***If we work on computer then we would know that it has a temporary memory (Random Access Memory or RAM) and a permanent memory (e.g., a hard disk*)**

For example: when we are required to solve a mathematical problem, the memory relating to mathematical operations, such as addition or subtraction is activated and put to use and receive

the output (the solution). This analogy led to the development of the first stage model of memory.

a) Sensory Memory
b) Short term Memory
c) Long term Memory




**(a) Sensory memory**

Sensory memory has large capacity but for short duration that is less than 1 sec. It registers information with each sense and its exact replica of the stimulus.

- Sensory memory may be iconic (i.e. visual) or Echoic (i.e. auditory)

  **Example:** The trail of light that stays after the bulb is switched off is an example of iconic sensory register. Similarly hearing reverberations of a sound when the sound has stopped, is an example of echoic sensory registers.

**(b) Short term Memory**

This is the second memory store.

- Only information that is attended to enters the second memory store is called the short-term memory (STM).
- It holds information for a brief period of time, usually 30 seconds or less.
- Information in STM if primarily stored acoustically and not rehearsed, is lost within 30 sec.
- STM is delicate but not as sensory registers where information is easily broken and decay automatically in less than a second.

### (c) Long term Memory

This is the permanent storehouse of all information that may be recent ordistant. (Wedding memory)

- Material that survive the capacity and duration limitations of STM finally enters LTM.
- Long Term Memory or (LTM) has a vast capacity.
- Information stored in long term memory is not forgotten because it is stored in terms of meaning that is semantically.
- When we experience as forgetting is due to retrieval failure.
- Retrieval failure is for various reasons; we cannot retrieve.
- We have always confused about how information travels from STM to LTM. And how information remains in one memory store.

Atkinson and Shiffrin propose the idea of **control processes** which monitor flow of information through various memory stores. In the stage model, the flow of information is monitored by four **control processes.**

1. Selective Attention
2. Maintenance Rehearsal
3. Elaborative Rehearsal.
4. Chunking

**Selective Attention**

- Selective Attention is the first control process that decides what information will travel from sensory register to short term memory.
- Only that information which is paid attention to, enters the STM from sensory registers. All other information fades away quickly.

**Maintenance Rehearsal**

- Maintenance rehearsal is a control process, which is set into motion by STM to retain information for as much time as required.
- This kind of information simply maintains information through silent or vocal repetitions and when such repetitions are discontinued, the information is lost.

**Elaborative Rehearsal**

In elaborative rehearsal information enters the LTM from the STM through elaborative rehearsals. This rehearsal attempts to connect the new information to existing information in LTM.

- For Example: Remembering the meaning of the word 'humanity ` will be much easier if the meaning of concept companion, truth and benevolence are already in place.
- The number of associations we can create around the new information will decide materials permanence in memory.

**Chunking**

This is a control process that operates STM to increase its capacity by breaking information in parts.

- Chunking helps to expand the capacity of STM which is otherwise 7±2.
  For example, if we have to remember a mobile number such as 999111786, we may create chunks as 999,111,786.
  Another example, if we have to remember a string of digits such as194719492004, we can create a chunk as 1947,1949, and 2004 and relate them as the year of independence, the year when the Indian constitution was adopted, and the year when tsunami hit the coastal regions of India and South East Asian countries.

**Summary**

- The stage model of memory compares memory process with working of a computer.
- Information is processed in through three distinct stages of sensory memory, short term memory, and long-term memory.
- Sensory memory is for short duration.
- Short term memory holds information for brief period, usually for less than 30 seconds.
- Long term memory it is permanent storehouse of all information.
- Control processes monitor flow of information through various memory stores. These four-control processes are selective attention, maintenance rehearsal, elaborative rehearsal and chunking.

**Components of Short-term Memory**

STM has many components. It not a passive store house but rather a work frame that holds a wide variety of memory materials that are constantly handled, manipulated and transformed as people perform various cognitive tasks. This bench of work is called *working memory*.

**Working Memory:** Baddeley (1986) proposed that STM is an active store house where lots of memory material is handled. Memory material are transformed for conducting cognitive tasks.

Components of working memory:

- Phonological loop
- Visuospatial sketch pad
- The Central Executive

**Phonological loop:** It holds for limited number of sounds and unless rehearsed they decay within two seconds.

- **Visuospatial sketchpad:** This is the second storehouse of working memory. It stores visual and spatial information and the phonological loop; the capacity of sketchpad is also limited.
- **The Central Executive:** This part organises information from the phonological loop the visual spatial sketchpad as well as from the LTM allocates attentional resources to be distributed to various information needed to perform a given cognitive operation and monitors, plans and control behaviour.

Shallice and Warrington in the year 1970 had cited the case of a man known asxyzzy who met an accident and damaged a portion of the left side of his cerebral hemisphere. Subsequently, it was found that his long-term Memory was intact but short-term memory was seriously affected. According to *Stage Model*, information is committed to the long-term memory via STM and if xyzzy's STM was affected, how can his long-term memory will work normally? All these queries led to development of another concept of memory which we will discuss in second model of memory

## 5. Level of Processing

The level of processing view of memory was proposed by Craik and Lock hart in 1972 as against Atkinson's boxes in the head scheme. This approach emphasizes that it is possible to analyse any incoming information at more than one level.

- A stimulus can be processed at deep level comprising abstract and semantic analysis or at shallow level involving sensory analyses.
- This view suggests that, the processing of any new information relates to the manner in which it is perceived, analysed and understood which in turn determines the extent to which it will eventually be retained.

- Analysing information in terms of its structural and phonetic features amounts to shallower processing level, while encoding it in terms of the meaning it carries (the semantic encoding) is the deepest processing level that leads to memory that resist forgetting.
- For example: At shallow level, visual configuration may be analysed as per physical or sensory features like lines and angles. At deeper level, the stimuli are matched with stored information example are letters of the word corresponding to the pattern identified as `A'.

  At the highest level the recognised pattern may trigger associations or images based on the persons past experiences with the word.

## 6. Types of Long- term Memory

- Short-term memory consists of more than one component (working memory).
- Similarly, the long-term memory too is not unitary.
- It contains wide variety of information.
- For contemporary formulations imagine LTM as it consists of various types.

### Declarative Memory

All information pertaining to facts, names and dates etc. are a part of declarative memory.

- For example, a rickshaw has three wheels or India gained in dependence on August 15,1947 or a frog is an amphibian or you and a celebrity share the same name.
- Declarative memory can be given with verbal descriptions.

### Procedural Memory

Procedural memory refers to memories relating to procedure for performing various task and skills such as how to ride a bicycle, how to make tea or how to play basketball.

- Procedural memory cannot be expressed readily verbally.
- When we learn a skill, we think about our working and describe our actions verbally. This is declarative knowledge. As we master the skill the declarative knowledge is replaced by procedural knowledge and we gradually became less able to describe precisely how we perform actions.

**Episodic Memory**

It contains biographical details or memories of certain experience of our lives and that why it is emotional in nature.

- It has an autobiographical reference.
- For example: How did you feel when you got gold medal in sports? how did you felt when your friend didn't fulfil his or her promise or seeing the ocean for the first time, enjoying parasailing etc.
- In this kind of memory, you are able to answer these questions with reasonable accuracy.
- Such experience is hard to forget, yet it is equally true that many events take place continuously in our lives and that we do not remember all them.
- There are many painful and unpleasant experiences which are not remembered in as much details as pleasant life experiences.

**Semantic Memory**

It is memory of general awareness, concepts, rules and abstract ideas.

- For example, meaning of Non-violence or remembering 2+6=8or the STD code of New Delhi is 011 or that the word, elephant, is misspelt.
- This kind of memory is not dated like episodic memory.
- This type of memory is less susceptible to forgetting.

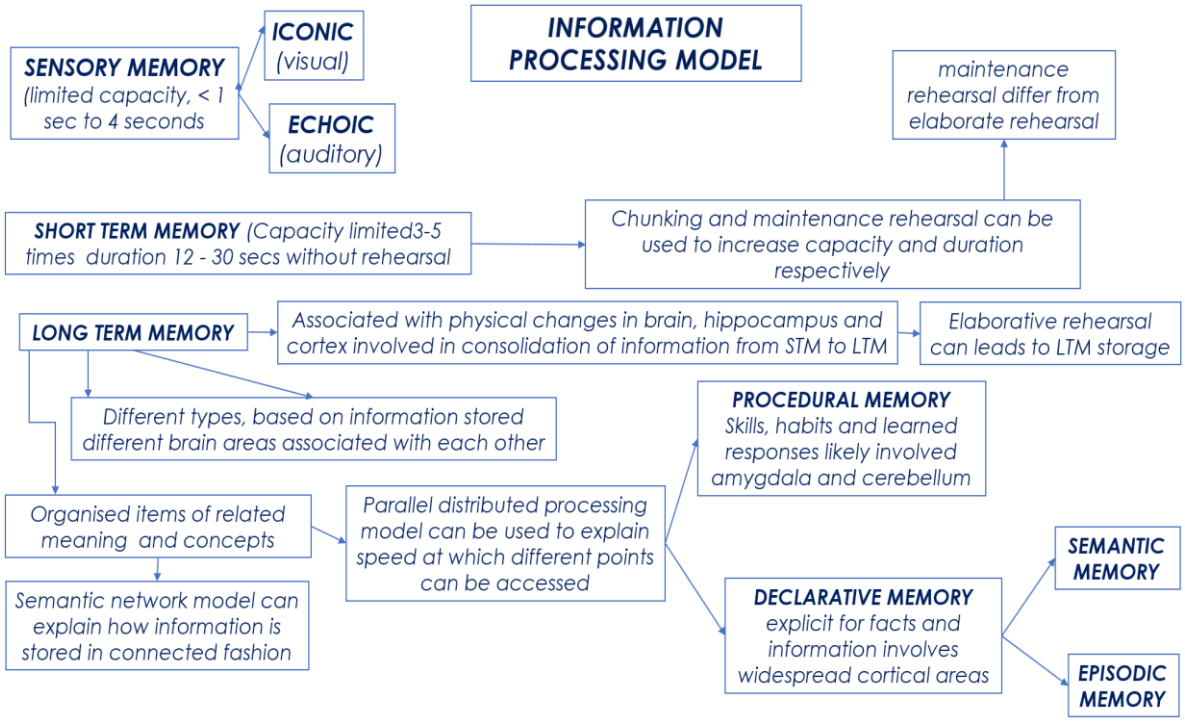
**Classification of LTM on the basis of complex and dynamic nature of memory:**

**Flashbulb Memories:** These are the memories of events that are very arousing or surprising.

- Such memories of events that are very detailed and tied to particular places, dates and times.
- They are like a photo taken with an advanced model camera.
- You can push the button, and after one minute you have recreation of the scene. Flashbulb memories are like images frozen in memory and to particular places, dates and times.
- It takes lots of effort for formation of these memories and highlighting its details might lead to deep levels of processing.
- It offers more cues for retrieval.

**Autobiographical Memory:** These are personal memories

- These are not evenly distributed throughout our lives. Some periods in our lives produces more memories than others.
- For example, no memories are reported pertaining to early childhood particularly during the first 4 to5 years. This is called **childhood amnesia.** There is a dramatic increase in the frequency of memories in the twenties due to emotionality, novelty and importance of events.




- Around 30 years of age, decline in certain kinds of memory starts.
- During old age, the most recent years of life are likely to be well remembered.

**Implicit Memory**

Implicit memory is a kind of memory that a person is not aware of. It is a memory that is retrieved automatically. The best example of implicit memory comes from the experience of typing. If someone knows the particular letters on keyboard. But many typists cannot correctly label blank keys in drawing of a keyboard. Implicit memories lie outside the boundaries of awareness. Sometimes we are not conscious of the fact that a memory of a given experience exists. Implicit memories do influence our behaviour. This kind of memory is found in patients of brain injuries.

**Activity:** Patients with brain injury where presented a list of common words. A few minutes later the patient was asked to recall words from the list. No memory was shown for the words Implicit memories are also observed in people with normal memories.

## 7. Methods of Memory Measurement

There are many ways in which memory is measured experimentally.

We have many kinds of memory; any one method is not appropriate for measuring one type of memory. There are few major methods of memory measurement.

1. Free Recall and Recognition
2. Sentence Verification Task
3. Priming

### (a) Free Recall and Recognition:(For measuring facts /episodes related memory)

- In free recall method, participants are presented with some words which they are asked to recall them in any order. The more they able to recall, the better their memories.
- In recognition, participants are presented with some words and their task is to recognise which one of those they had learnt. The greater the number of recognitions of old items; better is the memory.

### (b) Sentence Verification Task: (for measuring semantic memory)

- Semantic memory is not amenable to forgetting because it embodies general knowledge that we all possess.
- In sentence verification task the participants are asked to indicate whether the given sentences are true or false. Faster the participants respond, better retained is the information needed to verify those sentences.

### (c) Priming:(for measuring information, we cannot report verbally)

- We store many kinds of information that we can't report verbally. For instance, information necessary to ride a bicycle or play a sitar.
- Besides, we also store information that we are not aware of, which is described in implicit memory
- In priming method, participants are shown a list of words, such as garden. playground, house, etc. and then they are shown parts of these words like gar, pla, ho along with parts of other words they had not seen. When asked they are often unaware of this and report that they have only guessed.

**Summary**

- Short term memory has many components which is not passive and they are constantly manipulated and transformed as people perform various cognitive task. This is working memory.
- Level of processing view of memory contends that information can be encoded at three levels, namely the structural, the phonetic and the semantic.
- If the information is encoded semantically it is deepest level of processing, then it leads to better retention.
- Long term memory is classified in many ways. One major classification is declarative and procedural memory and another is that of episodic and semantic.

Classification based on dynamic and complex nature are flash bulb and autobiographical memory.