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 2
Module Id	kepy_10702
Pre-requisites	Basic knowledge of psychology, human development, bases of human behaviour and knowledge of learning
Objectives	Understanding of nature of memory, Information processing model level of processing, Types of Long-term memory and Method of measurement
Keywords	Cognitive economy, concepts dual coding, fugue state, memory making, Mnemonics.

2. Development Team

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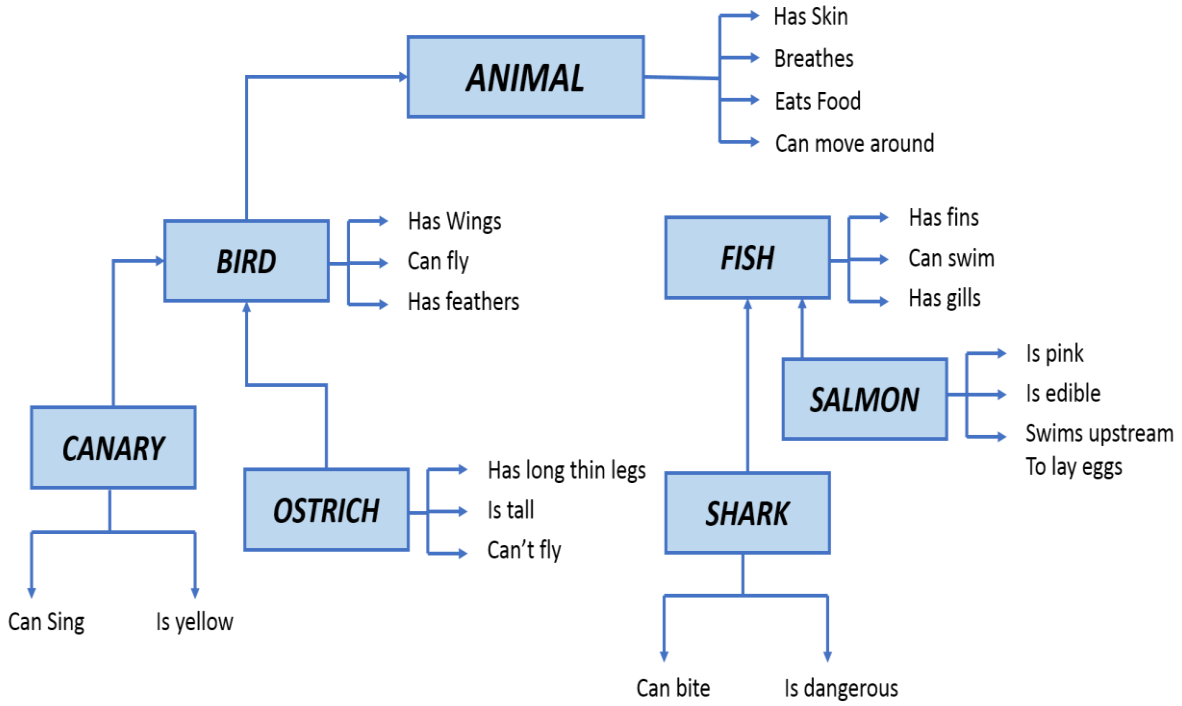
1. Knowledge Representation and Organisation in Memory

- The organisational structure of Long-term memory holds a very large amount of information which is put to use with amazing efficiency. In this way our memory system organises its contents so that the right information is available at right information is available at right moment.
- This was exactly the result of the 1969 study, leading the researchers to develop the semantic network model, which assumes that information is stored in the brain in a connected fashion with concepts that are related to each other stored physically closer to each other than concepts that are not highly related (Collins & Quillen)
- Long term memory is organized hierarchically and assumes a network structure. Elements of this structure are called nodes. Nodes are concepts while connections between nodes are labelled relationships which indicate category memberships or concept attributes.
- Unit of representation of knowledge long term memory is concept. **Concepts** are mental **categories** for objects and events, which are similar to each other in one or in more than one way. For example: the word mango is a category because different varieties of mango are a category because different varieties of mangoes can be subsumed with in it and it is also a concept with in the category of fruit. Concept may get organised in schema.
- **Schema** are mental frame work which represent our knowledge and assumption about the world. E.g. think of schema of drawing room.it will have different objects /things, like a sofa set, centre table, paintings, etc. which are found in the drawing room and where they are found in drawing room.
- This ensures higher degree of **cognitive economy** which means maximum and efficient use of the capacity of long-term memory with minimum redundancy.
- To verify the statement “a canary is a bird” requires moving to only one node, but “a canary is an animal” would require moving through two nodes and should take longer.



- Above figure is an **example of semantic network of memory.** Here, canary and ostrich are stored near the concept node for "bird," whereas shark and salmon are stored near "fish." But the fact that a canary is yellow is stored directly with that concept.
- In the Hierarchical Network model, we can store all knowledge at certain level that applies to all members of a category without having to repeat that information at the lower levels.
- In **dual coding hypothesis** Paivio proposed that an image is a concrete form of representation which directly conveys the perceptual attributes of an object. According to this view concrete nouns and information related to concrete objects are encoded and stored in the form of images while information related to abstract concepts assume verbal and a descriptive code. If you were to come across the word 'school', an image of your own school will get generated. In fact, almost all concrete objects (and concepts) generate images and the knowledge related to them is encoded both verbally as well as visually.
- Information which has been encoded and stored in the form of images leads to the development of ***mental model*** *which are recalled with greater ease.*
- For example, following a road direction, assembling a bicycle or even preparing to cook an exotic dish from instructions given in a cookery book require that spatial mental models are created with the help of concrete images as well as verbal descriptions.

Memory Making: Eyewitness and False Memories

Eyewitness Memory

Loftus and her colleagues during the mid-seventies showed that the eyewitness's memory is susceptible to many flaws.

- A film clipping of an event (usually a car accident) was shown to the participants. This was followed by some questions, which interferes with encoding of the event. One of the questions was "how fast were the cars going when they smashed into each other". In another question the verb smashed was replaced with the verb contacted. Those who were asked the first question (which included the word 'smashed') estimated the speed of the cars as 40.8 mph. Those who were given the second question (i.e. with the word 'contacted') estimated that the speed of the cars was only 31.8 mph. Clearly, the nature of leading questions changed the memory.
- In fact, the encoding of the event was 'overwritten' by misleading questions. Some of these errors are also committed because of affective nature of the event itself. For example, events depicting violence or a tragedy tend to arouse strong emotions, the eyewitnesses get overwhelmed and do not pay attention to details while encoding. What people see and hear about an event after the fact can easily affect the accuracy of their memories of that event.

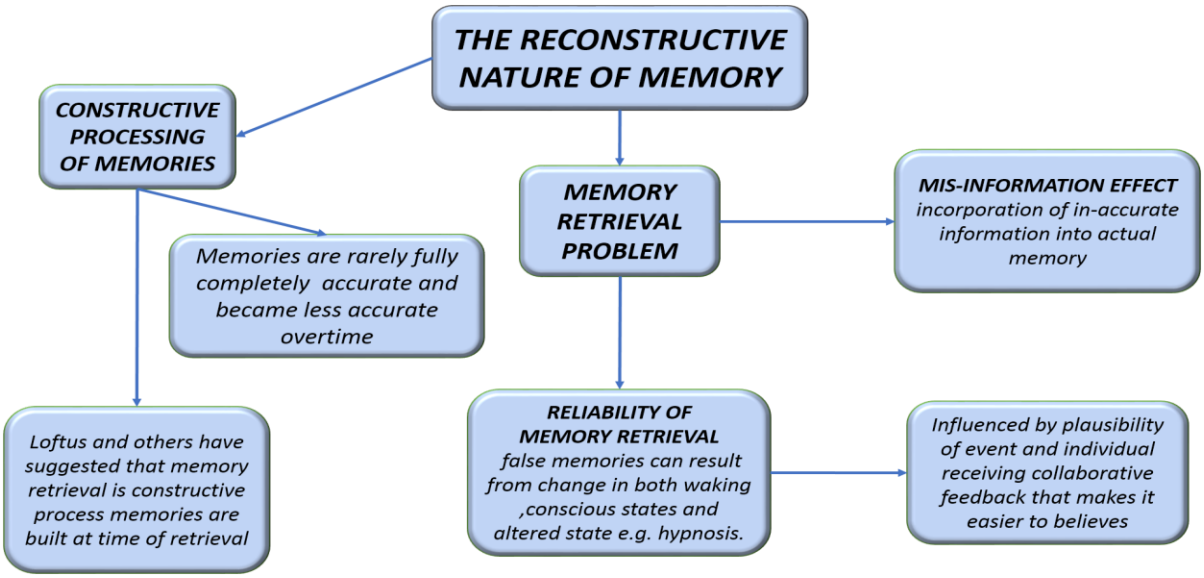
False Memory

- An interesting phenomenon called false memory can be induced by powerful imagination of events that did not take place at all. Garry, Manning and Loftus in 1996 carried out a study and understand the features of false memory.
- Findings suggest that memory can be induced and implanted through imagination inflation — a finding that provides useful insights into memory processes.

Summary

- Contents of Long-term memory get represented in terms of concepts, categories and images and are organised hierarchically.

2. Memory as a Constructive Process



- In the initial explorations about memory processes, we find that memory primarily consists of reproduction of stored materials.
- The memory was a passive occurrence of learnt material that has been stored in long-term storehouse.
- According to Bartlett in the early thirties who contended that memory is an active process and all material that we have stored undergoes continuous change and modification. What we memorise is influenced by the meaning we assign to the stimulus material and once it is committed to our memory system, it cannot remain insolation from other cognitive processes.
- Bartlett saw memory as a constructive and not a reproductive process. Using meaningful materials such as texts, folk talks, fables, etc.
- Bartlett attempted to understand the manner in which content of any specific memory gets affected by a person's knowledge, goals, motivation, preferences and various other psychological processes.
- Bartlett used the method of **serial reproduction** in which the participants of his experiments recalled the memory material repeatedly at varying time intervals. While engaging in serial reproduction of learned material his participants committed a wide variety of 'errors'
- Bartlett considered it useful in understanding the process of memory construction.
    - His participants altered the texts to make them more consistent with their knowledge,
    - glossed over the unnecessary details,
    - elaborated the main theme and
    - transformed the material to look more coherent and rational.

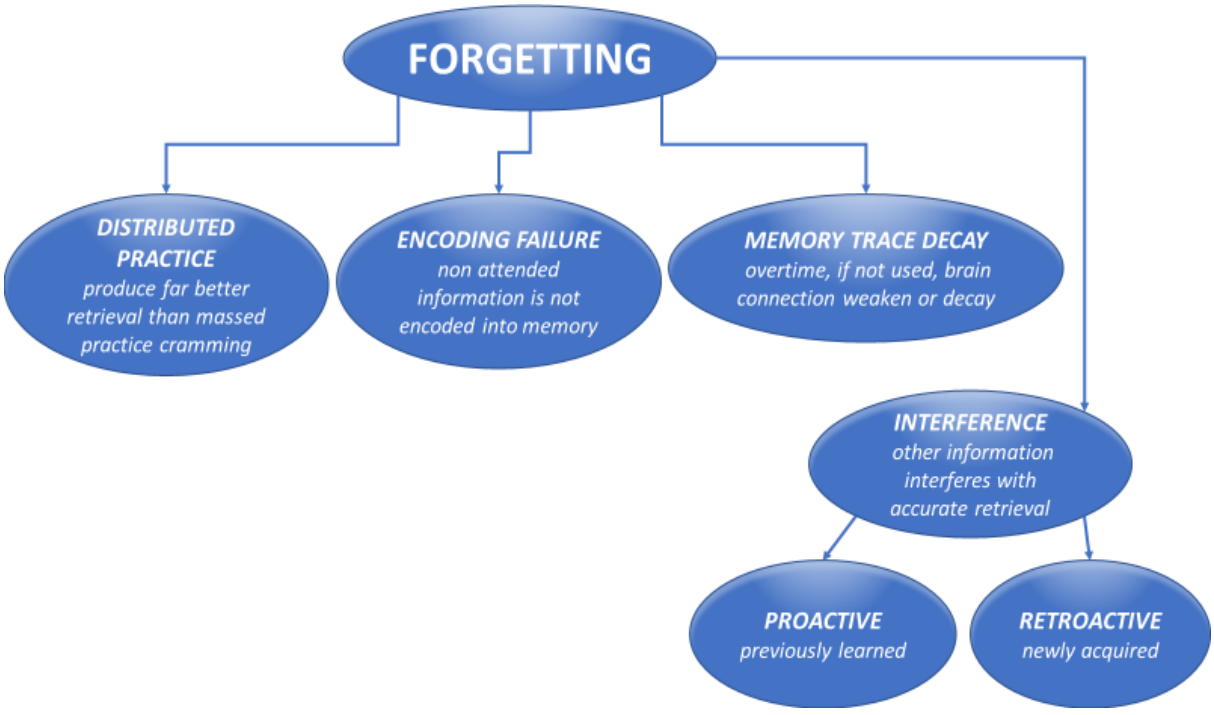
- According to Bartlett **Schema** was an active Organisation of past reactions and past experiences.
- Schema influence the way in which incoming information is interpreted, stored, and later retrieved.

Summary

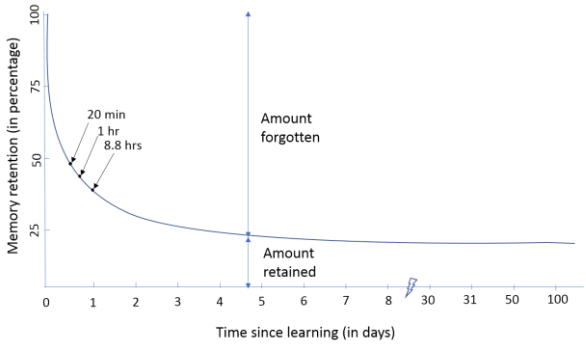
- Memory is not only reproductive but also a constructive process. What we store undergoes change and modification with in one's past knowledge and schema**.**

3. Nature and causes of forgetting

Why do we forget? Is it because we did not memories it well enough? Is it because we did not encode the information correctly or is it because during storage, it got distorted or misplaced? Many theories have been forwarded to explain forgetting and now we will read about those that seem plausible and have received considerable attention.



- The first systematic attempt to understand the nature of forgetting was made by Hermann **Ebbinghaus**, who memorized lists of nonsense syllables (CVC trigrams such as NOK or SEP etc.) and then measured the number of trials she took to relearn the same list at varying time intervals.
- He observed that the course of forgetting follows a certain pattern.
- **which you can see in Figure below. As the figure indicates,**



- 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.
- Ebbinghaus's said there is always a sharp drop in memory and thereafter the decline is very gradual.

Cause of Forgetting

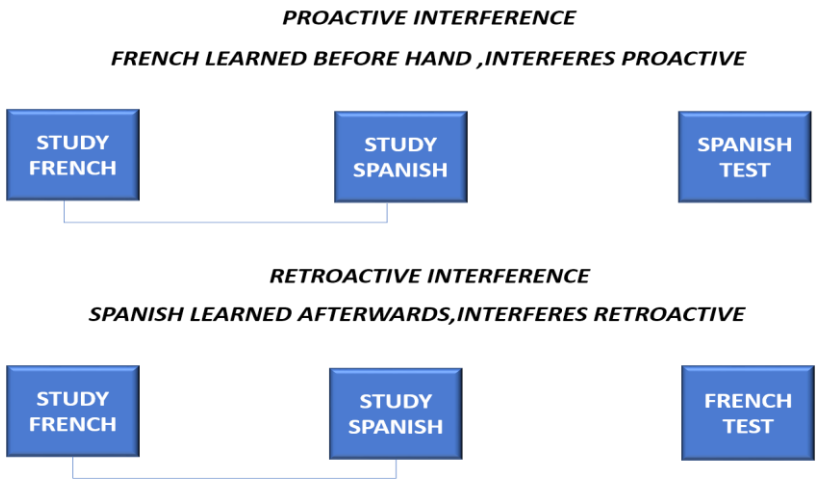
Forgetting due to Trace Decay or Disuse theory

- Trace decay (also called disuse theory) is the earliest theory of forgetting which assumes that memory leads to modification in the central nervous system, which is akin to physical changes in the brain called memory traces.
- When these memory traces are not used for a long time, they simply fade away and become unavailable.
- If forgetting takes place because memory traces decay due to disuse, then people who go to sleep after memorizing should forget more compared to those who remain awake, simply because there is no way in which memory traces can be put to use during sleep results, however, show just the opposite. Those who remain awake after memorizing (waking condition) show greater forgetting than those who sleep (sleeping condition).
- Because trace decay theory did not explain forgetting adequately, so another theory of forgetting replaced it; which suggested that new information that enters the long-term memory interferes with the recall of earlier memories and therefore, interference is the main cause of forgetting.

Forgetting due to Interference:

- Interference theory which suggests that forgetting is due to interference between various information's that the memory store contains.
- This theory assumes that learning and memorizing involve forming of associations between items and once acquired, these associations remain intact in the memory.

Interference can be Proactive or Retroactive



- People keep acquiring numerous such associations and each of these rest independently without any mutual conflict. However, interference comes about at a time of retrieval when these various sets of associations compete with each other for retrieval (Refer-Figure) If a student were to study for a French exam and then a Spanish exam, interference could occur in two directions. When taking the Spanish exam, the French information studied first may **proactively interfere** with the learning of the new Spanish information. But when taking the French exam, the more recently studied Spanish information may **retroactively interfere** with the retrieval of the French information.

Forgetting due to Retrieval Failure

- Forgetting can occur not only because the memory traces have decayed over time (according to disuse theory).
- Independent sets of stored associations compete at the time of recall (according to the interference theory) but also because at the time of recall, either the retrieval cues are absent or they are inappropriate.
- Retrieval cues are aids which help us in recovering information stored in the memory.
- Tulving and his associates who carried out several experiments to show that contents of memory may become inaccessible either due to absence or inappropriateness of retrieval cues that are available/employed at the time of recall

Repressed Memory:

- Some individuals undergo experiences that are traumatic. A traumatic experience emotionally hurts a person.

- **Sigmund Freud** concluded that such experiences are repressed into the unconscious and are not available for retrieval from memory. It is a kind of repression — painful, threatening, and embarrassing memories are held out of consciousness.
- In some persons, traumatic experiences may give rise to psychological amnesia. Some individuals experience crisis, and are utterly incapable of coping with such events. They close their eyes, ears and mind to such harsh realities of life, and take mental flight from them. It results in **highly generalized amnesia**.
- One of the results of such flights is the emergence of a disorder known as **'fugue state'**. Persons who become victims of such a state assume a new identity, name, address, etc. They have two personalities and one know-nothing about the other.
- Forgetfulness or loss of memory under stress and high anxiety is not uncommon. Many hardworking and ambitious students aspire for high scores in final examinations and to achieve such ends they put in long hours in studies. But when they receive the question paper, they become extremely nervous and forget everything they had prepared well.

Summary

- Forgetting refers to loss of stored information over a period of time. After a material is learnt,
  there is a sharp drop in its memory and then the decline is very gradual.
- Forgetting has been explained as resulting from trace decay and interference. It may also
  be caused due to absence of appropriate cues at the time of retrieval

4. Enhancing memory

All of us desire to possess an excellent memory system that is robust and dependable. Who, after all, likes to face situations of memory failures that lead to so much of anxiety and embarrassment?

After learning about various memory related processes, we certainly would like to know how our memory can be improved.

Mnemonics

- There are a number of strategies for improving memory called mnemonics (pronounced ni-mo-nicks) to help you improve your memory.

- Mnemonics involve use of images whereas others emphasize self-induced Organisation of learned information. Mnemonics using Images requires a creation of vivid and interacting images of and around the material we wish to remember.
- The two prominent mnemonic devices**,** which make interesting use of images, are the keyword method and the method of loci.

  (a) **The Keyword Method**: Suppose we want to learn words of any foreign language. In keyword method, an English word that sounds similar to the word of a foreign language is identified. This English word will function as the keyword. For example, if you want to remember the Spanish word for duck which is 'Pato', you may choose 'pot' as the keyword and then evoke images of keyword and the target word (the Spanish word you want to remember) and imagine them as interacting. You might, in this case, imagine a duck in a pot full of water. This method of learning words of a foreign language is much superior compared to any kind of rote memorization.

  (b) **The Method of Loci**: This method requires that we first visualize objects or places that we know well imagine in a specific sequence, imagine the objects we 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 mental walk along the route from your kitchen to the bathroom recalling all the items of your shopping list in a sequence.

Mnemonics using Organisation

Organisation refers to imposing certain order on the material we want to remember. Mnemonics of this kind are helpful because the framework you create while Organisation makes the retrieval task fairly easy.

- **Chunking:** In chunking, several smaller units are combined to form large chunks. For creating chunks, it is important to discover some Organisation 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.
- **First Letter Technique:** In this technique, the first letter of each word is picked and arranged them to form another word or sentence for example, colors of a rainbow are remembered in this way (VIBGYOR- that stands for Violet, Indigo, Blue, Green, Yellow, Orange and Red). Mnemonic strategies for memory enhancement are too simplistic and perhaps underestimate complexities of memory tasks and difficulties

people experience while memorizing. In place of mnemonics, a more comprehensive approach to memory improvement has been suggested by many psychologists. In such an approach, emphasis is laid on applying knowledge about memory processes to the task of memory improvement. Let us examine some of these suggestions.

It is suggested that one must engage in:

(a) **Engage in Deep Level Processing:** If you want to memories any information well, engage in deep level processing. Craik and Lockhart have demonstrated that processing information in terms of meaning that they convey leads to better memory as compared to attending to their surface features. In this way, the new information will become a part of your existing knowledge framework and the chances that it will be remembered are increased.

(b) **Minimize Interference:** Interference, is a major cause of forgetting. We know that maximum interference is caused when very similar materials are learned in a sequence. Avoid this. We can arrange our study in such a way that we should 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 our learning/practice. This means giving our self-intermittent rest periods while studying to minimize interference.

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Retrieval Cues

While learning something, identifying retrieval cues inherent to our study material. Identify them and link parts of the study material to these cues which will help us in enhancing memory. Cues are easier to remember compared to the entire content the links we have created between cues and the content will facilitate the retrieval process.

- 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 at the end, a note of caution must be sounded.

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

Summary

- Mnemonics are strategies for improving memory. While some mnemonics use images, other emphasize Organisation of the learnt material.