THEORIES : ATKINSON & SHIFFRIN'S INFORMATION PROCESSING THEORY

(LECTURE SERIES-5), B.A. IIND (HONORS)

(PAPER-IVTH SYSTEMS IN PSYCHOLOGY)

By
Dr. Masaud Ansari
Department of Psychology,
A.P.S.M. College, Barauni
L. N. M. University, Darbhanga

9th SEPTEMBER 2020

THEORIES OF COGNITIVE PSYCHOLOGY

There are three important cognitive theories. The three cognitive theories are:

1. Piaget's developmental theory (1936),
2. Lev Vygotsky's socio-cultural cognitive theory (1934), and
3. Atkinson and Shiffrin's information processing theory (1968)

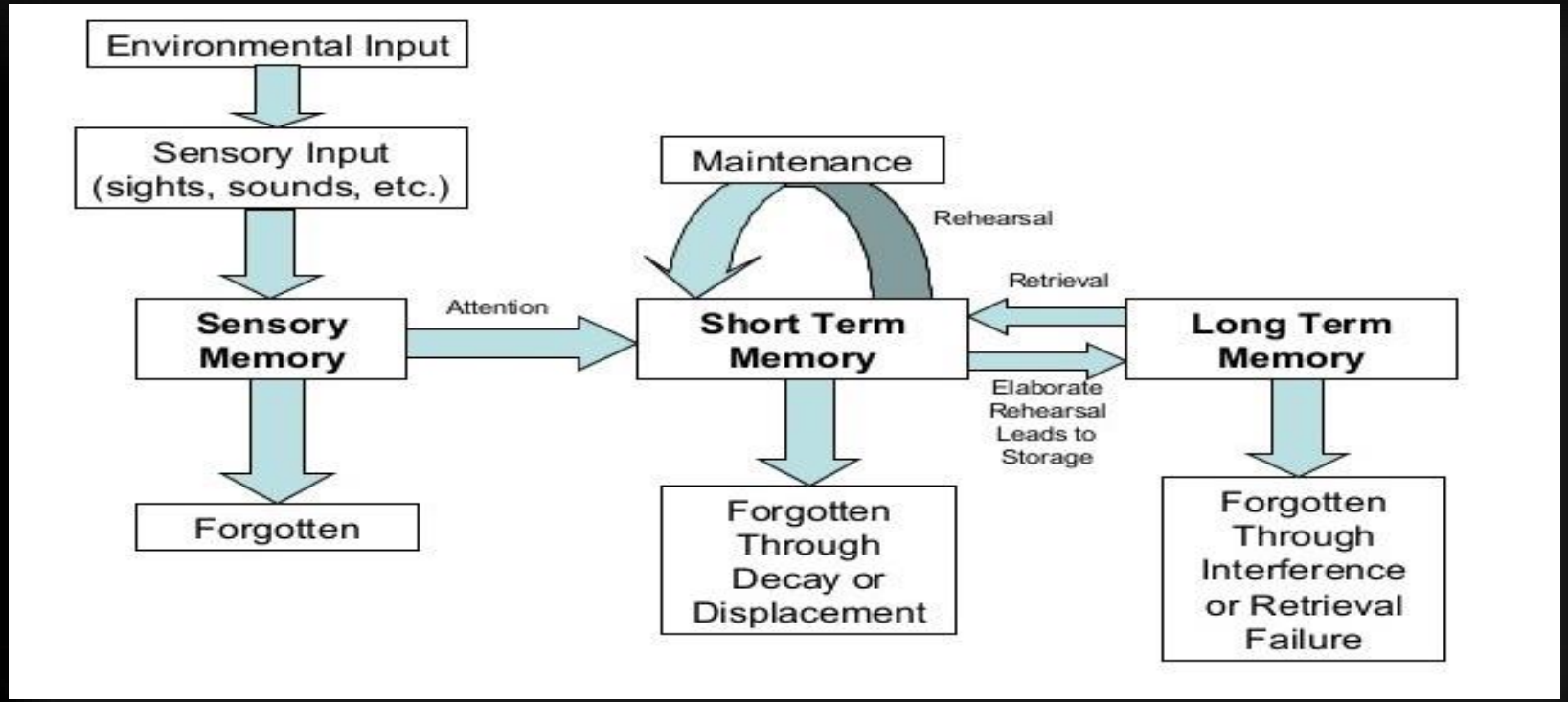
Here, we will discuss **Atkinson and Shiffrin's information processing theory** only.

3. ATKINSON AND SHIFFRIN'S INFORMATION PROCESS THEORY (1968)

The **Atkinson–Shiffrin model** (also known as the **multi-store model** or **modal model**) is a model of memory proposed in 1968 by Richard Atkinson and Richard Shiffrin. The model asserts that human memory has three separate components:

i. a *sensory register*, where sensory information enters memory,
ii. a *short-term store*, also called *working memory* or *short-term memory*, which receives and holds input from both the sensory register and the long-term store, and
iii. a *long-term store*, where information which has been rehearsed (explained below) in the short-term store is held indefinitely.

INFORMATION PROCESSING MODEL: ATKINSON & SHIFFRIN (1968)



I. SENSORY REGISTER

When an environmental stimulus is detected by the senses, it is briefly available in what Atkinson and Shiffrin called the *sensory registers* (also *sensory buffers* or *sensory memory*). Though this store is generally referred to as "the sensory register" or "sensory memory", it is actually composed of multiple registers, one for each sense. The sensory registers do not process the information carried by the stimulus, but rather detect and hold that information for use in short-term memory. For this reason Atkinson and Shiffrin also called the registers "buffers", as they prevent immense amounts of information from overwhelming higher-level cognitive processes. Information is only transferred to the short-term memory when attention is given to it, otherwise it decays rapidly and is forgotten.

A. INABILITY ICONIC MEMORY

Iconic memory, which is associated with the visual system, is perhaps the most researched of the sensory registers. The original evidence suggesting sensory stores which are separate to short-term and long-term memory was experimentally demonstrated for the visual system using a **Tachistoscope.**

Iconic memory is only limited to field of vision. That is, as long as a stimulus has entered the field of vision there is no limit to the amount of visual information iconic memory can hold at any one time. As noted above, sensory registers do not allow for further processing of information, and as such iconic memory only holds information for visual stimuli such as shape, size, color and location (but not semantic meaning). As the higher-level processes are limited in their capacities, not all information from sensory memory can be conveyed. It has been argued that the momentary mental freezing of visual input allows for the selection of specific aspects which should be passed on for further memory processing. The biggest limitation of iconic memory is the rapid decay of the information stored there; items in iconic memory decay after only 0.5–1.0 seconds.

B. ECHOIC MEMORY

Echoic memory, coined by Ulric Neisser, refers to information that is registered by the auditory system. As with iconic memory, echoic memory only holds superficial aspects of sound (e.g. pitch, tempo, or rhythm) and it has a nearly limitless capacity. Echoic memory is generally cited as having a duration of between 1.5 and 5 seconds depending on context but has been shown to last up to 20 seconds in the absence of competing information.

II. SHORT-TERM STORE

While much of the information in sensory memory decays and is forgotten, some is attended to. The information that is attended is transferred to the *short-term store* (also *short-term memory*, *working memory*; note that while these terms are often used interchangeably they were not originally intended to be used as such)

A. DURATION

As with sensory memory, the information that enters short-term memory decays and is lost, but the information in the short-term store has a longer duration, approximately 18–20 seconds when the information is not being actively rehearsed, though it is possible that this depends on modality and could be as long as 30 seconds. Fortunately, the information can be held in the short-term store for much longer through what Atkinson and Shiffrin called rehearsal. For auditory information rehearsal can be taken in a literal sense: continually repeating the items. However, the term can be applied for any information that is attended to, such as when a visual image is intentionally held in mind. Finally, information in the short-term store does not have to be of the same modality as its sensory input. For example, written text which enters visually can be held as auditory information, and likewise auditory input can be visualized. On this model, rehearsal of information allows for it to be stored more permanently in the long-term store. Atkinson and Shiffrin discussed this at length for auditory and visual information but did not give much attention to the rehearsal/storage of other modalities due to the experimental difficulties of studying those modalities.

B. CAPACITY

There is a limit to the amount of information that can be held in the short-term store: 7 ± 2 chunks. These chunks, which were noted by Miller in his seminal paper *The Magical Number Seven, Plus or Minus Two*, are defined as independent items of information. It is important to note that some chunks are perceived as one unit though they could be broken down into multiple items, for example "1066" can be either the series of four digits "1, 0, 6, 6" or the semantically grouped item "1066" which is the year the Battle of Hastings was fought. Chunking allows for large amounts of information to be held in memory: 149283141066 is twelve individual items, well outside the limit of the short-term store, but it can be grouped semantically into the 4 chunks "Columbus [1492] ate[8] pie[314→3.14→π] at the Battle of Hastings [1066]". Because short-term memory is limited in capacity, it severely limits the amount of information that can be attended to at any one time.

III. LONG-TERM STORE

The *long-term store* (also *long-term memory*) is a more or less permanent store. Information that is stored here can be "copied" and transferred to the short-term store where it can be attended to and manipulated.

A. TRANSFER FROM SHORT TERM STORE

Information is postulated to enter the long-term store from the short-term store more or less automatically. As Atkinson and Shiffrin model it, transfer from the short-term store to the long-term store is occurring for as long as the information is being attended to in the short-term store. In this way, varying amounts of attention result in varying amounts of time in short-term memory. Ostensibly, the longer an item is held in short-term memory, the stronger its memory trace will be in long-term memory. Atkinson and Shiffrin cite evidence for this transfer mechanism in studies by Hebb (1961) and Melton (1963) which show that repeated rote repetition enhances long-term memory. One may also think to the original Ebbinghaus memory experiments showing that forgetting increases for items which are studied fewer times. Finally, the authors note that there are stronger encoding processes than simple rote rehearsal, namely relating the new information to information which has already made its way into the long-term store.

B. CAPACITY AND DURATION

In this model, as with most models of memory, long-term memory is assumed to be nearly limitless in its duration and capacity. It is most often the case that brain structures begin to deteriorate and fail before any limit of learning is reached. This is not to assume that any item which is stored in long-term memory is accessible at any point in the lifetime. Rather, it is noted that the connections, cues, or associations to the memory deteriorate; the memory remains intact but unreachable.

CRITICISM OF INFORMATION PROCESSING MODEL/THEORY OF ATKINSON & SHIFFRIN

- **Sensory register as a separate store**

One of the early and central criticisms to the Atkinson-Shiffrin model was the inclusion of the sensory registers as part of memory. Specifically, the original model seemed to describe the sensory registers as both a structure and a control process. Parsimony would suggest that if the sensory registers are actually control processes, there is no need for a tri-partite system. Later revisions to the model addressed these claims and incorporated the sensory registers with the short-term store.

- **DIVISION AND NATURE OF WORKING MEMORY**

Baddeley and Hitch have in turn called to question the specific structure of the short-term store, proposing that it is subdivided into multiple components. While the different components were not specifically addressed in the original Atkinson-Shiffrin model, the authors do note that little research has been done investigating the different ways sensory modalities may be represented in the short-term store. Thus the model of working memory given by Baddeley and Hitch should be viewed as a refinement of the original model.

▪ REHEARSAL AS THE SOLE TRANSFER MECHANISM

The model has been further criticized as suggesting that rehearsal is the key process which initiates and facilitates transfer of information into LTM. There is very little evidence supporting this hypothesis, and long-term recall can in fact be better predicted by a levels-of-processing framework. In this framework, items which are encoded at a deeper, more semantic level are shown to have stronger traces in long-term memory. This criticism is somewhat unfounded as Atkinson and Shiffrin clearly state a difference between rehearsal and coding, where coding is akin to elaborative processes which levels-of-processing would call deep-processing. In this light, the levels-of-processing framework could be seen as more of an extension of the Atkinson-Shiffrin model rather than a refutation.

- **DIVISION OF LONG-TERM MEMORY**

In the case of long-term memory, it is unlikely that different types of information, such as the motor skills to ride a bike, memory for vocabulary, and memory for personal life events are stored in the same fashion. Endel Tulving notes the importance of encoding specificity in long-term memory. To clarify, there are definite differences in the way information is stored depending on whether it is episodic (memories of events), procedural (knowledge of how to do things), or semantic (general knowledge). A short (non-inclusive) example comes from the study of Henry Molaison (H.M.): learning a simple motor task (tracing a star pattern in a mirror), which involves implicit and procedural long-term storage, is unaffected by bilateral lesioning of the hippocampas regions while other forms of long-term memory, like vocabulary learning (semantic) and memories for events, are severely impaired.

See also:

https://en.wikipedia.org/wiki/Atkinson%E2%80%93Shiffrin_memory_model

https://en.wikipedia.org/wiki/Information_processing_theory

Thank You