Memory: The Essential Part of Organism

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Abstract:
In psychology, memory is the process by which information is encoded, stored, and retrieved. Encoding allows information that is from the outside world to reach our senses in the forms of chemical and physical stimuli. In this first stage we must change the information so that we may put the memory into the encoding process. Storage is the second memory stage or process. This entails that we maintain information over periods of time. Finally the third process is the retrieval of information that we have stored. We must locate it and return it to our consciousness. Some retrieval attempts may be effortless due to the type of information.

Life passes in moments of time where action happens. Something occurs and a response is triggered. An emotion is felt, a door is closed, a word is spoken. The face before you moves to communicate with you, or the car seems motionless as Earth itself passes by. Somewhere in your head, inside the piece of flesh that controls our personality – a stain is made. Something in life spilt and burned itself into a psychic world that you can't control. A transparent image that can be summoned or rise alone. Sounds, geography, scent; these pieces of now *act as a ritual to* then*. Like a séance for remembering, and that vision appears, and all the factors of reality can reassemble themselves like it was* just yesterday*. Time doesn't really go very far at all. You're not following a line with distance from beginning to now. You're a mass within a mass and every moment of time passing is just mass changing, rotating. The pictures flash, and we can be very thankful for that. That memory gives us a portal to something gone; something we can't get back. Thus, Memory is an Essential part of our life.*

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1. Introduction

Memory is something we deal with every moment of the day, even when it seems like we're not actively using it. Right now, I'm using my memory of the keyboard to type the words I'm writing. My brain focuses on the content, but while I'm doing that, I'm also remembering what keys to hit in order to make words appear on the screen in front of me. Of course, while I type, I'm not recalling how to type on a conscious level. It's a part of my implicit memory. Today I'm going to talk about memory recall and how you can use the two types of memory to help yourself stay organized.

Memory plays a big role in our life. It allows us to remember skills that we've learned, or retrieve information that is stored in the brain, or recall a precious moment that occurred in the

past. Memory also organizes information so that when we retrieve it, we can apply that information in the proper context and use it in the current activity we are involved in. In general, we use short term memory to recall information we've learned very recently. Long term memory is used to recall information that we've learned anytime in the recent past to childhood. In neuroscience, there are some fascinating studies about the types of memory we have access to as well as how memory contributes to the sense of self a person has. Here the author wants to introduce the components of Short-term Memory in this article.

2. Short-term Memory

Short-term Memory is the capacity for holding a small amount of information in mind in an active, readily available state for a short period of time. The duration of Short-term Memory (when rehearsal or active maintenance is prevented) is believed to be in the order of seconds. A commonly cited capacity is 7 ± 2 elements. In contrast, long-term memory indefinitely stores a seemingly unlimited amount of information.

Short-term Memory should be distinguished from working memory, which refers to structures and processes used for temporarily storing and manipulating information.

3. Subsistence of a Separate Store

The idea of the division of memory into short-term and long-term dates back to the 19th Century. A classical model of memory developed in the 1960s assumed that all memories pass from a short-term to a long-term store after a small period of time. This model is referred to as the "modal model" and has been most famously detailed by Shiffrin. The exact mechanisms, by which this transfer takes place, whether all or only some memories are retained permanently, and indeed the existence of a genuine distinction between the two stores, remain controversial topics among experts.

One form of evidence, cited in favor of the separate existence of a short-term store comes from anterograde amnesia, the inability to learn new facts and episodes. Patients with this form of amnesia, have intact ability to retain small amounts of information over short time scales (up to 30 seconds) but are dramatically impaired in their ability to form longer-term memories (a famous example is patient HM). This is interpreted as showing that the short-term store is spared from amnesia and other brain diseases.

Other evidence comes from experimental studies showing that some manipulations (e.g., a distractor task, such as repeatedly subtracting a single-digit number from a larger number following learning; cf Brown-Peterson procedure) impair memory for the 3 to 5 most recently learned words of a list (it is presumed, still held in Short-term Memory), while leaving recall for words from earlier in the list (it is presumed, stored in long-term memory) unaffected; other manipulations (e.g., semantic similarity of the words) affect only memory for earlier list words, but do not affect memory for the last few words in a list. These results show that different factors affect short-term recall (disruption of rehearsal) and long-term recall (semantic similarity). Together, these findings show that long-term memory and Short-term Memory can vary independently of each other. Not all researchers agree that short-term and long-term memory is separate systems. Some theorists propose that memory is unitary over all time scales, from milliseconds two years. Support for the unitary memory hypothesis comes from the fact that it

has been difficult to demarcate a clear boundary between short-term and long-term memory. For instance, Tarnow shows that the recall probability vs. latency curve is a straight line from 6 to 600 seconds (ten minutes), with the probability of failure to recall only saturating after 600 seconds. If there were really two different memory stores operating in this time frame, one could expect a discontinuity in this curve. Other research has shown that the detailed pattern of recall errors looks remarkably similar for recall of a list immediately after learning (it is presumed, from Short-term Memory) and recall after 24 hours (necessarily from long-term memory).

4. Review of Related Literature

Further evidence against the existence of a Short-term Memory store comes from experiments involving continual distractor tasks. In 1974, Robert Bjork and William B. Whitten presented subjects with word pairs to be remembered; however, before and after each word pair, subjects had to do a simple multiplication task for 12 seconds. After the final word-pair, subjects had to do the multiplication distractor task for 20 seconds. In their results, Bjork and Whitten found that the recency effect (the increased probability of recall of the last items studied) and the primacy effect (the increased probability of recall of the first few items) still remained. These results would seem inconsistent with the idea of Short-term Memory as the distractor items would have taken the place of some of the word-pairs in the buffer, thereby weakening the associated strength of the items in long-term memory. Bjork and Whitten hypothesized that these results could be attributed to the memory processes at work for long-term memory retrieval versus Short-term Memory retrieval. Here some review of related researches.

Ovid J.L. Tzeng (1973) also found an instance where the recency effect in free recall did not seem to result from the function of a Short-term Memory store. Subjects were presented with four study-test periods of 10 word lists, with a continual distractor task (20-second period of counting-backward). At the end of each list, participants had to free recall as many words from the list as possible. After free-recall of the fourth list, participants were asked to free recall items from all four lists. Both the initial free recall and the final free recall showed a recency effect. These results went against the predictions of a Short-term Memory model, where no recency effect would be expected in either initial or final free recall.

Koppenaal and Glanzer (1990) attempted to explain these phenomena as a result of the subjects' adaptation to the distractor task, which therefore allowed them to preserve at least some of the functions of the Short-term Memory store. As evidence, they provided the results of their experiment, in which the long-term recency effect disappeared when the distractor after the last item differed from the distractors that preceded and followed all the other items (e.g., arithmetic distractor task and word reading distractor task). Thapar and Greene challenged this theory. In one of their experiments, participants were given a different distractor task after every item to be studied. According to Koppenaal's and Glanzer's theory, there should be no recency effect as subjects would not have had time to adapt to the distractor; yet such a recency effect remained in place in the experiment.

One proposed explanation of the existence of the recency effect in a continual distractor condition, and the disappearance of it in an end-only distractor task is the influence of contextual and distinctive processes. According to this model, recency is a result of the final items' processing context being similar to the processing context of the other items and the distinctive

position of the final items versus items in the middle of the list. In the end distractor task, the processing context of the final items is no longer similar to the processing context of the other list items. At the same time, retrieval cues for these items are no longer as effective as without the distractor. Therefore, the recency effect recedes or vanishes. However, when distractor tasks are placed before and after each item, the recency effect returns, because all the list items once again have similar processing context.

4. Organic Foundation

4.1 Synaptic hypothesis of Short-term Memory

Various researchers have proposed that stimuli are coded in Short-term Memory using transmitter depletion. According to this hypothesis, a stimulus activates a spatial pattern of activity across neurons in a brain region. As these neurons fire, the available neurotransmitters in their store are depleted and this pattern of depletion is iconic, represents stimulus information and functions as a memory trace. The memory trace decays over time as a consequence of neurotransmitter reuptake mechanisms that restore neurotransmitters to the levels that existed prior to stimulus presentation.

5. Association with Working Memory

The relationship between Short-term Memory and working memory is described differently by various theories, but it is generally acknowledged that the two concepts are distinct. Working memory is a theoretical framework that refers to structures and processes used for temporarily storing and manipulating information. As such, working memory might also be referred to as *working attention*. Working memory and attention together play a major role in the processes of thinking. Short-term Memory in general refers, in a theory-neutral manner, to the short-term storage of information, and it does not entail the manipulation or organization of material held in memory. Thus, while there are Short-term Memory components to working memory models, the concept of Short-term Memory is distinct from these more hypothetical concepts. Within Baddeley's influential 1986 model of working memory there are two short-term storage mechanisms: the phonological loop and the visuospatial sketchpad. Most of the research referred to her involves the phonological loop, because most of the work done on Short-term Memory has used verbal material. In recent years, however, there has been a surge in research on visual Short-term Memory, and also increasing work on spatial Short-term Memory.

6. Duration of Short-term Memory

The limited duration of Short-term Memory quickly suggests that its contents spontaneously decay over time. The decay assumption is part of many theories of Short-term Memory, the most notable one being Baddeley's model of working memory. The decay assumption is usually paired with the idea of rapid covert rehearsal: In order to overcome the limitation of Short-term Memory, and retain information for longer, information must be periodically repeated or rehearsed either by articulating it out loud or by mentally simulating such articulation. In this way, the information will re-enter the short-term store and be retained for a further period.

Several researchers, however, dispute that spontaneous decay plays any significant role in forgetting over the short-term, and the evidence is far from conclusive. Authors doubting that decay causes forgetting from Short-term Memory often offer as an alternative some form of interference: When several elements (such as digits, words, or pictures) are held in Short-term

Memory simultaneously, their representations compete with each other for recall, or degrade each other. Thereby, new content gradually pushes out older content, unless the older content is actively protected against interference by rehearsal or by directing attention to it.

7. Capacity of Short-term Memory

Whatever the cause or causes of forgetting over the short-term may be, there is consensus that it severely limits the amount of new information that we can retain over brief periods of time. This limit is referred to as the finite capacity of Short-term Memory. The capacity of Short-term Memory is often called memory span, in reference to a common procedure of measuring it. In a memory span test, the experimenter presents lists of items (e.g. digits or words) of increasing length. An individual's span is determined as the longest list length that he or she can recall correctly in the given order on at least half of all trials.

In an early and highly influential article, The Magical Number Seven, Plus or Minus Two, the psychologist George Miller suggested that human Short-term Memory has a forward memory span of approximately seven items plus or minus two and that that was well known at the time (it seems to go back to the 19th-century researcher Wundt). More recent research has shown that this "magical number seven" is roughly accurate for college students recalling lists of digits, but memory span varies widely with populations tested and with material used. For example, the ability to recall words in order depends on a number of characteristics of these words: fewer words can be recalled when the words have longer spoken duration; this is known as the word-length effect, or when their speech sounds are similar to each other; this is called the phonological similarity effect. More words can be recalled when the words are highly familiar or occur frequently in the language. Recall performance is also better when all of the words in a list are taken from a single semantic category (such as games) than when the words are taken from same categories. According to the available evidence, the best overall estimate of Short-term Memory is about four pieces or "chunks" of information. In free recall it has been shown, to the contrary, that there is no such "quantized" limit, rather it is a function of memory decaying with time.

7.1 Rehearsal

Rehearsal is the process where information is kept in Short-term Memory by mentally repeating it. When the information is repeated each time, that information is re-entered into the Short-term Memory, thus keeping that information for another 15 to 20 seconds (the average storage time for Short-term Memory).

7.2 Chunking

Chunking is the process by which one can expand his/her ability to remember things in the short term. Chunking is also a process by which a person organizes material into meaningful groups. Although the average person may retain only about four different units in Short-term Memory, chunking can greatly increase a person's recall capacity. For example, in recalling a phone number, the person could chunk the digits into three groups: first, the area code (such as 123), then a three-digit chunk (456), and, last, a four-digit chunk (7890). This method of remembering phone numbers is far more effective than attempting to remember a string of 10 digits. Practice and the usage of existing information in long-term memory can lead to additional improvements in one's ability to use chunking. In one testing session, an American cross-country runner was

able to recall a string of 79 digits after hearing them only once by chunking them into different running times (e.g., the first four numbers were 1518, a three-mile time.)

7.3 Factors affecting Short-term Memory

It is very difficult to demonstrate the exact capacity of Short-term Memory (STM) because it will vary depending on the nature of the material to be recalled. There is currently no way of defining the basic unit of information to be stored in the STM store. It is also possible that STM is not the store described by Atkinson and Shiffrin. In that case, the task of defining the task of STM becomes even more difficult.

However, capacity of STM can be affected by the following: Influence of long-term memory, Reading aloud, Pronunciation time and Individual differences. Diseases that cause neurodegeneration, such as Alzhiemer's Disease can also be a factor in a person's short-term and eventually long-term memory. Damage to certain sections of the brain due to this disease causes shrinkage in the cerebral cortex which disables the ability to think and recall memories.

8. Conditions that may Impact Short-term Memory

Memory loss is a natural process in aging. One study investigated whether or not there were deficits in Short-term Memory in older adults. This was a previous study which compiled normative French data for three Short-term Memory tasks (Verbal, visual and spatial). They found impairments present in participants between the ages of 55 and 85 years of age.

8.1 Alzheimer's Disease

Memory distortion in Alzheimer's disease is a very common disorder found in older adults. Performance of patients with mild to moderate Alzheimer's disease was compared with the performance of age matched healthy adults. Researchers concluded the study with findings that showed reduced Short-term Memory recall for Alzheimer's patients. Episodic memory and semantic abilities deteriorate early in Alzheimer's disease. Since the cognitive system includes interconnected and reciprocally influenced neuronal networks, one study hypothesized that stimulation of lexical-semantic abilities may benefit semantically structured episodic memory. They found that with Lexical-Semantic stimulation treatment may improve episodic memory in Alzheimer's disease patients. It could also be regarded as a clinical option to counteract the cognitive decline typical of the disease

8.2 Aphasia

Aphasia's are also seen in many elder adults. Aphasias are responsible for many sentence comprehension deficits. Many language-impaired patients make several complaints about Short-term Memory deficits. Several family members confirming that patients have trouble recalling previously known names and events. The opinion is supported by many studies showing that many aphasics also have trouble with visual-memory required tasks.

8.3 Schizophrenia

Core symptoms of Schizophrenia patients have been linked to cognitive deficits. One neglected factor that contributes to those deficits is the comprehension of time. In this study, results confirm that cognitive dysfunctions are a major deficit in patients with schizophrenia. The study provided evidence that patients with schizophrenia process temporal information inefficiently.

8.4 Higher Age

Higher age is associated with decrements in episodic memory. The associative deficit is in which age differences in recognition memory reflect difficulty in binding components of a memory episode and bound units. A previous study used mixed and blocked test designs to examine deficits in Short-term Memory of older adults and found there was an associative deficit for older adults. This study along with many other previous studies, continue to build evidence of deficits found in older adults Short-term Memory.
Even when neurological diseases and disorders are not present, there is a progressive and gradual loss of some intellectual functions that become evident in later years. There are several tests used to examine the psychophysical characteristics of the elderly and of them, a well suitable test would be the functional reach (FR) test, and the mini–mental state examination (MMSE). The FR test is an index of the aptitude to maintain balance in an upright position and the MMSE test is a global index of cognitive abilities. These tests were both used by to evaluate the psychophysical characteristics of older adults. They found a loss of physical performance (FR, related to height) as well as a loss of cognitive abilities (MMSE).

8.5 Posttraumatic Stress Disorder

Posttraumatic stress disorder (PTSD) is associated with altered processing of emotional material with a strong attentional bias toward trauma-related information and interferes with cognitive processing. Aside from trauma processing specificities, a wide range of cognitive impairments have been related to PTSD state with predominant attention and verbal memory deficits.

8.6 Short-term Memory and Intelligence

There have been few studies done on the relationship between Short-term Memory and intelligence in PTSD. However, examined whether people with PTSD had equivalent levels of short-term, non-verbal memory on the Benton Visual Retention Test (BVRT), and whether they had equivalent levels of intelligence on the Raven standard Progressive Matrices (RSPM). They found that people with PTSD had worse short-term, non-verbal memory on the BVRT, despite having comparable levels of intelligence on the RSPM, concluding impairments in memory influence intelligence assessments in the subjects.

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