

# Analysis on Factors of Forgetting and Three Ways for Effective Memory

XinYi Zeng<sup>1\*</sup>

<sup>1</sup>Yali High School, Changsha 410007

**Abstract.** Psychologists often attribute the term 'memory' to the retention of information like knowledge or experience. This paper focuses on the reason why not only older people but also the younger generation have been reported that they often forget about certain things that happened before or not happened yet. This paper includes the methods of comparing several data from different studies and citing many conclusions in other studies. This paper presents current knowledge about how and why people usually forget. The conclusion I draw from this whole process of writing is that the factors such as the aging, stress and emotion, encoding failure, storage failure, and the retrieval failure can influence differently on the retain of the memory. But, still, we have some solutions to do our utmost in reducing their effects.

## 1 Introduction

Human minds are mysterious because the information we put into our minds may not be consciously reported as we remember them, but the information itself may influence us in many different ways. In order to understand why we forget about things, it's crucial to learn about how we remember things. Remembering often be divided into three levels of information processing, including the shallow level of processing, immediate level of processing, and deep level of processing. After understanding how we remember things, we can then talk about why we forget things. Since forgetting to exert the negative impact on both the people themselves and others around them, five factors are mentioned to be expected as the approaches to solve the difficulties that have mentioned above. In this paper, in order to resolve the huge degree of serious influences of forgetting, I compare two contradictory voices in a single item to analyze the accuracy of a single factor. It is clear that older people tend to have more deficits in remembering items than the younger generation. For example, in the recent laboratory research study, and the results of which reveal that younger people successfully recalled more collecting works of the building on a map than the older people did [1]. Not only ages are one of the factors that have an influence on why forgetting takes place, but the relationship between stress and performances also is the indicator, and so do the three stages of failure including encoding failure, storage failure, and retrieval failure. This paper also provided several solutions about how to achieve effectiveness in the process of memorization.

## 2 Information processing in the correlations of the memory retaining

Remembering can generally refer to memory encoding. To be more specific, information that has been first exposed to you is the physical structures of stimuli, and this is the shallow level of information processing. The second stage of information processing is intermediate processing which is giving the label to the things that have been recognized. The last stage of information processing is the deep level. The deepest level of processing involves the meaning and symbolic characteristics of the items. For better memorization, the deeper the processing it must achieve. This happens when people are remembering the words, for example, when people are encoding the word "on". First, people may notice the shape of the word "on", and it includes one vault and one circle. This Iconic memory, which is one small branch of the sensory memory, can only retain for about one-quarter of a second. To successfully encode the word "on", people have to process it deep down into the intermediate level. In this level, people will recognize the words with the shape like this is the word "on". Because making an association can help us encode better[2], the deepest level of information processing is necessary. At this level, it entails individuals to think carefully about the meaning behind the items. When people see the words "on", they may form a clear image of their personal stuff placing on a small desk. They may imagine themselves sleeping on their own bed, and their positions indicate the meaning of the word "on". To held longer in the short-term or long-term memory, individuals must combine the information they remember with certain meanings.

\* Corresponding author Email: 1315376428@qq.com

### 3 Five factors positively effect the effectiveness of memory storage

#### 3.1 The symptoms of certain diseases and the deteriorate of the brain owing to aging associate with the memory loss

Brain's aging deters a bunch of cognitive activity, including the dwindling speed of receiving and processing information from the external environment. The reduction of the working memory capacity is crucial in the use of discourse processing [3], which is combining the meaning of the words and the relationships between the novel stimuli with the existing

information. Furthermore, there has been suggested that the affection of Alzheimer Disease, continuously memory loss, has positively related to the increasing age [4]. Although there has been some evidence which rejected the view that Alzheimer Disease is diagnosed by pathological tests which are regardless of the age effects. The pathological characteristic of Alzheimer's disease is the presence of plaques and the disappearance of cholinergic neurons in the brain [5]. Why aging people becoming more and more common with the diagnosis of Alzheimer Disease? In this study, the aluminum concentration might show some positive correlation with the Alzheimer Disease, but it doesn't mean high aluminum cause people to learn.

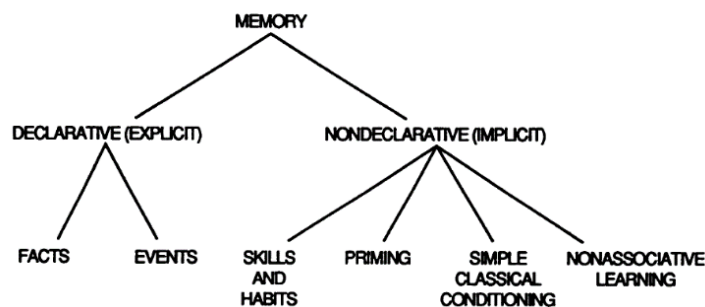


Fig.1. The category of memory

Memory is divided into two parts, one part is declarative memory, which is explicit memory, required people to voluntarily recall the information including facts and events, and the information can orally converse [9]. The other part is nondeclarative memory, implicit memory, in which people's behavior will be affected by their prior experience when they are not consciously recollecting the information.

#### 3.2 Yerkes-Dodson Law correlates with hippocampus and the level of stress and its impact on cognitive performances

The hippocampus, target of stress hormones, is an especially malleable and vulnerable regions of the human brain [10]. Hippocampus that combined with the medial

temporal lobe plays important role in memory formation [11]. If stress hormones attack the hippocampus area, memory formation may be affected. Also, memory for the intense or stressful mostly emotional situation is strong. For example, the flashbulb memory is the memory type that contains the emotionally significant things that people will often recollect information more accurately and more vividly than other things that are not emotionally impressive to people themselves. Yerkes-Dodson Law, which emphasizes the performance is better under the influence of moderate arousal rather than either lower or higher arousal. Because when people are in either a lower or higher arousal state, they cannot perform as well as when they are in a moderate arousal state.

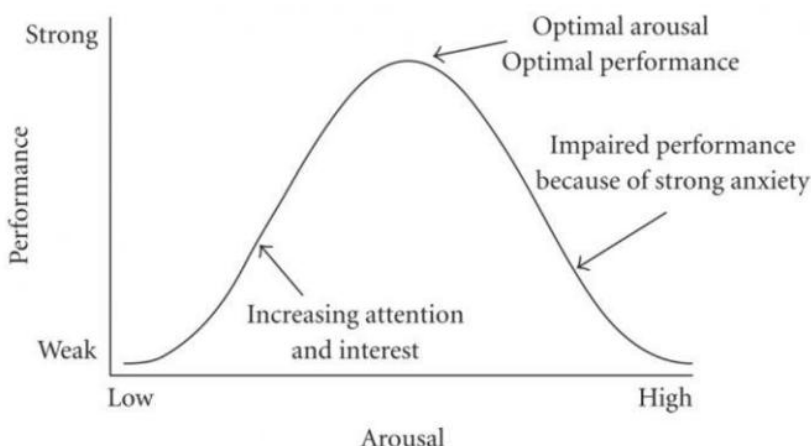


Fig. 2. Yerkes-Dodson Law

When people are in the optimal arousal, which is at the middle of the X-axis, their performance is better than when they are in the state of increasing attention and interest and the one with a significant amount of anxiety. If people are remembering some important stuff, it's crucial for them to be in a moderate level of the aroused state. Because the appropriate amount of stress can help them remember things better.

### **3.3 Encoding failure and its consequences including memory loss**

Sometimes we realize that we did not remember the things we are supposed to remember which is just because we didn't encode the information in the first place. And that's where the encoding failure takes place, which is the hippocampal amnesia results from deficits in actually remembering the information [12]. Encoding efforts were divided into two levels: incidental and intentional [13]. In other words, incidental levels are a high level of encoding efforts, the other is the intentional levels of encoding efforts, which is a low level of encoding efforts. Selective attention may be responsible for encoding failure. Selective attention happens around many communicative situations, a couple of sources of the acoustic information are simultaneously detectable for the sensory processing especially auditorily [14]. For example, at a certain cocktail party, people may wish to listen to some certain people's fascinating anecdote while ignoring the noise made by the speaker on stage and other conversations sound in the background. While those people are being asked what did the speaker talk about on stage, for example, they may claim that they don't remember. In fact, they did not encode that information at all. Behind the principles of selective attention, the techniques that have been used often by people is called the dichotic-listening paradigm. Take Cherry (1953) as an example, she assigned each subject with different people talking about different texts right next to each subject's two ears [15]. She required the subjects to separately listen and report one speech presented near one of their ears while ignoring the other irrelevant speeches that listened by another ear. Moreover, the irrelevant speech frequently starts with a male voice in English and ended with English as well, but the middle strength of the messages are the independent variables which is the thing that experiments tend to test. Test-takers' can separate the useless information from the one they are supposed to remember, but, surprisingly, they failed to encode the differences of the content of the messages that right in the middle such as the gender of talking people or the changing languages.

### **3.4 The importance of rehearsing of stored memory and its negative impacts which causes the lately memory loss**

Learning sometimes is being defined as environmental encounters in which animals are asked to be able to store their own experiences and recall information in the

long-run [16]. Researchers think that the stored information is being graded in strength [17]. However, that stored information is actually connected closely with one another. There is a number of researchers believe that the nature of relational networks is that activating only a single point of the compiled information leads to the firing of other items, including those which has been activated before that will occur simultaneously in the learning process and those not directly stayed in touch with the activated points, unearthing various relationships between stored items [18]. There are several types of drugs that will hinder memory Within the trials tested the least amnesia animal groups, the researchers have found that the treatments of amnesia will interfere the memory storage but have barely yielded the complete disruption among memory formation [19]. Also, memory storage has been categorized into two separate parts, one is the 'short-term store'(STS), and the other is the 'long-term store'(LTS) [20]. STS has some characterized limitation that exists in the real scenario, but LTS has no known capacity [21]. Information transferring process often approach from the short-term store (STS) to the long-term store (LTS). An example to illustrate this is the experiment done by Hebb (1961) and Melton (1963). To be more specific, these two people asked their subjects to report the order of the digits that they presented. They assumed that when the subjects report some certain sequence on every trial, it can be reasonably referred that along with the process of learning, the subjects transfer the information they stored from STS to the LTS, so that they can perform successfully after several times of rehearsals [22]. Without that repetition, memory can no longer be held so long at the storage level.

### **3.5 The failure of taking the stored memory out and its final influence on holding the contents of the memory and its relation with the memory loss**

When people are remembering the cues from the external world, they often accomplish it by themselves. However, when they are supposed to present the information they encode to others, they have to retrieve the information in their memory system. The reason why some people fail to retrieve the information may due to the incoming of new information or the recall of the existing information. To be more specific, the interference theory has speared into two separate parts of new or old information disrupt memory. The first one is proactive interference, which is the items that people have learned earlier that interfere with the retrieval of information people learned later [23]. The other is retroactive interference, which is the information learned later renders some confusion on the recall of information learned earlier. These can be explained by corresponding with the problems of retrieval cues. Some researchers have attributed the retrieval failure to the effect of longitude of time, which refers to the decay theory. Decay theory is the theory that increasing memory loss happens over time. The other retrieval failure happens frequently in people's life, and

it's the TOT phenomenon, which refers to the tip-of-the-tongue phenomenon. This is the kind of semantic retrieval failure that requires a lot of efforts, and often reply on something that people are familiar with but they are not sure that it is what they thought [24]. TOT's internal interest owned by the researchers largely due to its cognitive control. There is a study in which the researchers were using fMRI scanning subjects' brain

while the subjects are doing the effortful semantic retrieves by answering some knowledge questions. This study demonstrates the different areas of the brain are responsible for different levels of activities when subjects were doing the test. Subjects were being randomly categorized into three groups based on their responses of know(K), don't know (DK), and the tip of the tongue (TOT)[25]

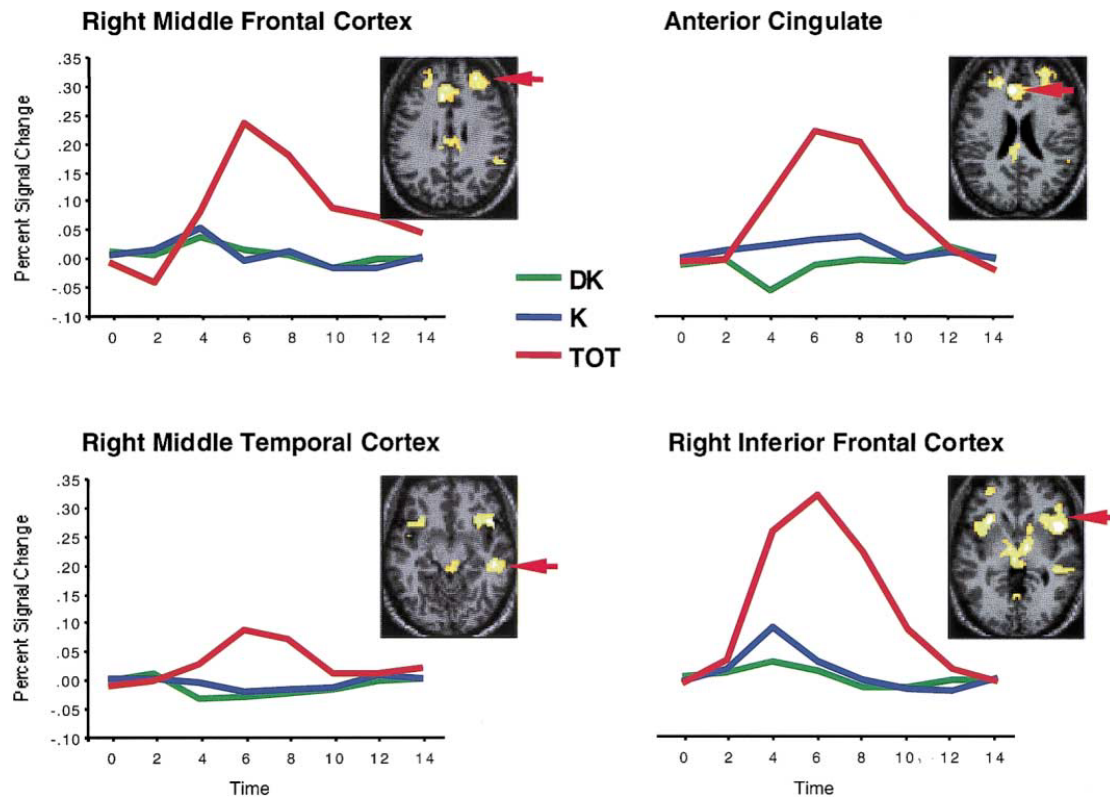


Fig. 3. Regions of the brain that activated during the process of TOT

This figure shows four different regions of brain activities while subjects are answering the questions. DK and K's magnitudes don't vary too far from one another in these four images, and the most active areas of the brain while subjects are doing the TOT are the right inferior frontal cortex, anterior cingulate and the right middle frontal cortex.

## 4 Solutions to relieve the situation of the memory loss and some solutions to better the memory storage

### 4.1 Healthy lifestyle and improvement of memory because of it

Pleasing lifestyle factors such as a low-calorie diet and unsaturated fatty acids (UFA) exert the function of enhancing the ability of memorization. To be more specific, a research study demonstrates that a diet rich in mono- and poly UFA can effectively strengthen the rats' cognitive abilities [26]. Also, the importance of breakfast cannot be ignored to improve elder people's cognitive performances as well. There is an experimental study

which is for the beneficial effects of breakfasts on memory function including recall, episodic memory, short-term and long-term memory. A study of 569 students whose ages range from 11 to 13 suggests that the timing of taking breakfasts are crucial to memory success [27]. What's more, this study illustrates the positive effects on not only the children but also the adults' attention, problem-solving, reading and listening only when the subjects are taking lower-energy breakfast.

### 4.2 Better quality of sleep and its positive relationship with improving the quality of memory

In addition, sleep plays an important role in memory consolidation, although the true function of sleep remains unclear now. Human sleep has been broadly accepted to be categorized into two parts: non-rapid eye movement (NREM) and rapid eye movement (REM). Furthermore, NREM sleep further developed 4 different depths of sleep (NREM-1, NREM-2, NREM-3, and NREM-4), and stage 3 and stage 4 are the small branches of the REM sleep. Some researchers suggested that sleep is mainly

helpful in hippocampus-related types of memory. Recently, however, some other views about sleep are also influencing the procedural memory [28]. In particular, insufficient sleep such as microsleep, sleep attack, sleep apnea, and sleep deprivation have a negative impact on memory [29], and different aspects of cognitive performances are listed below, and those are sensitive to sleep deprivation.

The overall summary of cognitive performance after the sleep deprivation:

1. Both short-term recall and working memory performances decline after sleep deprivation.
2. The learning process is reduced during the cognitive tasks.
3. Divergent thinking skills are impaired.
4. Errors increase when the test-takers are using the prefrontal cortex.
5. Errors about saying the irrelative answers increase.
6. Performance decreases when time progresses.
7. Errors of answering not situational answers increase.

There exists a contradictory voice, though. Walker mentions the role of sleep in the formation of different stages of procedural memory. The acquisition and the stabilization stage, which is the first and second stage of procedural memory, don't fully require sleep. The enhancing stage requires sleep [30]. In 1924, Jenkins and

Dallenbach found that the loss of existing memory was due to sensory disturbance rather than decay, and sleep didn't play many roles in it [31]. However, some researchers show that rapid-eye-movement deprivation (REMD) does harm the memory processes, especially procedural and implicit memory other than explicit one [32]. The studies of animals have suggested that REM sleep is being adjusted according to the needs of memory consolidation. During REM sleep, the brain can do the comprehensive process of memory consolidation [33].

### 4.3 Studies summarization and information gathering in the favor of the physical exercises which will elaborate the cognitive abilities

It has been proposed that physical exercise can actually improve cognitive performance including short-term memory and long-term memory. Researchers develop a study that uses physical exercise as the dependent variables, and to test the difference of the response time between both the older people and the younger people who did exercise and those who didn't [34]. Although it has been expected that the people who did the exercise did a greater job on the speed of response, the results of those studies have been pointed out as inconclusive [35]. Here is a graph of the compile studies on the influence of exercise on cognitive behaviors [36].

**Table.1.** Small summarization of studies on the positive relationship between physical exercise and cognitive performances

Studies	Preliminary index of fitness	Exercise intervention (short duration, high-intensity of anaerobic exercise)	Cognitive task	Time of test	results
Andreassi (1965)	Measure of maximal strength	Head dynamometer (4 levels)	Perception of geometric figures	During exertion	Facilitation at moderate tension levels
Bills (1927)	None	Head dynamometer	Addition; paired-associate perception	During exertion	Facilitation
Bills & Hokanson (1984)	None	Weights suspended over pulleys	Addition; complex reasoning	During exertion	Facilitation of addition
Burgess & Hokanson (1964)	None	Weights suspended over pulleys	Digit-symbol test	During exertion	Facilitation
Courts (1939)	Measure of maximal strength	Head dynamometer (6 levels)	Paired-associate	During exertion	Facilitation at moderate tension levels
Krus, Wapner, & Werner (1958)	None	Push-board	Absolute visual threshold	After exertion	Impairment
Shaw (1956)	Measure of maximal strength	Weights suspended over pulleys (4 levels)	Digit-span test	During exertion	Facilitation at moderate tension levels
Stauffacher (1937)	Measure of maximal strength	Weights suspended over pulleys (4 levels)	Paired associate	During exertion	Facilitation at moderate tension levels

Also, more evidence seems to support this. To be more specific, there is a study which turned out that the group who do exercise has been demonstrated with the significant improvement on short-term memory [37]. Furthermore, there is a study which claims that the decline of cognitive abilities among old people contributes to the reduced oxygenation in brains. Therefore, the importance of aerobic exercise among old people can help them to strengthen the strongness of cognitive skills. In this study, aerobic exercise did improve on most neuropsychological measures [38]

## 5 Conclusion

It's important to get to know how people will encode items before understanding why forgetting happens and how forgetting happens. The level of attention people puts into encoding the new information decides how much information people actually process into a deeper level. We cannot actually avoid the forgetting from happening, but we can do something including having a much better diet, get a nice sleep, and doing some exercise to improve the ability of our memory storage. Therefore, not only for adults but also for teenagers who can both experience the high efficiencies in lives, studies and works.

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