BRAIN AND MEMORY: LEARNING FOREIGN LANGUAGE VOCABULARY

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Товч утга: *Энэхүү өгүүллийн гол зорилго нь гадаад хэлний шинэ үгийг түргэн хугацаанд үр дүнтэй цээжлэх, түүнтэй холбоотой тархины бүтэц, урт болон богино хугацааны санах ой зэргийг нейро хэлшинжлэлийн үүднээс авч үзнэ. Өгүүллийн эхний хэсэгт шинэ ой санамжийг бий болгоход чухал үүрэгтэй хиппокампусын талаар танилцуулах бол дараагийн хэсэгт ой санамж, сэтгэл хөдлөлийг бий болгогч амигдалагийн талаар үзнэ. Өгүүллийн сүүлийн хэсэгт Японы хэлшинжлэлийн эрдэмтэн Юүжи Икэяагийн гадаад хэлний шинэ үг сурах арга, тус аргад тулгуурласан судалгааны үр дүнг танилцуулна.*

Key words: *Hippocampus, brain, memory, vocabulary learning, amygdala, Yuji Ikeya's technique*

The hippocampus (via Latin from Greek ἱππόκαμπος, "seahorse") is a major component of the brain of humans and other vetebrares. Humans and other mammals have two hippocampi, one in each side of the brain. The hippocampus is part of the limbic system, and plays important roles in the consolidation of information from short-term memory to long-term memory, and in spatial memory that enables navigation. The hippocampus, about 2.5 cm in size (Figure 1) is located under the cerebral cortex in the allocortex, and in primates it is in the medial temporal lobe. It contains two main interlocking parts: the hippocampus proper (also called Ammon's horn) and the denate gyrus. Over the years, three main ideas of hippocampal function have dominated the literature: response inhibition, episodic memory, and spatial cognition. The behavioral inhibition theory (caricatured by John O'Keefe and Lynn Nadel as "slam on the brakes") was the popular up to the 1960s. It derived much of its justification from two observation: first, that animals with hippocampal damage tend to be hyperactive: second, that animals with hippocampal damage often have difficulty learning to inhibit responses that they have previously been taught, especially if the response requires remaining quiet as in a passive avoidance test. Jeffrey Gray developed this line of thought into a full-fledged theory of the role of the hippocampus in anxiety. In short, hippocampus has a major role in learning and memory and traces of episodic memory acquired during wakefulness and initially stored in the hippocampus is progressively transferred to the cortex as long-term memory during sleep. Let us take an unfamiliar English word as an example. The English word "aggrandize (v) *enhance power, wealth or status*" and what happens in the brain when you trying to remember is; first of all, it directly jumps into a short-term memory place-hippocampus (Figure 2). If you think

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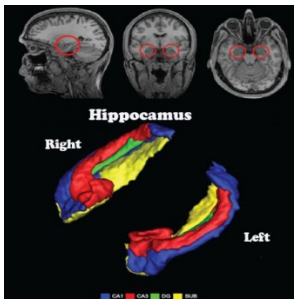
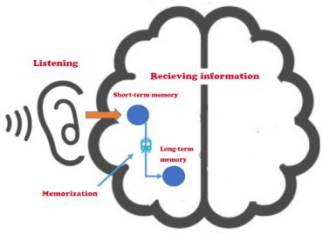
you have just memorized “aggrandize ", but remember it until tomorrow morning, and if it does not make any sense to you, you might forget it. If it is not important to you, hippocampus will be cut off it without your permission. Besides, if you remember all the information without forgetting, it would be too large and you will become lazy and sluggish, and it becomes a disease called “hyperthymesia” (www.medicalnewstoday.com).



(Figure 1. Source: Bonnici 2012)



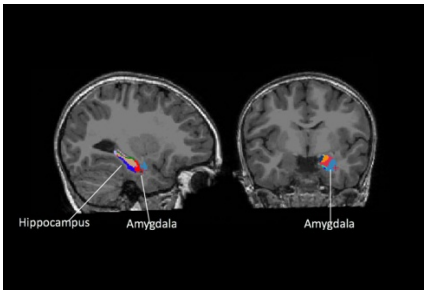
(Figure 2. Source: www.chiya-eng.com)

We forget about 50% of what we hear in the first hour. (Figure 3). Therefore, it is a good idea to review what you are learning every 4 hours. Because of new information acts on the brain's reward system in the same way as money or food, the brain likes interesting and fresh information, a foreign language learner can easily get bored, search for easy ways to learn, and buy new books. Linguists, on the other hand, recommend that you should study the foreign language textbook and finish it to the end, and move on to the next one (Ehri, L. C., & Wilce, L. S. (1980). Do Beginners Learn to Read Function Words Better in Sentences or in Lists? Reading Research Quarterly 15, 451-476). The more the information is repeated or used, the more likely it is to be retained in long term memory. What it means, the hippocampus considers it as an important information and transfers it to long-term memory.

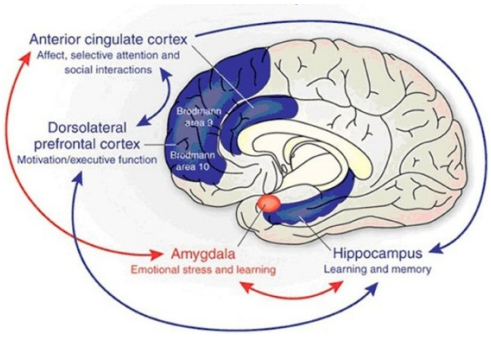
(Figure 3. Source: Bunkyo University, Japan)

The amygdala or amygdalas (/əˈmɪgdələ/; plural: amygdalae /əˈmɪgdəli, -laɪ/ also corpus amygdaloideum: Latin from Greek, ἀμυγδαλή, amygdalē, 'almond', 'tonsil' is one of two almond shaped clusters of nuclei located deep and medially within the temporal lobes of the brain in complex vertebrates, including humans. Shows in research to perform a primary role in the processing of memory, decision-making and emotional responses (including fear, anxiety, and aggression), the amygdalae are considered part of the limbic system and such emotions have a substantial influence on the cognitive processes in humans, including perception, attention, learning, memory, reasoning, and

problem solving Atkinson and Shiffrin (1968) first proposed a systematic and comprehensive information processing model (Barcroft, J. (2002). Semantic and Structural Elaboration in L2 Lexical Acquisition. Language learning 52, 323—363). The effects of emotion on learning and memory are not always univalent, as studies have reported that emotion either enhances or impairs learning and long-term memory retention, depending on a range of factors (Figure 4, 5). It is commonly assumed that amygdala exerts directional influence onto the hippocampus during processing of salient information. This network model of salience processing us primarily based on rodent data. For example, the amygdala receives direct subcortical inputs thought to facilitate rapid detection of salient information, consistent with a proposed role of the amygdala in early cognitive engagement that may influence in humans has only been indirectly inferred from behavioral and neuroimaging studies showing that memory enhancement for emotionally arousing stimuli is positively associated with markers of endogenous norepinephrine release from the basolateral amygdala. However, there is no direct electrophysiological evidence for amygdala-hippocampal connectivity in humans and thus their directional relationship is unknown. Recent neuroimaging findings have indicated that the amygdala and prefrontal cortex cooperate with the medial temporal lobe in an integrated manner that affords the amygdala modulating memory consolidation and, the prefrontal cortex mediating memory encoding and formation and, the hippocampus for successful learning and retention (www.ncbi.nlm.nih.gov).



(Figure 4. Source: Roger Harris / Science Photo Library)



(Figure 5. Hippocampus and amygdala interaction. Source: www.researchgate.net/)

The influence of emotional arousal on memory formation has been attributed in part to stress hormones, including catecholamines (e.g., noradrenaline) and glucocorticoids (corticosterone in rodents; cortisol in humans). During an emotionally arousing event, stress hormones released via the HPA axis may influence memory by stimulating noradrenergic, glucocorticoid, or mineralocorticoid receptors in the brain. Following release from the periphery, corticosterone readily crosses the blood brain barrier and thus may modulate brain function directly. In contrast, adrenaline cannot cross the blood brain barrier and instead influences brain function by activating the vagus nerve, which enters the brain and innervates the nucleus of the solitary tract. The nucleus of the solitary tract then projects to the locus coeruleus, which releases noradrenaline in multiple brain areas, including the amygdala. Reciting out aloud or mumbling the information or writing it on a piece of paper and repeating it over and over again helps

the information move from the hippocampus to long-term storage in the cortex (www.intechopen.com). While you are asleep, the brain is busy forming new memories, consolidating older ones, and linking more recent with earlier memories, during both REM (Rapid Eye Movement) and non-REM sleep. Study results appear in the Journal of Neuroscience. According to the biologically realistic network model the researchers used, input from the hippocampus reaches the cortex during deep sleep and influences how the slow oscillations are initiated and propagated in the cortical network. "Input from the hippocampus -- the sharp-wave ripples -- determines the spatial and temporal pattern of these slow oscillations," she said. "By influencing the nature of these oscillations, this hippocampal input activates selective memories during deep sleep and causes a replay of specific memories (Randall, Mick. (2007). Memory, Psychology, and Second Language Learning. Amsterdam: John Benjamins Publishing Company). During such memory replay, the corresponding synapses are strengthened for long-term storage in the cortex. These results suggest the importance of the hippocampal sharp-wave ripple events in transferring memory information to the cortex" (Lightbown, Patsy M., & Spada, Nina (1999). How Language are Learned. Oxford: Oxford University). Thus, lack of rest could have a significant affect the hippocampus. For this reason, sleep plays a very important role in learning - it helps us to cement the new information we're taking in for better later recall (www.howtolearn.com). Learners do not usually memorize a new word as soon as they first meet the word. Memorizing a new word requires a process. Yuji Ikeya, a well-known Japanese linguist, developed a vocabulary learning strategy taxonomy on the basis of the four stages. In order to remember and retrieving new information later, the linguist suggests that information should be recalled: (1) In every 4 hours after learning; (2) In every week; (3) In every two weeks; (4) In a month. The study investigates the influence of Yuji Ikeya’s technique and chose 120 participants, same language background (Mongolian) and randomly assigned to two groups, each has 30 participants (the English and Japanese language learners) and given flash cards contained 200 academic English and Japanese words to gain larger vocabulary base through the Yuji Ikeya’s technique a duration of one- month-time (March 2019-April 2019). The purpose of the study is to test whether the different vocabulary learning ways have different effect on retention (duration). Participants were ranging in age from 18 to 22 years students and recruited on a voluntary basis. A pre-test was given to all participants one week before the memorization session. All the participants were given a test, that is, they were given 100 academic words to see how many words they could recognize, and provide the meaning of those words. All the participants were given 20 minutes to finish the test. Hence no differences in English and Japanese proficiency were expected between the participants in the two groups (Group 1 and 2). (Table 1, 2)

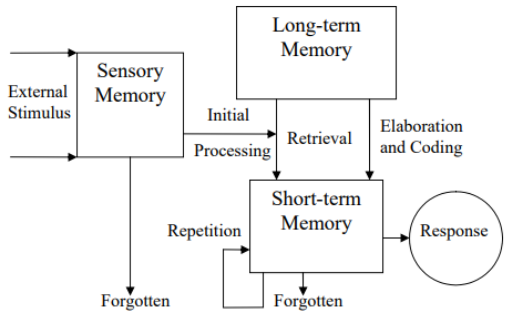
English		Japanese	
Group 1	200 words (upper-intermediate)	Group 1	200 words (beginner)
Group 2	200 words (upper-intermediate)	Group 2	200 words (beginner)

(Table 1. Group 1 memorized the words their own way and group 2 memorized the words by Yuji Ikeya's technique)

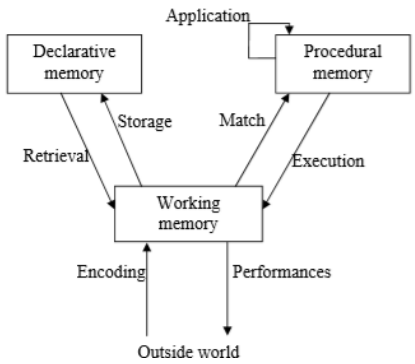
English			Japanese		
	their own way	Yuji Ikeya's technique		their own way	Yuji Ikeya's technique
Groups	72%	90%	Groups	78%	93%

(Table 2)

In the experiment words were taken from 400 must-have words for the Toefl by Mcggraw-Hill and Japanese proficiency test N5 and N3 vocabulary list. There are two reasons to choose TOEFL vocabulary to test participants. First, TOEFL vocabulary list is suitable for students; second, Nagy and Anderson (1984) claimed that people could learn almost 8 words per day from context; word acquisition is not a 3 once-in-a-while thing (1984: 304). In the tests, in order to avoid a serial learning effect, keep changing the order of the words in the pack. This will avoid serial learning where the meaning of one word reminds you of the meaning of the next word in the pack. Learners can use many strategies to promote memory of vocabulary, as already established (see Schmitt, 1997). Memory refers to the mental processes of retaining information for later use and retrieving (R. Loftus & F. Loftus 1976). That model includes a three-scale processing model of memory: sensory memory, short-term memory, and long-term memory, as demonstrated in the following figure. (Figure 6, 7)



(Figure 6. Stage model of information processing based on the work of Atkinson and Shiffrin (1968)



(Figure 7. A schematic diagram of the major components and interlinking processes in Anderson's (1983, 1993) ACT models. From Eysenck & Keane, 1995, p. 386

The above table (Table 2) shows that 90% of the "group 1" participants, memorized English and Japanese words by Yuji Ikeya's technique, managed to get the required score by memorizing them on time, while 78% of the "group 2" participants who memorized English and Japanese words by any methods (Table 2). The score achieved in learning by Yuji Ikeya's technique is 13% higher than the score achieved in learning by any methods; in the active recall test, so learning by Yuji Ikeya's technique got better effect on remembering the meaning and spelling of words than learning by any methods do. Moreover, knowledge that is processed more deeply is retained for a longer period of time and has a greater chance to enter into the long-term memory than knowledge that is processed for a shorter period of time. The main conclusion of the present study is: Yuji Ikeya's 4 technique (mentioned above) is effective in the long-term memory, however, there is no answer to the question of which method is most effective for memorizing foreign words, and we need to continue to study and put it into practice.

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