# Emotion’s Impact on Memory Encoding and Recall

Jialei Qiu

{jialeiqiu_2027@thestudentbuddy.org}

Shanghai World Foreign Language Academy, Shanghai, 200030, China

**Abstract:** The fact that emotional experiences are easier to encode and recall later suggests that emotions have a significant role to play in memory formation and the neural pathways required to generate long-term memories. The paper will briefly outline the findings of experimental behavioral and neuroscience studies about the impact of emotions on memory encoding and retrieval. Behavioral data indicate that emotional stimuli are more attended to and more deeply processed such that they result in a higher level of memory retention. As indicated by neurocognitive studies, an emotional arousal triggers the amygdala and communicates with the hippocampus and prefrontal cortex, therefore promoting the encoding and consolidation of the emotional experience. Coordinated oscillatory activity is also observed in the amygdala-hippocampal circuit after encoding electrophysiologically, which is a sign of improved emotional memory discrimination. By understanding these principles, it can aid in the future studies in regard to dynamic.

**Keywords:** Emotion, memory encoding, memory recall, amygdala, hippocampus

## 1. Introduction

Affects are one of the factors that influence human thought and action. The emotional episodes are more memorable than neutral ones. Attention and perception might manipulate the data human receive and thereafter affect this information in order to create long term memory. It is important to understand how emotions impact the process of memory in terms of its applications in education, mental health, some illnesses associated with memory among other things. Memory processes of encoding and retrieval rely on emotions in various parts of the brain including the amygdala and pre front cortex. Such systems may boost or impair memory performance based on the situation and the type of emotions and the conditions of the tasks [1].

The new research conducted in the field of behavioral science and neuroscience has brought about some findings related to how emotions impact memories. Research by Cahill and McGaugh demonstrated that emotionally arousing material is processed at a higher level and produces better long-term recall than neutral information [2]. Neurocognitive studies indicate that emotional stimuli stimulate certain areas of the brain that include the amygdala, prefrontal cortex, and medial temporal lobe, and their communications play a role in encoding and consolidation processes. Functional neuroimaging studies indicate that amygdala activation is

ICIAAI 2026, May 22-24, Singapore, Singapore

DOI 10.4108/eai.22-5-2026.2365134

predictive of better memory performance through interaction with the hippocampus and PFC [3]. Dolcos et al. highlighted the importance of this network in enhancing memory with the help of emotions even more [4].

Other investigations found out that emotions have no single impact on memory. To illustrate, studies incorporating arousal-biased competition theory indicate that emotional arousal can improve memory of certain features of an event whereas other features are impaired.

The review seeks to explore what is the role of emotions in memory encoding and recall, as well as to examine the behavioral data and the possible neurological processes. Initially, the article will discuss what role emotion has in encoding, such as attention and neural processes. Secondly, it will focus on how emotion affects retrieval of memory and memory recall. Lastly, this article will summarize this evidence and define further research perspectives.

## 2. Emotion and memory

Feelings can be systematically used to influence the process of both encoding and retrieving memories, and this can be observed at the behavioral level and neural structure. Behaviorally speaking it is easier to recall emotional stimuli (whether they are in a negative or positive form) compared to neutral ones. The core mechanism is to stimulate the emotion that may enhance the level of attention and facilitate more intensive cognitive activity. In the case where people have an emotional experience, the cognitive system will use more resources, and this will produce stronger memory traces as opposed to when the event was not emotionally charged [5].

Research in neuroscience also contributes to expanding on those results of behavioral phenomena by demonstrating that emotions interact dynamically with selective regions of the brain, which are connected to memory. Amygdala plays a key role in modulating the emotional memory. It can be strongly activated by the experiences that can activate emotion, and after such stimulation, it can enhance or strengthen such experiences through their interactions with the hippocampus, medial temporal lobe, and other memory-related structures. Animal and human neuroimaging demonstrate that stronger long-term memory of emotional materials correlates with greater amygdala activation during the act of emotion encoding. It means that the amygdala does not contain memory, but labels emotionally charged information so as to intensify consolidation processes in many brain circuitries [6].

The latest research in electrophysiology offers more information on institutions. They indicate that after the encoding of emotions, there are synchronized neural processes between the hippocampus and the amygdala. As an illustration, the increased oscillatory events that emerge following the encoding of emotional stimuli are referred to as ripples. Ripples represent an electrophysiologically visible consequence of hippocampal-amygdala coordinated coupling. It is a predictor of more efficient memory discrimination ability subsequently. This confirms the concept that the dynamic networks encoded facilitate enhancement of the durable memory impact of emotional experiences [7].

It must be mentioned that feelings do not impact memories uniformly. Studies on the comparison between superficial and deepest levels of encoding have revealed that emotions appear to enhance memory, but this effect is less evident when using the deepest level of encoding. This proves that conditions of tasks may alter how emotions influence memory processing [8].

To sum up, the cited research indicates that emotions can improve memory by controlling the focus, neural connections in different parts of the brain responsible for memory, as well as the encoding process. The following processes will render emotional experiences more prone to having intense and easily accessible representations in long-term memory [9].

# 3. Encoding, recall, and integration

## 3.1. Neural basis of emotional memory encoding

One of the most persuasive research findings on the topic of emotional memory is the occurrence of strong emotional stimuli, particularly the interaction between the amygdala and the hippocampus, that will prompt the coordinated response of neuroactivities within the memory system. Findings in human intracranial electroencephalogram (iEEG) demonstrate that during emotion encoding, high-frequency activity (HFA) of the amygdala and the hippocampus increases dramatically. HFA is also a form of neuro impulsive signals, and this circuit will take precedence over storing highly emotional messages because it is linked to more neurons firing. Moreover, various investigations determined that direct electrophysiological activation of the hippocampus could disrupt these processes and consequently decrease emotional memory, thus indicating that the connectivity between the amygdala and the hippocampus could positively influence the encoding of emotional memories [10].

In terms of biology, the induction of emotion could similarly affect memory construction via neurochemical processes. Intense emotions would secrete stress hormones, including adrenaline or cortisol. They are able to change the synaptic plasticity of the amygdala and hippocampus and to facilitate the process of long-term potentiation (LTP) that is the key part of producing a long-term memory. The production of these hormones is associated with improved coding and stabilization, whereas prolonged stress could harm the functionality of the amygdala and the retrieval of memories [3].

It is important to remember that the level of information processing as well as the cognitive process itself, will interact with the emotional responses. At superficial encoding there will be a stronger improvement effect whereas at deep semantic encoding, the relative benefits of emotional information will lessen. It suggests that emotion has an interaction with coding strategies but does not have an overall effect on the creation of memory [8].

## 3.2 Biological mechanisms in emotional memory recall

The phase of recall in memorization is a continuous process wherein emotion influences the formation of memory, and neural reactivation takes a key role. The negative memories recalled result in gamma-frequency patterns of activity in the hippocampus that indicate the original mode of encoding influenced by the activity of the amygdala. It has been recorded that successful recall of an emotional scene can be associated with an increase in the gamma activities taking place in the hippocampus; the same representation patterns occur during encoding. It is indicative of the fact that recalling the emotional memory implies the reactivation of the original coding circle caused by the processes in the amygdaloid structure within the hippocampus [11].

Emotion can also influence the subjective recollection experience and further control the brain area related to the event. Integration of emotional information with previously acquired memories will require the involvement of the prefrontal cortex that is involved in strategic retrieval, monitoring, and memory clue choice. At the time of retrieval, the prefrontal cortex would monitor the present emotional state, so as to actively utilize it as a cue to the situation to guide the search of memory in the medial temporal lobe. Besides, when the emotional context at retrieval is the same as the emotional context at encoding, recall performance tends to be higher, a phenomenon known as emotion-state-dependent memory. This is a dynamic interplay between the frontal lobe control network, the midline and emotion-related areas, the medial temporal lobe [12].

### 3.3 Integrated mechanisms of emotional memory

In addition to the individual process of encode and recall, research has shown that there are certain biological mechanisms that retain emotional memory at various stages of memory. One such crucial mechanism is encoded neural waves, a burst of activity in synchronized activity that happens instantly following learning in the hippocampus and amygdala. They become stronger upon affective learning, and predict higher discrimination of emotional memories later, indicating their facilitating role in the initial consolidation by replaying and enhancing memory traces in different areas of the brain. Studies on intracranial recordings indicate that other comparable methods associated with these waves initially manifest in the amygdala, then in the hippocampus, which implies that there is directional influence between the area of emotion processing and the memory storage region [7].

Research on animals has also demonstrated that co-activation of emotional memory circuits during sleep takes place, where electrical brain waves and oscillations in the hippocampus appear to be associated with the functioning of the basolateral amygdala. The activation is even more impressive due to its effects on experiences with significant emotional significance and serves the purpose of integrating emotional memories, which implies that the mechanism of integration can link emotional and situational data across various waking and resting conditions [13].

The activation of the basolateral amygdala (BLA) at the cell network level facilitates the formation of emotional memory by increasing neuron firing rate and synchronizing neurons, which results in enhancement of long-term potential (LTP) effects in associated brain cells. Such a usual occurrence of gamma frequencies may facilitate synaptic plasticity of hippocampal circuits and therefore assist in maintaining memories of events with intense emotional engagement [14].

This biological evidence reveals that feelings not only influence the process of coding and decoding memories, however also reinforce the memory trace in terms of the pulsatory function of the amygdala-hippocampus network following encoding and enhance the process of emotional memory consolidation during sleep via a synchronized sharp wave-rapid oscillation reactivation mechanism.

## 4. Outlook

However, despite the considerable advances in knowledge about emotional influence on the encoding and retrieval of memories, numerous areas of vital research need further investigation. To begin with, it is also unclear what the emotional memory can do concerning the temporal dimension, i. e., in terms of how emotions can impact the timing of memories, and this gap in knowledge should be filled by additional research. There is also some evidence that emotions might improve temporal-source memory, as chronological order can differ across tasks and situations, indicating a multifaceted effect of emotions on the temporal aspects of memory [15].

Third, future studies ought to further explore the relationship between emotions and associative memory, relational memory, and prospective memory (that is, the capacity to recall future intentions). The findings of these studies currently differ considerably. As an example, it seems that positive emotional cues may improve prospective memory whereas the effects of negative cues are more ambiguous [16].

To conclude, studies need to go forward and continue to use approaches that involve neurobiology and computational models in order to explain the dynamic relationships between the amygdala, hippocampus, prefrontal cortex, and other networks at the memory stage more effectively. Such an all-inclusive standpoint will allow explaining what emotions do to memory in terms of their neural correlates, which would offer some theoretical framework for the treatment of particular maladies.

## 5. Conclusion

The given article will review the literature in a systematic way concerning the role of emotions in memory, based on the combination of behavioral and neurobiological data, to investigate the role of emotional arousal in memory encoding and recall and the neurological basis behind these effects.

The findings of these studies all point to the fact that information encoded by the occurrence of emotionally significant events is retained longer in long-term memory and has better recall compared to neutral events. Emotions help a person to pay more attention and engage in deeper cognitive processing in the memory encoding stage eventually creating more potent memories. Other neuroimaging studies have also shown support for the fact that amygdala activation in emotional learning can actively predict memory capacity via functional connectivity to both hippocampus and prefrontal cortex, implying that this distributed neural network is a critical neuronal substrate underlying the emotion-enhanced memory phenomenon.

Electrophysiological evidence also exposes the intricate biological processes underlying selective handling of emotional information. It has been shown that synchronized hippocampal-amygdala impulses occur more often after emotional learning. This process has better predictive value on subsequent memory discrimination capabilities, which means that coherent neural oscillations are key factors in memory consolidation beyond the early stage of emotional memory encoding. Memory retrieval studies also indicate that recall clarity of emotional memories is much higher than neutral memories regardless of the length of time elapsed between encoding and retrieval, and this result is supported by prolonged activity of the amygdala-medial temporal lobe memory network.

Nevertheless, it turns out that there are not always beneficial effects of emotion regulation on memory. This enhancing capacity of the memory is also dependent on task conditions (task demands, depth of encoding, etc.), and the influence on particular memory dimensions (chronological order, source of information) is much different. It implies the idea of mutual reinforcement between emotion regulation and cognitive processes instead of their independence.

Future studies might be able to address the dynamics of time regarding emotional memory. In this case, it means exploring how emotion controls the time-related and structural properties of memory retrieval and examining the patterns of emotional content integration within associative and prospective memory systems. Moreover, neurobiological information coupled with computational models has the potential to reveal the interaction of emotion and memory networks in a more mechanistic way. Research of such intensity and depth will not only help us understand different kinds of memory dysfunction but also give clues that will be useful in the context of education, clinical practice, and cognitive science.

## References


[1] Chai, T.M.; Amin, H.U.; Saad, M.N.M.; Malik, A.S.: The influences of emotion on learning and memory. Frontiers in Psychology. 8, 1454 (2017)

[2] Cahill, L.; Babinsky, R.; Markowitsch, H.J.; McGaugh, J.L.: The amygdala and emotional memory. Nature. 377(6547), 295–296 (1995)

[3] LaBar, K.S.; Cabeza, R.: Cognitive neuroscience of emotional memory. Nature Reviews Neuroscience. 7(1), 54–64 (2006)

[4] Dolcos, F.; LaBar, K.S.; Cabeza, R.: The memory-enhancing effect of emotion: Functional neuroimaging evidence. Neuropsychologia. 44(8), 1323–1333 (2006)

[5] Kensinger, E.A.: Remembering the details: Effects of emotion. Emotion Review. 1(2), 99–113 (2009)

[6] McGaugh, J.L.: The amygdala modulates the consolidation of memories of emotionally arousing experiences. Annual Review of Neuroscience. 27, 1–28 (2004)

[7] Zhang, H.; Skelin, I.; Ma, S.; Paff, M.; Mnatsakanyan, L.; Yassa, M.A.; Knight, R.T.; Lin, J.J.: Awake ripples enhance emotional memory encoding in the human brain. Nature Communications. 15, 94 (2024)

[8] Yuan, Y.; Jiang, Y.; Guan, L.; Long, Y.; Guo, Y.; Zhang, X.: The effects of encoding levels on the item and source memory of fearful and disgusting stimuli. BMC Psychology. 13, 22 (2025)

[9] Fairfield, B.; Mammarella, N.; Palumbo, R.; Di Domenico, A.: Emotional meta-memories: A review. Brain Sciences. 5(4), 509–520 (2015)

[10] Qasim, S.E.; Mohan, U.R.; Stein, J.M.; Jacobs, J.: Neuronal activity in the human amygdala and hippocampus enhances emotional memory encoding. Journal of Neuroscience. 43(3), 462–475 (2023)

[11] Costa, M.; Pacheco-Estefan, D.; Gil-Nagel, A.; Toledano, R.; Imbach, L.; Sarnthein, J.; Strange, B.A.: Human hippocampal reactivation of amygdala encoding-related gamma patterns during aversive memory retrieval. Nature Communications. 16, 1428 (2025)

[12] Buchanan, T.W.: Retrieval of emotional memories. Psychological Bulletin. 133(5), 761–779 (2007)

[13] Girardeau, G.; Inema, I.; Buzsáki, G.: Reactivations of emotional memory in the hippocampus–amygdala system during sleep. Nature Neuroscience. 20(11), 1634–1642 (2017)

[14] Paré, D.; Headley, D.B.: The amygdala mediates the facilitating influence of emotions on memory through multiple interacting mechanisms. Trends in Cognitive Sciences. 27(2), 123–137 (2023)

[15] Petrucci, A.S.; Palombo, D.J.: A matter of time: How does emotion influence temporal aspects of remembering? Current Opinion in Behavioral Sciences. 41, 22–28 (2021)
[16] Zhao, Z.; Zhang, X.: The effect of emotion on prospective memory: A three-level meta-analytic review. Psychological Research. 89, 315–329 (2025)