Spring 5-8-2020

# Effects of Emotional Valence and Depth of Processing on Memory

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by

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Psychology

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Submitted in Partial Fulfillment of the

Requirements for the Degree of Bachelor of Science

In the HTC Honors College at

Coastal Carolina University

Fall 2019

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Abstract

This study looks at the relationship between emotionally charged words and the depth at which information is processed and how this relationship affects memory. It is predicted that emotional stimuli make the depth of processing process easier, resulting in emotionally charged words being recalled most frequently. Participants were presented with stimuli using a word task and then took a memory test. Responses to the memory test were measured via Qualtrics. Due to small sample size, the results did not conclusively indicate whether or not emotional valence and depth of processing interact to affect memory. There was no significant interaction between the two variables. There was also no significant interaction in relation to confidence. No significant difference between gender was found.

*Keywords:* depth of processing, emotional valence, emotion, memory

## Effects of Emotional Valence and Depth of Processing on Memory

Neutral words are retrieved more easily when the information given to participants regarding the word is emotionally charged (Murray and Kensinger, 2012). Murray's and Kensinger's study gave participants neutral words paired with either a neutral or an emotionally charged word and told to visualize them together or apart. The results suggested that mentally integrating neutral-neutral word pairs took longer than neutral-emotional word pairs, further suggesting that the encoding of neutral-emotional word pairs is an easier process.

Memory enhanced by emotion is specific to the type of emotion. Negative emotion associated with words involves regions of the brain responsible for sensory processing (temporal and occipital), whereas, positive emotion involves regions of the brain responsible for self-referential processing (frontal and parietal). The self-referential processing associated with positive emotion would lend one to have a sense of familiarity when trying to remember stimuli but it would not necessarily aid in detailed memory (Kensinger, 2009). It is suggested that negative emotions create a seemingly more vivid memory of an experience because of the difference between these two different processes, causing negative words to be recalled more accurately.

The previous discussion on negative versus positive emotion could also involve the suggestion that valence as well as arousal of a positive word influence memory (Madan, Scott, & Kensinger, 2018). This study utilized cued-recall tasks to test participants' memory of neutral-positive and positive-positive word pairs. The results indicated that association memory was enhanced for positive-positive word pairs, but not for neutral-positive word pairs. This would suggest that higher levels of arousal for positive words more so enhance memory.

Flashbulb memories explain how people vividly remember events that are emotional in nature (MacKay and Ahmetzanov, 2005; Gandolphe and El Haj, 2017). Even though there is no difference in the accuracy of memory for flashbulb memories, there is an increase in vividness and confidence for these memories. If the response to highly emotional events increases confidence in memory of those events, then perhaps the same principle applies to the present study.

Emotional valence of words, particularly negatively charged words, result in increased retrieval of details regarding those words (Kensinger and Corkin, 2003). A similar binding mechanism as that in flashbulb memories has been found in the memory of taboo words versus neutral words. The emotional reaction system prioritizes the source of an emotion, causing memory processes to bind to this source rather than remembering every word equally (Hadley & MacKay, 2006).

Depth of processing is another major area which focuses on creating a more vivid encoding experience in relation to memory. The direction of memory research was changed when psychologists Craik and Tulving (1975) first studied the levels of processing model. They found that the depth of the information being processed has an impact on how long the memory of the information will last. It suggested that the way information is encoded affects how well it is remembered. In a similar study, high school and college students were tested for levels of processing by completing tasks on cued recall of related and unrelated word pairs (Epstein, Phillips, & Johnson, 1975). Participants were given three different processing tasks: semantic, nonsemantic, and intentional. Semantic tasks are those which focus on the meaning of a word or phrase in a particular context, nonsemantic tasks focus on phonemic or orthographic aspects of a word or phrase, and intentional tasks were tasks in which the participant actively tried to learn

and memorize the information. Words in the semantic task that were deeply processed were recalled more accurately than shallowly processed words. This further proves Craik's and Tulving's model of levels of processing.

Evidence of more accurate memory based on levels of processing can also be seen in how the information is retrieved. Instead of processing information shallowly or deeply during the learning process, it can be processed during retrieval. Previous research as shown that the questions asked regarding information can deeply retrieve the information similar to how it can be deeply learned. Information retrieved using inference-based questions about a given text was more accurately remembered than that retrieved using paraphrased or verbatim questions (Friedman & Rickards, 1981). Inference-based questions require a more deep level of processing, so depth of processing is involved in both encoding and retrieval. In either case deeply processed information is remembered more accurately.

Memories that are deeply processed lead to longer lasting memories while shallow processing leads to memories that decay more easily (Loaiza, McCabe, Youngblood, Rose, and Myerson, 2011). In this study, participants were given to-be-remembered words during a reading span task. The first experiment consisted of two blocks where the words were accompanied by either deep or shallow sentences regarding the words. The participants were then asked to recall the words immediately after receiving the sentences. Then they were given distractor tasks such as a demographics questionnaire or a short word search, which was followed by a delayed retrieval task in which they were asked to remember the words to be remembered. The second experiment was identical to the first experiment except each word was preceded by an arithmetic problem. The results of this study showed that deep levels of processing resulted in better performance in the cases of both immediate and delayed retrieval tasks.

There is a difference in gender when it comes to emotional experience and emotional expressivity (Deng, Chang, Yang, Huo, & Zhou, 2016). Men tend to experience emotion more intensely, while women tend to be more expressive of emotion. This study was conducted by presenting men and women with videos that triggered eight types of emotion (sadness, anger, horror, disgust, neutrality, amusement, surprise, and pleasure). The men and women then reported whether it made them feel positively or negatively (valence) and to what extent (arousal). The results showed overall higher arousal in women, but generally similar responses in valence between the two genders.

The purpose of this study is to test for an interaction between emotional valence and depth of processing. We expected that emotional valence of a word makes processing easier because it creates a more vivid memory. Alternatively, we expected that emotional valence and depth of processing would not interact to create a more efficient encoding process because their respective processes are similar mechanisms. We also expected that participants would be more confident in their memory of emotionally charged words, similar to elevated levels of confidence in flashbulb memories. Gender was also considered; since the major gender difference is in emotional arousal rather than emotional valence, we expected to see no difference in gender in the present study.

## Method

### Participants

College students (n = 4, 2 men, 2 women, age range: 19-43 years, M = 25.25 years, SD = 11.84) at Coastal Carolina University were recruited using SONA Systems and by word-of-mouth. Participants were not compensated for their participation.

**Procedure**

The study was conducted online via Qualtrics with a subsequent demographics questionnaire. The participants were given the survey in two phases. In the learning phase participants were presented with a series of words at random from the Affective Norms for English Words (Bradley & Lang, 1999). There were 60 words in total during the learning phase, with 20 negatively charged words (e.g. blood, slave), 20 positively charged words (e.g. trophy, award), and 20 neutral words (e.g. water, paper). Each word had a corresponding question that that either allowed the word to be processed shallowly (e.g. “Is this word uppercase?”) or deeply (e.g. “Is this word part of the body?”). Next, in the testing phase, the participants were shown words one at a time, which included the original 60 words from the learning phase as well as 60 new lure words, and were given a recognition test which asked whether or not the word appeared during the first phase of the test. They were also asked to rank their confidence in their memory on a Likert scale ranging from 1 (*not confident*) to 5 (*confident*). Then a demographic questionnaire was given which asks a participant’s age (years), gender (male, female, nonbinary), and ethnicity.

## Results

The accuracy of memory for the learned words was measured using a 3 x 3 Factorial Repeated Measures ANOVA. There was no significant interaction between emotional valence and depth of processing, $F(9, 12) = 1.20$, $p = .37$. *See Figure 1*. It cannot be concluded that emotional valence and depth of processing interact to affect memory. There was also no significant difference in emotional valence, $F(2, 6) = 2.07$, $p = 0.21$. The emotional valence of words had no effect on the memory of words. There was a significant difference in the depth of processing, $F(2, 6) = 39.273$, $M = 0.63$, $SD = 0.28$, $p = .008$. The depth at which words were

processed had a significant effect on the participant's memory. The confidence in memory for learned words was measured using a 3 x 3 Repeated Measures Factorial ANOVA. There was no significant interaction between emotional valence and depth of processing in relation to confidence, $F(9, 12) = .23$, $p = .80$. *See Figure 2*. It cannot be concluded that the interaction between emotional valence and depth of processing had an effect on the confidence of memory. Emotional valence did not affect participants' confidence in their memory. *See Figure 3.* Gender was measured using a Mixed Factors Repeated Measures ANOVA. There is no significant interaction between gender and emotion, $F(2, 6) = 2.28$, $p = .22$, or between gender and depth of processing, $F(2, 6) = .2$, $p = .70$. *See Figures 3 and 4.*

## Discussion

The results for this study were not significant most likely due to the small sample size. There was not enough data to be able to accurately conclude whether or not emotional valence and depth of processing interact with one another. There could have also been potential difference in how a person experiences a word in terms of how they see it versus how they hear it. Words that are spoken often but are not often read could pose as a cue to a participant. If the participant is not accustomed to seeing a word written as opposed to hearing it, that unfamiliarity could cause the participant to remember that word more because their attention is called to it more. However, in the case of the present study it does not seem that any words would have that effect.

The implications of depth of processing are significant in that they can be applied to aspects of my peers' lives, particularly studying. Knowing that deeply processed words are remembered more easily and accurately, people can use this to develop or improve the way they study. Instead of focusing on rote memorization, creating examples that make you interact with

the topics more and possibly attributing them to personal experiences if possible lends to more deeply processed information and can help you recall the information more easily and effectively. These variables apply to teachers/professors as well. Giving context to the information which we want to remember helps further strengthen recall of the information. With this in mind, teachers can structure class time based on this. In-class activities that give more meaning to a concept rather than an arbitrary definition allows a student to put the concept in context, which prompts memory that will help students recall the information during closely related events in the real world. The problem still remains that we still cannot remember neutral information as well as emotional information. But perhaps that is not necessarily a problem, but more so just how we are built to process information.

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# Appendix

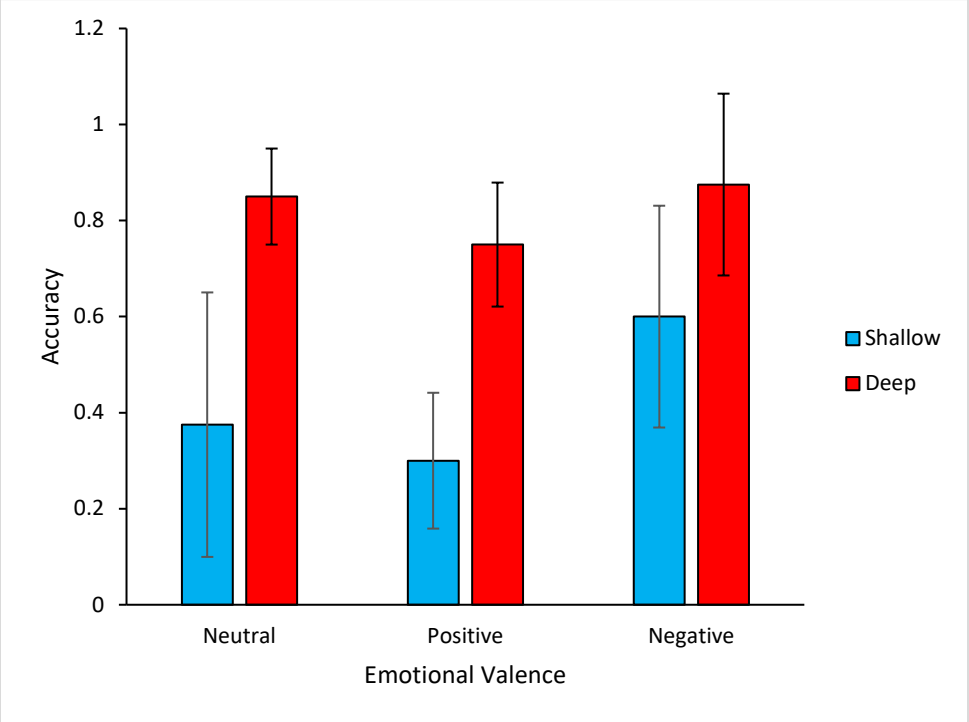


*Figure 1*: Relationship between emotional valence and depth of processing in relation to accuracy of memory

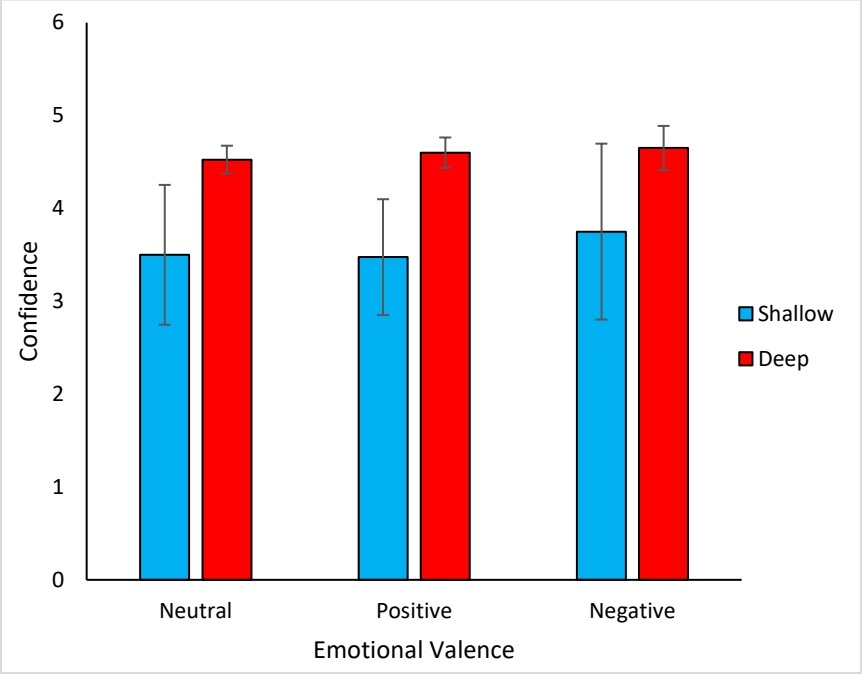


*Figure 2*: Relationship between emotional valence and depth of processing in relation to confidence of memory

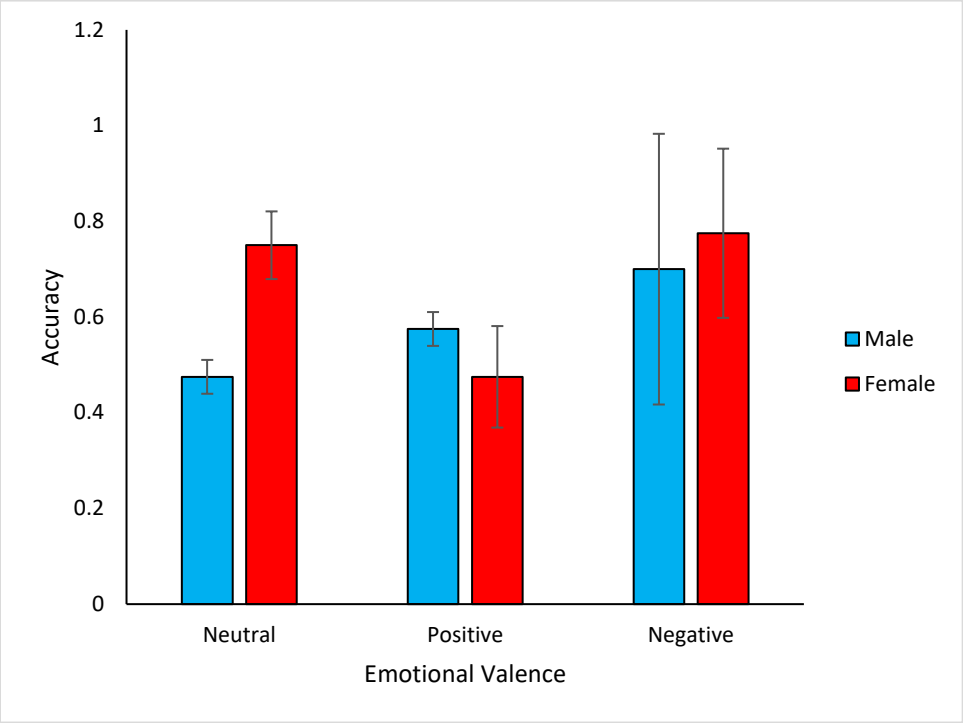


*Figure 3*: Relationship between emotional valence and gender in relation to accuracy of memory

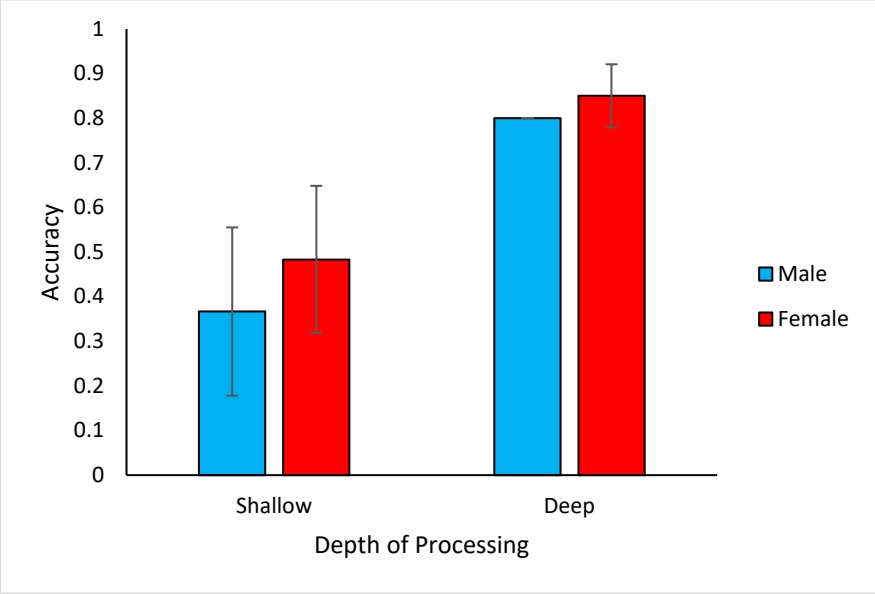


*Figure 4*: Relationship between depth of processing and gender in relation to accuracy of memory