



Happy and Sad Mood Priming Effects on Memory of Emotional and Non-emotional Photographs

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: In this study we were interested in the effect of happy and sad mood on the memory of emotional (happy and sad) and non-emotional photographs.

Study Design: A 3 (mood: happy, sad, or control) x 3 (photograph type: happy, sad, and neutral) mixed factorial design was used. Mood was the between-subjects factor and photograph type was the within-subject factor. Photograph memory was the dependent variable.

Place and Duration of Study: College students enrolled at Coastal Carolina University in Conway, South Carolina, USA, between February 2013 and April 2013 served as research participants.

Methodology: Participants ($n = 111$) were randomly asked to either write about the happiest, saddest, or an average day in their lives. Next, participants viewed 18 photographs (6 happy, 6 sad, and 6 neutral) for 10 seconds each in random order and reported the descriptions of as many photographs as they could remember.

Results: Participants in the happy mood condition remembered the least overall (45.7%) and participants in the sad mood condition remembered the most overall (55.7%). Participants in the sad mood condition remembered significantly more photographs than participants in the happy mood condition ($P = .02$). Overall, participants remembered more sad photographs than happy photographs ($P = .006$) or neutral photographs ($P = .004$). Compared to the control condition, being in a sad mood slightly increased memory for sad photographs and increased memory for neutral photographs, but did not change

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memory for happy photographs. Compared to the control and sad mood conditions, being in a happy mood decreased memory for all types of photographs.

Conclusion: This study shows that being in a sad mood may narrow attention to improve memory of photographs, while being in a happy mood may broaden attention and obstruct memory of photographs. Regardless of mood state, participants also remembered more sad photographs than happy and neutral photographs. In the future, more research is needed with different priming methods, stimuli, and group sizes.

Keywords: *Emotion; priming; attention; memory.*

1. INTRODUCTION

Emotions are an important part of our lives [1]. From the time we enter this world to the time we exit the world of the living, we are constantly experiencing some sort of emotion. There may even be an evolutionary advantage to retention of emotional information [2]. If we remember emotional situations then we can decide whether to avoid that situation in the future. If we forget emotionally relevant information, then we may not avoid fearful situations or even experience fear. Emotions affect the mind and the way that we process information [3], and can even elicit physiological responses [2]. For example, when we are nervous or scared there are changes that occur in our bodies. The current study focuses on how mood can influence memory for different types of emotional stimuli.

Information is continuously flowing through our minds [4]. There is never a moment that our minds are not working to figure out the world around us and ensure our survival. The debate in the literature seems to be over whether emotions actually enhance memory or just the belief that the memories are enhanced because of false details in our memories [5]. We need to determine how much of our memories are accurate, and how much of the information is created to fill in the gaps or exaggerate the memory. Much of the research in the past has focused on either negative or positive emotions or stimuli, and does not look at the emotional state of participants to begin with [1]. This is a significant issue because the initial emotional state could greatly influence results of any emotion based study.

Associations are an important part of memory where items or events outside of a person's mind interact and connect with other memories already acquired, usually through a functional relationship [4]. Maybe we can force those connections to happen more frequently by tying information to our emotions, because organizing our perceptual field might be able to be aided by priming [6]. Previous research states that attention mediates some, but not all, of emotion's effects on memory [7]. The answer may be in the emotional connection itself. As people have noticed for years, the emotions that we experience and ruminate on tend to exaggerate the emotions and feelings that we experience [3]. This may create connections that we are unaware of in our long-term memories, allowing for quicker and better encoding. This is further supported by the idea that emotions increase the possibility that recognition will occur when the information is retrieved [8].

Positive rumination and emotions seem to increase creativity and attention [3]. When we are in a positive mood, ideas and thoughts may flow better between our short and long-term memory. When emotions are then stimulated, elaborate processing may be associated with increased attention [8], and neutral stimuli may process at a lower level [2]. This elaborate processing may in turn allow for deeper encoding of the emotional stimulus. This may also

be why neutral items are less accurately described than emotional items [6]. Consider the way people describe events in their lives. If there is strong emotional content, people often describe the event in more detail. However, if the event is low in emotional content, the event is described more factually with few details. During processing it seems that emotional stimuli is often a priority [6,9], and there seems to be a decrease in the rate of decay of those memories [10]. This is interesting because it shows that there may be a deeper encoding in this emotional stimulus that allows for greater memory retention. This does not seem to carryover to all emotions, though, because certain emotions reduce the effectiveness of stimulus-response learning strategies [10]. People seem to encode more information that is associated with their emotional focus than any other details [9,10,11]. Another explanation for this debate might be that unusual objects draw attention faster and longer than non-emotional objects [2,7], using more cognitive resources during these experiences, or inhibition mechanisms might be activated to minimize the effects of distress on the individual [11]. This research is limited since the emotions are only primed through pictures and not through other methods.

Attention also plays a significant role in the emotional memory of negative pictures [12]. Stimuli of an emotional nature will sometimes capture attention to the point of disrupting some cognitive processing. This can affect short term memory depending on the degree of effort required in the processing of the stimuli [13]. Our attention is drawn to and influenced by the stimuli attended to most recently, such as emotionally related items [14]. Positive moods can even expand what we see and hear [9]. If we are happy or excited, we may notice and want to include all the details into our view. If we are sad, we block out all the details and focus on internal details. However, when we are angry, we narrow our focus to the immediate location of our anger.

Emotionally enhanced memory (EEM) suggests that emotion modulates memory through attention, but this might be more specific to negative stimuli [12]. This is contradictory to other research that states positive emotion modulates memory. The opposing literature states that cognitive priming for negative stimuli might be highly adaptive [15]. Also, prior research states that inhibitory control can be reduced by positive moods and increased by negative moods [4], which can influence cognitive flexibility in the opposite direction [9]. Emotion may be a mediating factor in retrieving information from memory as long as it is connected to the emotion [1]. If a person is sad they may remember sad events with more clarity. Once activated, evaluative priming seems to connect similar valences to an automatic response and further evaluations are then spontaneous in nature [15]. Emotional states influence visual processing [1], but there does not seem to be a difference between negative or positive images in the eye movement of participants [7].

If emotions influence visual processing then maybe emotions influence implicit memory as adults [1]. All throughout a person's life, a person is influenced by what she receives through her senses and emotions. To take a person's senses or feelings away would leave the person with gaps in her memories and the connections between those memories and the world. Surprisingly, research suggests that positive words are remembered easier than pictures in implicit memory [1]. This is surprising because our world is presented to us as images; whereas, words must be interpreted. Emotional memory studies can help further the understanding of emotional disorders, and the memory alterations that occur in some disorders [12]. People with stress disorders often have reduced memories of traumas; whereas, patients with post-traumatic stress disorder (PTSD) have enhanced memories of the traumas [11]. This difference in the memory of traumas requires more research for the connection between memory and emotions.

1.1 Study Hypotheses

In the present study, the connection between relived past emotions and pictorial retention was investigated. Priming occurs when exposure to a stimulus mentally activates a concept. By making people think about different words, colors, ideas, or emotions, we can activate implicit memories which can influence how people react to later stimuli [16]. Emotional, or affective, priming would therefore involve exposing people to emotional stimuli to influence their cognitive processing of subsequent material. We hypothesized that people primed to be in happy emotional states would increase their retention of all pictorial stimuli. In addition, sad and happy emotional states were predicted to lead to greater retention of pictorial stimuli associated with those matching emotional states; people in happy moods will recall more happy photos, people in sad moods will recall more sad photos.

2. METHODOLOGY

2.1 Participants

A convenience sample of 111 participants completed the study in group settings. The participants were undergraduate students enrolled in Psychology classes at Coastal Carolina University who received partial course credit for study completion. The sample included 20% men and 80% women. Fifty seven percent of the participants were Psychology majors, and 43% were majoring in marketing, education, biology, or management. The participants included 21% freshmen, 23% sophomores, 17% juniors, and 10% seniors. The remaining 29% of participants declined to answer the question on class rank. The age range for participants was 18 to 43, with an average age of 20.39 years. Of the participants, 58% were Caucasian, 32.4% were African American, and 8.1% were Hispanic. All participants were treated according to the ethical guidelines for research provided by the American Psychological Association [17].

2.2 Materials

In order to measure memory, 18 photographs were used as visual stimuli. The photographs were chosen by the experimenters specifically for this study and were selected to be linked to an emotional response. Photographs were chosen from internet searches. Six photographs were linked to sadness, six to happiness, and six photographs were neutral, meaning they had no emotional content. The photographs were standardized to 4 inches in height and 3.5 inches in width. The sad photographs included dark, dreary scenes or people who were upset. The happy photographs were of celebrations, families, or people in joyful conditions. The neutral photographs were of neutral objects, everyday scenes, or people in non-emotional conditions. Pilot testing with a group of 24 volunteers who were blind to the study predictions verified these images were emotionally perceived as intended.

The emotional priming prompt instructed participants to write about the saddest day in their lives, happiest day in their lives, or an average day in their lives on a blank piece of paper. While this protocol is commonly used as a mood manipulation, to ensure priming of emotions occurred participants completed the Positive and Negative Affect Schedule (PANAS) [18,19] after the mood manipulation protocol. The internal validity of the PANAS scales was calculated using Cronbach's alpha [20]. For positive affect, Cronbach's alpha was .89 and for negative affect, Cronbach's alpha was .85 [20].

Participants completed a demographics survey at the end of the study, consisting of questions on age, race, sex, college major, and college year.

2.3 Procedure

The study was completed in several group classroom settings. Participants signed informed consent forms and were then randomly assigned to one of three experimental groups. Participants were instructed to turn their packets over and write about the topic given for eight minutes: the saddest day in their lives, happiest day in their lives, or an average day in their lives. Next, they were instructed to complete the PANAS survey [18,19]. Then, participants viewed an automatic PowerPoint slide show of all 18 photographs where each picture was shown for ten seconds. The total presentation of all photographs took three minutes. Following the slide show, participants were instructed to record as much as they could remember from each picture presented. Then, the participants were instructed to turn to the last page to complete a brief demographic survey. When all participants had completed the study, they were debriefed on the purpose of the study and thanked for their participation.

3. RESULTS AND DISCUSSION

A manipulation check was conducted to demonstrate the writing prompt led to a different emotional state for each condition based on results from the PANAS [18,19]. The happy mood group reported more positive affect than the sad mood group, $t(72) = 13.18, P < .001$, and the sad mood group reported more negative affect than the happy mood group, $t(72) = 14.24, P < .001$. These results show the mood manipulations were successful at inducing positive and negative affect, respectively.

To test the hypothesis that participants in a happy mood would remember more photographs overall than the sad mood or control condition groups, a one-way analysis of variance (ANOVA) was conducted for total picture recall (correct recall for the happy, sad, and neutral photographs combined). The results revealed a significant difference in recall between conditions, $F(2, 108) = 3.91, P = .02, \eta_p^2 = .07$. Individual comparisons found that participants in the sad mood condition (55.72%; $M = 10.03, SD = 2.48$) remembered significantly more photographs than participants in the happy mood condition (45.67%; $M = 8.22, SD = 3.07$), $P = .02$. The other group comparisons were not significantly different. See Fig. 1 for overall differences.

Next, a 3 (mood: happy, sad, or control) \times 3 (photograph type: happy, sad, and neutral) mixed factorial ANOVA was conducted for photograph memory recall. Mood was the between-subjects factor and photograph type was the within-subjects factor. As reported with the one-way ANOVA previously, there was a significant main effect for mood ($P = .02$). In addition, there was a significant main effect for photograph type, $F(2, 108) = 6.29, P = .002, \eta_p^2 = .06$. Individual comparisons found that regardless of mood state, participants remembered more sad photographs ($M = 3.34, SD = 1.41$) than happy photographs ($M = 2.93, SD = 1.20$), $P = .006$, and they recalled more sad photographs than neutral photographs ($M = 2.95, SD = 1.15$), $P = .004$. However, the mood \times photograph type interaction was not statistically significant, $F(4, 108) = 1.34, P = .26, \eta_p^2 = .02$. Compared to the control condition, being in a sad mood slightly increased memory for sad photographs and increased memory for neutral photographs, but did not change memory for happy

photographs. Compared to the control and sad mood conditions, being in a happy mood decreased memory for all types of photographs. See Fig. 2 for results.

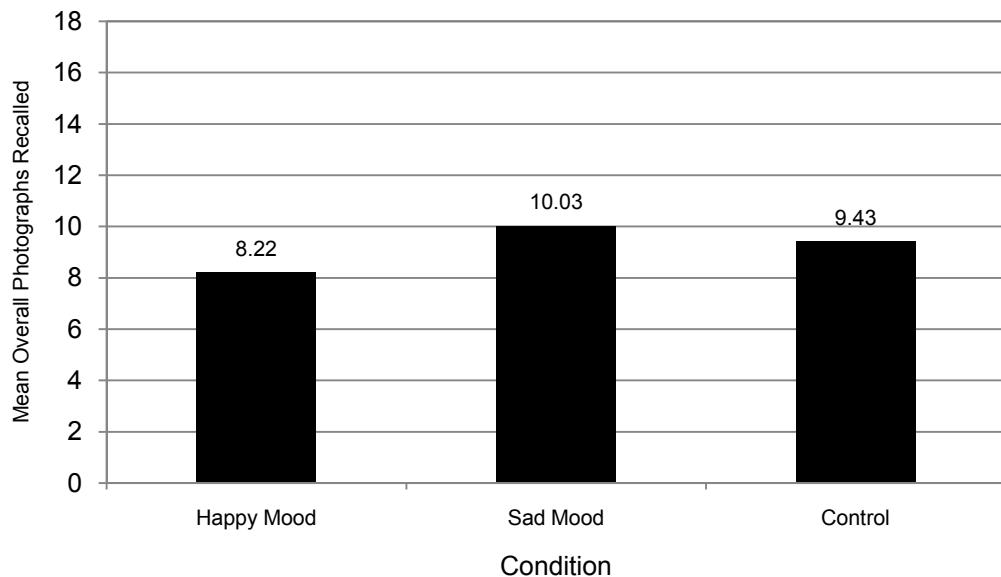


Fig. 1. Mean overall photographs recalled by mood condition

Happy and sad mood conditions were significantly different, $P = .02$. All other comparisons were not statistically significant. Possible range of photographs recalled was 0-18 overall

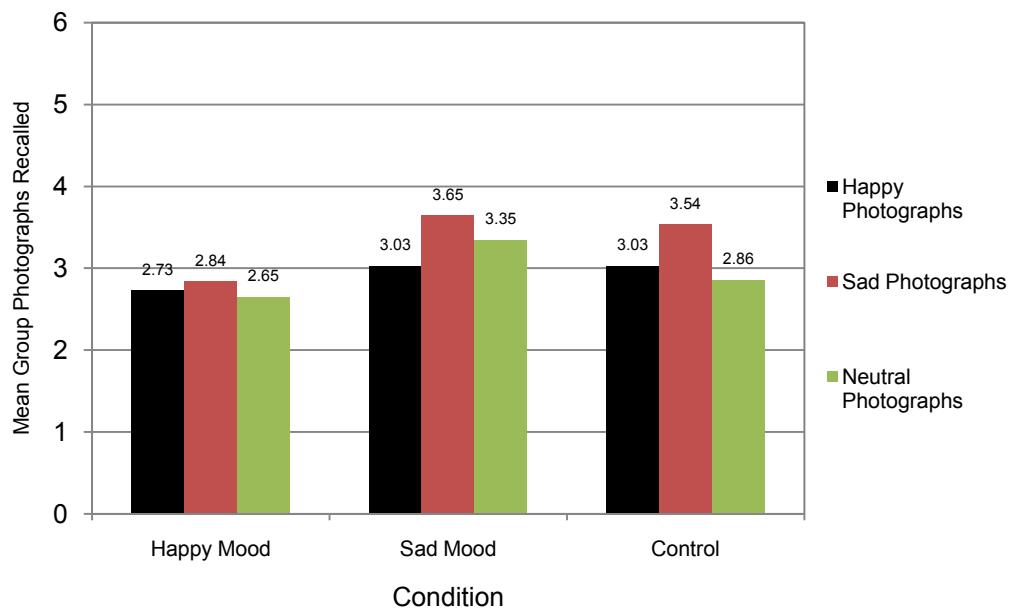


Fig. 2. Mean group photographs recalled by mood condition and photograph type

Main effects for mood ($P = .02$) and photograph type ($P = .002$) were statistically significant, but the interaction effect was not statistically significant ($P = .26$). Possible range of photographs recalled was 0-6 per group

The goal of the current research was to explore the effects of emotional priming on the memory of emotional (happy and sad) and non-emotional photographs. It was hypothesized that participants in the happy mood condition would remember more photographs overall than participants in either the sad mood or control conditions. It was also hypothesized that participants in the happy mood condition would remember more happy photographs and participants in the sad mood condition would remember more sad photographs. The results of the current study showed that the happy mood group, on average, remembered fewer photographs of each type than either the sad mood group or the control group. This does not support the hypothesis, but may extend the theory that positive mood broadens attention [9]. In a large group setting, attention in the happy mood group may have been broadened to the point of disrupting encoding of the intended stimuli. In recent research, Henkel found that museum patrons who took whole photographs of museum art remembered less about the art than those who did not take photographs [21]. However, if people zoomed in on parts of the art with their camera, the “photo-taking-impairment effect” was eliminated and they remembered more details about the object [21]. Attention can certainly affect memory.

Participants in the happy mood condition may not have been as focused because they were interested in continuing the reflection [13], allowing them to become distracted by their thoughts and others around them rather than the stimuli [4]. Participants in the sad mood group may have been trying to distract themselves from the sad memory with the pictures allowing for greater retention of the stimuli. People do not like to experience negative feelings and thoughts. So, instead of focusing on the negative event they wrote about, participants may have concentrated on the details in the photographs [12]. They may have done this as a distraction so that their minds did not continually replay the sad events they wrote about.

The sad mood group remembered more photographs overall than either the happy mood or control groups. However, this difference was only significant between the happy and sad groups. As expected, the control group scored in the mid-range between the happy and sad groups. The sad mood group, consistent with the hypothesis, remembered more sad photographs than the happy mood group. Participants in the sad mood group may have experienced a narrowing of attention allowing them to remember more than the happy mood group. They may also have experienced greater negative rumination [22,23,24], which focused their attention on sad photographs or caused difficulty in focusing on happy photographs. Additional information about personality and coping styles may help explain how sad mood priming affects memory of emotional photographs [22,23,24].

This research contributes to a better understanding of the effects of emotional states on our memory. These results also support the narrowing of attention theory for negative moods. Surprisingly, the sad mood group also remembered more neutral photographs than the happy mood group. At least in a college setting, negative moods may increase retention of information in the classroom. More research is needed in this area to check for generalizability to other settings.

This research provides additional evidence in the debate over whether emotions actually enhance memory [5]. The happy mood group's memory enhancement may not be effective in the large group setting; however, in the sad mood group there is some evidence that memory was enhanced. It may be that specific emotions aide memory while others hinder memory. This study may be beneficial to individuals in advertising as well as those in management. Individuals in the advertising business could use this research to plan emotional primes in their advertising and choose advertising spots for their merchandise.

The research suggests that advertising professionals should assess the mood of the show or movie that their advertisements would be interrupting. If they find the show to have put people in a negative mood, then they should associate the advertisement with either a negative or neutral mood. Management personal could use this research to design company meetings that will increase retention of important information. Positive and negative affect are an important part of an individual's psychological state that should be considered before speaking to employees. Often workers tune-out mentally before a meeting even begins. Cognitive disengagement can be overcome with knowledge from emotional research such as the current study.

This study has some limitations. The most significant limitations are the sample and large group setting. The sample is a limitation because it consisted of only college students and the majority was women majoring in psychology. This limits the generalizability of the results because it is only representative of a small section of the population. The large group setting could be a limitation because with any large setting there are more distractions and increases in time between each part of the study. This is a limitation that also serves as a benefit of the study. In real world situations people are rarely without distraction while studying or recalling information. The effects we found can be generalized to not only the college classroom settings, but also any other setting including retention of visual stimuli and college level individuals.

More research is needed to investigate individual differences, such as personality, and check for generalizability to people outside the college settings. It would be beneficial to include more minority individuals as well as younger children as participants in future research. Testing in a primary school, comparing different grade levels, would add greater generalizability to the study. Investigating an older sample of participants would show whether these results can extend to the larger population. Also, more research is needed on the effects of settings and priming on emotions. For future research it would be beneficial to consider different emotional states. For example, it would be interesting to explore how anger and fear or joy affects memory. Also, further research with different priming methods as well as different types of stimuli, such as real objects or people, should be studied. A similar study should be conducted in a lab based or casual setting to see if the results would be the same.

4. CONCLUSION

The current research is important to the psychological theories of attention, memory, and emotions. This study shows that being in a sad mood may narrow attention to improve memory of photographs, while being in a happy mood may broaden attention and impede memory of photographs in a group setting. Regardless of mood state, participants also remembered more sad photographs than happy and neutral photographs. In the future, more research is needed with different priming methods, stimuli, and group sizes.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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