Spring 2016

The Influence of Emotion on Memory for a Crime

Taylor Langley

THE INFLUENCE OF EMOTION ON MEMORY FOR A CRIME

by

TAYLOR LANGLEY

(Under the Direction of Rebecca Ryan)

ABSTRACT

Researchers have reported errors in recall or recognition of witnessed events, accounting for the most common cause of false convictions of innocent people. Tiwari (2010) indicated that 25% of suspects who were identified in a line-up were actually innocent. Jurors are strongly influenced by eyewitness testimony and this can lead to false convictions. The validity of eyewitness identification is critical in cases in which it is used as evidence. In the current study we examined specific emotion states by inducing fear, surprise, and neutral moods. We hypothesized that participants in the Fear group would be least susceptible to the effects of exposure to misleading details, and that women would show higher levels of accuracy for details related to persons in a scene, and men higher levels of accuracy for spatial details. Participants were randomly assigned to one of the three mood groups, mood was manipulated, they viewed an image of a crime scene, were exposed to misleading details, completed a manipulation check, and lastly their memory for the scene was assessed. Results revealed no significant group differences on the number of correctly answered misleading items. The findings suggest that experiencing these specific mood states during encoding does not result in significant differences in later memory recall.

INDEX WORDS: Memory, Emotion, Mood, Eyewitness testimony, Eyewitness memory, Gender

THE INFLUENCE OF EMOTION ON MEMORY FOR A CRIME

by

TAYLOR J. LANGLEY

B.S., Florida State University, 2014

M.S., Georgia Southern University, 2016

A Thesis Submitted to the Graduate Faculty of Georgia Southern University in Partial
Fulfillment of the Requirements of the Degree

MASTER OF SCIENCE

STATESBORO, GEORGIA

THE INFLUENCE OF EMOTION ON MEMORY FOR A CRIME

by

TAYLOR J. LANGLEY

Major Professor: Rebecca Ryan

Committee: Amy Hackney

Larry Locker

Electronic Version Approved:

May 2016

ACKNOWLEDGEMENTS

I would certainly be remiss to not first thank God for the knowledge, strength, and perseverance to complete this project. Though things were tough at times, I was always comforted knowing that He had equipped me with the necessary abilities to conquer anything set before me.

Next, I would like to thank my mother for being my rock and always pushing me to pursue my dreams. I thank you for your unconditional and endless love and support, always motivating me to keep going. I'd also like to thank my loved ones, including close friends and family for the unwavering support, kind words, and simply being a listening ear, allowing me to vent at times. I can't imagine experiencing these past two years without my cohort members – a crazy, yet incredibly intelligent and talented group of people. Thanks to you guys for being encouraging and a great support system as we all figured out the ins and outs of grad school.

Lastly, I would like to thank my thesis advisor, Dr. Rebecca Ryan for your guidance, support, and long hours spent reading, revising, editing, and assisting me along the way. Thank you for pushing me to become a better researcher and writer. I'd also like to thank Dr. Amy Hackney and Dr. Larry Locker for serving on my thesis committee and contributing invaluable feedback to the finished product. Also, a huge thanks goes to my supportive professor and mentor, Dr. Jeff Klibert for mentoring me and being a positive resource as I finished my thesis and preparing me for my doctoral studies. Also, thank you to Dr. Meca Williams-Johnson for your support. Thanks to everyone that played a role in any way in helping me finish my thesis and supporting me throughout my graduate studies as I complete my Master's and move forward to my doctoral program.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1
INTRODUCTION

Every year, innocent people are found guilty of crimes they did not commit. Researchers have reported errors in recall or recognition of witnessed events and in many instances, the witness errors account for the most common cause of false convictions of innocent people. Jurors weigh eyewitness testimony very high in their decision-making, leading to false convictions. The validity of eyewitness identification evidence is critical in cases in which it is used as evidence and very powerful in criminal cases. The current study focused on the impact of specific emotional states on memory performance when recalling information from a scene depicting a crime. Research on the impact of emotion and gender on memory performance within a legal context can provide insight into how eyewitness testimony is viewed and used in a courtroom setting, which could ultimately affect sentencing. The current study addressed how emotional arousal may affect the accuracy of eyewitness memory.

Houston, Clifford, Phillips, and Memon (2013) have called for research that makes a greater distinction between various emotional states. It was anticipated that the in-depth research in the current study would reveal differences in these various emotional states, which can ultimately have implications in the criminal justice system.

Generally, researchers have found that negative emotional content (Houston et al., 2013; Kensinger & Corkin, 2003) or being primed with negative emotions (Kern, Libkuman, Otani, & Holmes, 2009) results in better memory recall. Also, research on gender differences in memory performance has revealed that women are more likely to remember female-oriented and more recent details of an event compared to men who are more likely to remember spatial details (Horgan, Mast, Hall, & Carter, 2004; Loftus, Banaji, Schooler, & Foster, 1987). This research will be discussed further in subsequent sections.

Emotion and Memory

    Memory for Emotional Stimuli. Emotional or arousing information, specifically negatively arousing information is more salient and easily retrieved than neutral or positive emotional information. In a study conducted by Kern et al. (2009), participants viewed negative arousal, positive arousal, or neutral images, depending on their condition. After engaging in a free recall memory test, results revealed that participants recalled more of the high negative arousal slides compared to the positive and neutral slides. Participants provided more detailed and accurate accounts for each negatively arousing slide. Similar results were also found by Levine and Edelstein (2009), who also found better memory for emotionally related events and stimuli compared to neutral events, with those in negative conditions providing better memory recall compared to those in positive conditions.

    It has been noted that emotion might serve as a cue at retrieval, making retrieval for emotional information easier than retrieval of neutral information. After viewing slides of negative, positive or neutral images, participants engaged in a free recall task, revealing better recall for negative emotional images compared to positive and neutral (Kensinger & Corkin, 2003). Sharot and Phelps (2004) also found participants' memory for neutral stimuli such as neutral words, decreased over time and memories for arousing stimuli remained the same or improved over time.

    Exposure to a negative event (witnessing a crime) can result in better memory for one aspect about the crime, while impairing memory for another aspect in comparison with those who were exposed to a neutral event as demonstrated by Houston et al. (2013). Participants viewed a video of a negative emotional event or a neutral emotional event, and those who witnessed a negative emotional event, provided a more complete and accurate description of the

scene compared to participants who viewed a neutral event. Researchers measured both completeness and accuracy of recall. The content was coded according to the four categories of details (environmental, critical incident, perpetrator and victim). Results revealed that in terms of completeness of recall, participants who viewed the mugging provided a more complete description of the perpetrator compared to participants who viewed the neutral video. Therefore, based on previous research, it is anticipated that negative emotional information will result in better memory than positive emotional information.

Impact of Mood States. Induced emotional arousal may also affect the accuracy of eyewitness memory. Mittal, Singh, Arya, and Tiwari (2013) conducted a study to examine the influence of mood and emotional arousal on the accuracy of eyewitness memory. Participants were randomly assigned to either low or high emotional arousal groups. The participants read verbal narratives about the crime that induced either low emotional arousal or high emotional arousal then viewed a video depicting a bank robbery. Later, they were tested for memory of immediate central and peripheral details and they were also tested a week later for delayed recognition. This procedure consisted of participants indicating whether or not a detail was present from the crime scene based on a pre-set list of statements containing central and peripheral details about the crime scene. Results showed that the two groups differed significantly on their recognition of central details but not peripheral details. With immediate recall, the participants in the high arousal condition recognized significantly more central details compared to the participants in the low arousal condition with immediate recall, but the groups did not differ on recognizing peripheral details. Also, participants in the high arousal condition provided significantly higher ratings of the vividness of the event with immediate recall, compared to those in the low arousal condition.

Drace (2013) examined how affect influences mood-congruent memory recall, specifically with autobiographical memories. In this study, the mood induction occurred before exposure to stimuli, examining mood and memory. Participants were randomly assigned to a positive mood condition or negative mood condition and were asked to look at a set of pictures and remember details of each, while listening to one of the two classical selections, Mozart's *Eine Kleine Nachtmusik* and *Divertimento #136* and Vivaldi's *Mandolin Concertos* for positive mood and Mahler's *Adagietto* for negative mood. After mood induction, participants' mood was assessed by completing the Brief Mood Introspection Scale (BMIS) and they were asked to recall a memory of a specific event that happened to them during the last year and write about it. Lastly, participants viewed a series of pictures and were asked to identify the pictures they had previously seen during the mood induction task. Results revealed that the valence of the induced mood was congruent with the valence and affect of the participants' autobiographical memories.

Forgas, Laham, and Vargas (2005) stated that mood may influence memory at any of the three stages: encoding, storage, and retrieval. Encoding occurs when the event is witnessed. Storage of the witnessed information occurs when the information is retrieved and judgments are made. Later, misleading information may influence a person, and lastly, during retrieval, the place in which a person makes decisions based on the information may have an influence. When experiencing negative moods, our processing involves a very careful focus on the actual details of the external world. Forgas et al. (2005) hypothesized that negative mood would facilitate a more externally oriented, bottom-up processing style, reducing the likelihood that misleading information would influence eyewitness recollections. The Affect Infusion Model provides reasoning and explanation on how mood can affect one's ability to process information. Mood tends to be more salient in complex situations that require more cognitive processing. According

to the model, affect infusion is described as a process that determines the degree to which mood can affect our judgment, and affect, including mood and emotion, exerts much influence not only on information processing but on the resulting response behaviors as well (Forgas, 1995). The Affect Infusion Model (AIM) is based on a multilevel process consisting of four levels: direct access, motivated, heuristic, and substantive processing. Substantive processing involves the most elaborative cognitive processing and explains that people tend to spend more time attending to and encoding mood-congruent information compared to mood-incongruent information. Participants in a negative mood would be more attentive to situational details and less influenced by misleading information (compared to people in a positive mood), which should improve eyewitness accuracy.

Predictions for Experiment 1 were that being in a good mood would increase and bad mood would reduce susceptibility to misleading information. They directly tested whether positive or negative moods would influence the incorporation of false information into eyewitness reports. Participants viewed an image of either a negative event (car crash) or a positive event (scene from a wedding party). After a 45-minute distractor task, participants engaged in a mood induction task. For the mood induction task, participants were asked to identify a specific social event that made them either happy or sad, and for the neutral condition they were asked to describe their activities from that morning while getting ready. According to Forgas et al. (2005), this procedure has been found to be very effective in inducing negative or positive mood states. After the mood induction procedure, some of the participants were exposed to misleading information by completing a brief questionnaire about the scenes they saw earlier (which either contained misleading information or not).

After a 45-minute interval of distractor tasks, participants answered 12 true/false

questions about scenes they viewed. There were four questions that evaluated memory for correct details, four questions for false details that were presented as misleading information, and four questions that evaluated incorrect details about the scene. Each question evaluated memory for a specific detail and three scores were calculated: number of correct details recalled, number of misleading details recalled, and number of incorrect details recalled. The results showed a significant interaction between mood and exposure to misleading information. Participants in a negative mood were less susceptible to misleading information than those in positive or neutral moods. The main hypothesis that positive moods promote and negative moods inhibit a particular information processing style that facilitates the incorporation of misleading details into eyewitness accounts was supported.

Experiment 2 examined whether moods can have a significant impact on the accuracy of eyewitness reports. Participants witnessed what they believed to be an unexpected 5-minute aggressive encounter between a lecturer and a female intruder who entered the classroom. One week later, they watched a short video that induced mood. During this mood induction task, they watched scenes from films to induce happy, neutral, or sad moods. For positive mood, a British comedy series was used, for neutral mood, a program on architecture was used, and for negative mood, a film dealing with death from cancer was used. Participants then rated their current mood after viewing whichever film they saw and then after an interval of 45 minutes, they answered four questions that either contained misleading information or no misleading information about the classroom incident. After engaging in various distractor tasks for 45 minutes, they completed a questionnaire containing 12 true/false questions consisting of four about correct details, four questions about the misleading information, and four questions about incorrect details. There was a significant interaction between mood and the presence of misleading information on memory

recall. Participants in a positive mood showed an increase in susceptibility to misleading information. Participants in a negative mood showed a decrease in susceptibility to misleading information. Mood induction did not have an effect on recognizing correct or incorrect details. Overall results from Experiment 2 aligned with Experiment 1.

Gender Differences in Memory

In eyewitness memory and eyewitness testimony research, it has been found that the gender of the witness plays a major role due to men and women focusing on different details. Women have been found to excel on verbal memory tasks such as quickly retrieving words starting with a certain letter and men on visuospatial memory tasks such as understanding irregular rotated figures (Herlitz & Rehman, 2008).

Loftus, Banaji, Schooler, and Foster (1987) examined gender differences in memory for complex events such as remembering specific details of an event. They hypothesized that neither gender has superior memory ability overall, but would differ in terms of what is remembered from studies of general eyewitness accuracy. They specifically stated that women would recall more recent memories than men, women would be more likely than men to mention their feelings, which would result in women recalling more emotional memories and that men would be more likely than women to provide spatial information while describing their memories. After having participants view sets of female and male faces, results showed women were better at recognizing faces they had previously seen, which relates to potential gender differences in eyewitness testimony. They also found that women generated more recent memories and memory associations more quickly than men. The men were more likely to include spatial information in their descriptions of a scene.

Research has found both men and women having more accurate memory about female targets from a set of crime scene slides (Horgan et al., 2004). Their participants were shown slides of various scenes and told to focus on the targets. The appearance accuracy scores of men and women did not differ significantly in their first study, in which participants were told to pay attention to each individual in the scene because their memory would be tested. In their second study, participants were told to focus on individuals in each scene displayed on the slide because they would be tested on the appearance of the individuals. Results revealed women having a more accurate memory for targets' appearance than did men. They also found women have better memory for information about others, specifically, their faces, names, and facts about their life. Women were also better at recalling female-oriented items such as women's clothing. Their findings suggest that depending on the nature of the scene, men and women will vary in their ability to remember different aspects.

Overall, Horgan et al. (2004), Herlitz and Rehman (2008), and Loftus et al. (1987) found gender differences in aspects of what is remembered, specifically, that women perform better on verbal memory and facial recognition, whereas, men were found to be better at spatial memory.

CHAPTER 2

THE CURRENT STUDY

Though many researchers have focused on memory for varying emotional stimuli, research

has yet to examine fear and how experiencing this emotional state may impact memory

pertaining to a crime. Emotion is both the state of mind a person is in at a particular moment as

well as the physiological response a person is experiencing at that time. We specifically

examined how experiencing fear impacts memory for different aspects of a crime scene as

compared to experiencing a neutral mood or a surprised mood state. Gender differences in

memory were also examined. Fear can be defined as an unpleasant emotional state consisting of

psychological and physiological responses to danger or threat. Fear and surprise are considered

to be basic emotions as proposed by Paul Ekman (Dagliesh & Power, 1999). Basic emotions are

emotions that have evolved over time to be beneficial in adapting to fundamental life tasks and

include anger, disgust, fear, happiness, sadness, and surprise. These emotions are described as

basic because they contain characteristics that distinguish them from other emotions. Their

characteristics include distinctive universal signals, distinctive physiology, automatic appraisal,

distinctive universals in antecedent events, distinctive appearance developmentally, presence in

other primates, quick onset, brief duration, unbidden occurrence, distinctive thoughts, and

distinctive subject experience (Dagliesh & Power, 1999).

Statement of the Problem

The current study examined the emotions of fear and positive/happy surprise. Therefore, Fear

and Surprise were used because of their distinctiveness within the nine categories. This study

added new information to our understanding of memory by examining both gender differences

and the impact of emotion on memory and it addressed the recommendation by Houston et al.

(2013) to examine the effects of specific emotions on the retrieval of information. If a person is currently experiencing a specific mood such as fear, being in this mood state and experiencing this emotion may impact how they encode, store, and retrieve information they are exposed to while in that mood state.

Aims and Hypotheses

Affective infusion refers to the way information is selected, retrieved, and interpreted. The Affective Infusion Model (AIM), proposed by Forgas (1995), addresses the complex character of social judgments and the different roles affect plays in informing judgments depending on processing strategies. Consequently, various emotional states may affect one's processing and recall of a specific event. Hypothesis one stated that participants in the Fear group will be less susceptible to misleading details when recalling memory of a crime scene as compared to Surprise and Neutral groups based on the findings of Forgas et al. (2005). According to results from the study, the happy (positive) mood increased susceptibility to incorporating misleading information into recall, while the sad (negative) mood decreased susceptibility. Based on research on mood-congruent memory and theoretical implications from the Affect Infusion Model, our prediction for the current study was that participants in the Fear group will be less susceptible to misleading information and participants in the Surprise group will be more susceptible. Mood-congruent processing occurs when material is selectively encoded or retrieved while individuals are in a mood state consistent with the affective tone of the material (Dagliesh & Power, 1999). Material is learned better because the affective tone of the material is consistent with the individual's mood state. This research supported my hypothesis that participants in the Fear group would be least susceptible to misleading information because being in the fear state most closely resembles the affective tone of the car crash scene image that the participants

viewed. It was anticipated that participants in the Fear group would spend more time studying the material that was congruent with their mood state and less time attending to the incongruent material.

Per Loftues et al. (1987) and Herlitz and Rehman's (2008) findings, hypothesis two stated that women would focus on and report more details related to persons in the scene and men would be more likely to focus on spatial details of the scene.

CHAPTER 3

METHOD

Participants

The participants included 229 (143 females and 84 males) undergraduate students from a

mid-size Southeastern university. Ages ranged from 18 to 30, ($M = 19.29$, $SD = 1.40$). There

were 129 freshmen, 49 sophomores, 40 juniors, and 10 seniors. They were recruited by signing

up on an on-line recruitment system used within the department. Participants received course

and/or extra credit for participating. The groups included 75 participants in the Fear group, 80 in

the Surprise group and 73 in the Neutral group.

Materials

Crime Scene Picture. Participants viewed a color image of a complex scene of a car

crash for a period of 1 minute (see Appendix A). Similar to the stimuli used in Forgas et al.

(2005) this image displayed a realistic and complex car crash. Participants were told to:

"Look at this picture as if you unexpectedly encountered this event while walking on the

street" (Forgas et al., 2005, p. 577).

Mood Induction. Participants engaged in an autobiographical mood induction task in

which they were asked to re-experience and write about a specific scary, surprising, or neutral

event from their lives. A similar procedure was used to induce mood states in the Forgas et al.

(2005) study. For the Fear group, participants were asked to "identify a personal experience that

occurred in your life in which you were very afraid. Picture the event as if you were experiencing

it right now in the moment, think of thoughts and feelings that you felt at that time. Imagine and

describe the event as vividly as possible". For the Surprise group, participants were asked to

"identify a personal experience that occurred in your life in which you were very surprised in a

positive/happy way. Picture the event as if you were experiencing it right now in the moment, think of thoughts and feelings that you felt at that time. Imagine and describe the event as vividly as possible." For the Neutral group, participants were asked to describe their activities they engaged in while getting ready that morning.

Misleading Information. All participants answered four questions containing misleading details about the crime scene; similar to the technique used by Forgas et al., (2005) (see Appendix B) (e.g. "Did you notice the broken guardrail blocking traffic on *both sides*?"), with the information in italics representing the planted, misleading information. These questions were misleading because they provided information about the observed scene that was not part of the original event.

Memory Measures. Participants answered 12 true/false questions including four that contained correct information, four that contained the misleading information, and four that contained incorrect information about the crime scene (see Appendix C). A question containing misleading information included the planted, misleading details from the previously answered questions that were not actually part of the scene. A question containing incorrect information included details about the scene that were made up.

Manipulation Check. The Positive and Negative Affect Scale (PANAS) (Watson, Clark, & Tellegan, 1988) was administered as a manipulation check to assess the effectiveness of the mood induction. The PANAS is a psychometric scale with 20 items used to measure positive and negative affect. Participants rated their current mood on a Likert scale ranging from 1 (very slightly or not at all) to 7 (extremely) on various emotions including items such as proud, ashamed, interested, afraid, and excited.

Procedure

Data was collected in a group setting ranging from 1-10 participants in a computer lab with the image displayed on an overhead projector. Presentation of stimuli was uniform for all participants. Each participant was randomly assigned to the Fear group, Surprise group, or Neutral group by using a random digit tracker. After reading and signing informed consent forms, participants completed a demographics questionnaire to provide information about their age, gender, and current classification in school (see Appendix D). To induce the specific mood in each participant (depending upon the condition), they engaged in the autobiographical mood induction task, which was written out in the study booklets provided to each participant. The duration of the mood induction task lasted until the last participant completed the task.

After the mood induction, participants viewed the image of a complex vehicular crime scene for 1 minute. Participants engaged in a series of distractor math tasks for an interval of 15 minutes to ensure that the details from the image were no longer stored in short-term memory, then they were asked to answer four questions containing misleading information about the car crash scene. Mood induction occurred before viewing the image, as was the case in the procedure used by Drace (2013) and used in the current study in order to assess the effects of mood state at the point of encoding. Next, they completed the PANAS as a manipulation check, and after another delay participants engaged in another set of distractor tasks for 15 minutes (see Appendix E for both sets of math problems). Lastly, their memory of the crime scene was assessed with the series of 12 questions about the scene. Upon completion, participants were given a debriefing form with contact information informing them that they will be made aware of the purpose of the study after data collection is complete. If participants did not have any questions, they were thanked and excused to leave.

CHAPTER 4

RESULTS

Manipulation Check MANOVA Analyses

To assess the effectiveness of the manipulation, a MANOVA was conducted comparing

the Fear, Surprise, and Neutral groups on the PANAS items. Crawford and Henry (2004) and

Watson, Clark, and Tellegan (1988) reported on a factor analysis conducted with the PANAS

items and noted that the items that are considered to assess positive affect include interested,

attentive, excited, enthusiastic, inspired, proud, determined, strong, and active and the items that

are considered to assess negative affect are scared and afraid. This test revealed only a significant

difference on the Alert item, $F (2, 220) = 3.25$, $p = .04$, partial-eta$^2 = .029$, Wilk's $\Lambda = .893$.

Specifically, this difference was present between the Fear and Neutral groups, as evidenced by a

Bonferroni post-hoc comparison. The descriptive and inferential statistics for all items are

reported in Tables 1, 2, and 3.

Misleading Memory MANOVA

To address the first hypothesis, a MANOVA was conducted comparing the Fear,

Surprise, and Neutral groups on the accurate, inaccurate, and misleading items from the memory

measure. The multivariate test revealed no significant differences between the groups on the

number of correctly answered accurate $F (2, 225) = 1.79$, $p = .065$, partial-eta$^2 = .016$,

misleading $F (2, 225) = .596$, $p = .55$, partial-eta$^2 = .005$, or inaccurate items $F (2, 225) = .756$, p

$= .471$, partial-eta$^2 = .007$. On the accurate items the Fear group ($M = 2.83$, $SD = .71$) responded

similarly to the Neutral group ($M = 2.78$, $SD = .82$), and the Surprise group ($M = 2.6$, $SD = .84$).

On the misleading items the Neutral group ($M = 1.70$, $SD = .98$), responded similarly to the

Surprise group ($M = 1.66$, $SD = .89$), and the Fear group ($M = 1.55$, $SD = .79$). On the inaccurate

items the Fear group (M = 3.41, SD= .76), responded similarly to the Surprise group (M= 3.33, SD = .82), and the Neutral group (M= 3.25, SD= .89).

MANOVA

In order to assess whether or not participants passed the manipulation check, another MANOVA was conducted including just participants who answered a two or above on the "Scared" and "Excited" PANAS item by filtering out the sample, still including participants from all three groups, Fear, Surprise, and Neutral. Results revealed no significant differences between the groups on the total number of correctly answered accurate F (2,20) = .859, p = .441, partial-eta^2 = .092, misleading F (2,20) = .305, p = .741, partial-eta^2 = .035, or inaccurate items F (2,20) = .046, p = .956, partial-eta^2 = .005, though it should be noted that the number of participants who met this criteria was very low. Based on this analysis, 209 participants were filtered out, leaving a sample of 20 participants. On the accurate items the Fear group (M = 2.57, SD = .79) responded similarly to the Neutral group (M = 2.50, SD = 1.05), and the Surprise group (M = 2.00, SD = .82). On the misleading items the Surprise group (M = 1.57, SD = 1.13) responded similarly to the Fear group (M = 1.29, SD = .76), and the Neutral group (M = 1.17, SD = .98). On the inaccurate items the Fear group (M = 3.29, SD = 3.14) responded similarly to the Neutral group (M = 3.17, SD = .89), and the Surprise group (M = 3.14, SD = .69).

Gender Differences Chi-Square Tests

To address the second hypothesis, a series of four chi-square analyses were conducted. These assessed the association between gender and accuracy on the two accurate spatial items and the two accurate person items from the memory measure. One of the four chi-square analyses revealed an association that approached significance between gender and the responses on an accurate person item X^2 (1, N = 226) = 3.72, p = .054. This item was question number ten

in the memory measure (see Table 2). Thirty-two percent of men were correct, and 68% were incorrect on this item. Twenty-one percent of women were correct, and 79% were incorrect on this item. The other three chi-square analysis did not reveal significant associations with gender for the other accurate person item (question #5) X^2 (1, $N = 227$) = .35, $p = .556$, accurate spatial item (question #1) X^2 (1, $N = 227$) = .061, $p = .804$, or accurate spatial item (question #7) X^2 (1, $N = 227$) = .873, $p = .350$.

Repeated Measures Mixed ANOVA

A 2 (gender) X 2 (spatial/person item type) mixed ANOVA was also conducted to examine the second hypothesis. The results indicated that there were significant differences present F (1, 225) = 6.42, $p = .012$, partial-eta^2 = .028. The descriptive statistics revealed that men had higher levels of accuracy on the correct person items from the memory measure ($M = 2.76$, $SD = .94$) compared to women ($M = 2.52$, $SD = .89$), $p = .05$, and women had higher levels of accuracy on the correct spatial items ($M = 5.20$, $SD = 1.21$) compared to men ($M = 4.92$, $SD = 1.30$), $p = .10$. Simple main effects analysis showed significant differences between person item type and gender.

Misinformation Effect ANOVA

The data also presented the opportunity to assess for the presence of the misinformation effect. An ANOVA was conducted comparing the total number of correct responses on the accurate, inaccurate, and misleading items from the memory measure. To clarify, this comparison included all the participants and compared their responses on each of the three different item types from the memory measure. This test revealed evidence that the misinformation effect occurred. The misinformation effect occurs when a person's recall of an event or memory becomes less accurate due to exposure to post-event, usually misleading,

information. The results indicated that significant differences were present, F (2, 681) = 240.63,

$p < .001$, partial-eta^2 = .41. Bonferroni post-hoc comparisons revealed significant differences

between all three of the item types. Accurate-misleading (*MD* = 1.09, *SEM* = .078, *p* = .000),

accurate-inaccurate (*MD* = -.60 *SEM* = .078, *p* = .000), and misleading-inaccurate (*MD* = -1.69,

SEM = .078, *p* = .000). The descriptive statistics revealed that the participants displayed the

highest level of accuracy on the inaccurate items (*M* = 3.33, *SD* = .825, *p* < .000) followed by the

accurate items (*M* = 2.73, *SD* = .793, *p* < .000), and they performed the worst on the misleading

items (*M* = 1.64, *SD* = .887, *p* < .000), thus providing evidence of the misinformation effect.

CHAPTER 5

DISCUSSION

Our two hypotheses for the current study were that participants in the Fear group would be least

susceptible to misleading details of a crime scene compared to the Surprise and Neutral groups

and that women would show higher levels of accuracy for details pertaining to persons of the

scene and men would show higher levels of accuracy for spatial details. We examined the

strength of the manipulation as well as the presence of the misinformation effect occurring. We

interpret these findings in relation to the hypotheses in the sections below.

Memory Measure

We hypothesized that participants in the Fear group would be the least susceptible to

exposure to misleading details about a crime scene as compared to the other groups. Contrary to

the hypotheses, there were no significant differences between the three groups on the total

number of correctly answered misleading items. In relation to previous research findings, Forgas

et al. (2005) conducted a similar study in which they found positive affect to promote and

negative affect to inhibit the incorporation of misleading details into memory recall of an event.

Specifically, they found their negative mood condition was significantly lower in susceptibility

to misleading information compared to both their positive and neutral conditions. Though we did

not see significant differences between the Fear and Surprise groups on the PANAS, we did see a

significant difference between the Fear and Neutral groups on levels of alertness. Thus, not

seeing a significant difference in susceptibility to misleading information between our Fear and

Neutral groups does not align with previous research findings. Important differences in the

current study include the more specific type of emotion that was manipulated (Fear and Surprise

in place of more basic happy/positive and sad/negative affect) and the mood manipulation

occurring before exposure to the target stimuli (the picture of the car crash). Specifically, although this study followed a similar procedure as conducted by Forgas et al. (2005), there was a difference in the current study in regards to the specific order of procedure. In the current study, mood induction occurred first, then exposure to the stimuli. Forgas and colleagues had their participants view the image first then engage in the mood induction task. This may have impacted the findings by altering the order of processing of information that was presented to participants, leading to differences in recall.

We also examined the total number of correctly answered inaccurate and accurate items from the memory measure. Though no significant differences were found when comparing the groups on the accurate items. The descriptive statistics revealed that the Fear group performed the best and the Surprise group performed the worst on the accurate items. Similar to previous findings, Kern et al. (2003) showed that being in a negative arousing condition produced better memory recall than being in a positive arousing condition based on a different level of processing that occurs when placed in different emotion or mood states. Forgas et al. (2005) also addressed many issues regarding memory performance between negative and positive mood states. It has been suggested that positive moods may lead to less effortful and systematic processing strategies, whereas negative moods are thought to facilitate more careful, vigilant and systematic processing, thus leading to better memory recall when in a negative mood state. A motivational explanation proposed by researchers suggests that happy people may try to preserve their good mood by avoiding cognitive effort, also known as mood maintenance, and dysphoric or individuals in a more negative state may try to increase their cognitive effort to improve their aversive mood state (Clark & Isen, 1982; as cited in Forgas et al., 2005, p. 576). Again, though the PANAS did not reveal significant differences between the Fear and Surprise groups, perhaps

a difference existed that was not detected with the specific items included in the PANAS. Forgas et al. (2005) found mood did not impact recognition memory for correct and incorrect details, only for misleading items. Although the terms "emotion", "affect", and "mood" are used interchangeably, they do differ. Affect is a more general, umbrella term including both emotion and mood. Emotion has been defined by having the properties of a reaction or an intense response to a stimulus, and mood is a more subtle, longer-lasting and less intense experience that tends to be more general (Dagliesh & Power, 1999). Therefore, there has not been a distinct difference in prior or current research in regards to manipulating "mood" or "emotion" and/or inducing "mood" or "emotion".

Gender Differences

We also predicted that women would be more likely to accurately recall person details of the crime scene and men would accurately recall more spatial details. Of the four chi-square analyses, only one revealed a significant association between gender and accuracy, though the descriptive statistics were not in the hypothesized direction, as proportionally more men answered this person item correctly. This result does not align with previous research and findings on gender differences and memory. According to Loftus et al. (1987) neither gender has superior memory ability overall but differ in terms of what is remembered. Horgan et al. (2004), Herlitz and Rehman (2008), and Loftus et al. (1987) all examined gender and memory, finding similar results of gender differences in aspects of what is remembered, specifically, that women perform better on verbal memory and facial recognition, whereas, men were found to be better at spatial memory. However, a mixed ANOVA revealed a significant difference between gender and item type. Results revealed that men had higher levels of accuracy on the correct person items from the memory measure compared to women who had higher levels of accuracy on the

correct spatial items compared to men. Perhaps the unequal number of women and men impacted our analysis. Also, though this item was originally considered to be a person item as it pertained to whether or not a fireman was on the scene, perhaps the item is actually more spatial in nature due to the nature of the scene and the item including whether or not the fireman was holding a fire extinguisher.

Misinformation Effect

Investigating the presence of the misinformation effect was not included in the original hypotheses, but in taking advantage of the opportunity to assess it, the results revealed that there was indeed evidence of the misinformation effect. The misinformation effect is a memory-biasing effect of post-event information that suggests that the original memory trace becomes overwritten by the misinformation received later on (Loftus & Hoffman, 1989). Acceptance of the misinformation effect also plays a major role in memory impairment. According to Loftus and Hoffman (1989), different processes are responsible for inaccurate reporting depending on the conditions of acquisition, retention, and retrieval of information. Similar to findings from Forgas et al. (2005), the misinformation effect may have occurred in the current study by the mere presence of exposure to misleading information leading participants to remember specific details as part of the original scene.

Limitations

A potential limitation of the current study is using the PANAS as the manipulation check to assess the effectiveness of the mood induction. We may have not assessed all possible differences in mood state between the groups. It is possible that participants were experiencing emotions that are not included in this measure. It also did not assess the time frame in which participants were in that mood. The PANAS is also a self-report measure. With self-report

measures, participants may be more inclined to answer questions or give responses that they think is the "correct" way to answer and may not respond objectively and without bias. The manipulation check used by Forgas et al. (2005) consisted of participants answering a post-experimental questionnaire consisting of distractor items including "Did you find the task difficult?" or "Have you done similar tasks?" and rating their mood on seven-point happy-sad and good-bad scales. We must also consider the fact that perhaps the mood manipulation was not sufficient to create significant differences in mood state between all of our groups. Another potential limitation in regards to the sample is that there were substantially more women than men, which may have impacted our findings in regards to the association between gender and accuracy on the person and spatial items on the memory measure.

Future Directions

The current research extended the scope of research in this area by examining specific types of mood states as called for by Houston et al. (2013), by looking at positive surprise and the state of fear. Further finer distinctions with specific mood states are needed. Researchers can explore a variety of more complex mood states. Future research can also investigate if there is an effect of mood-congruent memory present within a similar procedure. One can conclude that fear may eat up some of the cognitive resources needed for accurate memory recollections, which can be explored for possible research. The influence of when mood is manipulated should also be further explored. Forgas et al. (2005) specifically examined the influence of mood and incorporating misleading details during the post-event or storage stage, and called for further research examining mood effects during the encoding and retrieval stage. One may also examine the difference of recall when experiencing the emotion fear at the encoding phase and fear at the retrieval phase. This will provide us with an understanding of the influence of mood at all stages

of the memory process; including, encoding, storage, and retrieval. Future studies could also explore differences on these and other measures between various ethnic groups and address the current limitations as outlined above.

CHAPTER 6

CONCLUSION

Though the findings in the current study may not have aligned with previous research in some instances, the difference in the order of the procedures may play a role in the results that were found in this study. We examined the effect of being in a particular mood state then being exposed to the stimuli, and so our findings may reflect what occurs when that order of manipulation is used. The current study reflects the effect of being in a specific mood state when encoding the information that is to later be retrieved, as opposed to being in a specific mood state when retrieving the information. We believe this procedure to have more external validity and that this issue will be an important aspect of procedures to address in this area of research in the future.

The current study adds to the overall knowledge of eyewitness memory, testimony, and sentencing as it relates to the criminal justice system. It also adds to current research on memory, the effect of mood and emotion on memory recall and other factors that may have an influence, such as gender. In reference to the criminal justice system, implications and application of the findings of the current study can expound on the practice of how witnesses are questioned. Results indicated that participants performed the worst on the misleading questions, consequentially, presenting an instance of the misinformation effect. When questioning witnesses of a crime, their susceptibility to believe the information presented to them as true, when indeed, in can be false, may vary depending on their mood state. As this research continues, it will broaden our knowledge and understanding of various factors affecting memory recall and how they relate to real-world instances, such as questioning and sentencing in the criminal justice system.

REFERENCES

Crawford, J., & Henry, J. (2004). The Positive and Negative Affect Schedule (PANAS):

Construct validity, measurement properties and normative data in a large non-clinical

sample. *British Journal of Clinical Psychology, 43*(3)*,* 245-265.

doi: 10.1348/0144665031752934

Dagliesh, T., & Power, M.J. (1999). *Handbook of Emotion and Cognition.* Chichester, England:

Wiley.

Drace, S. (2013). Evidence for the role of affect in mood congruent recall of autobiographic

memories. *Motivation and Emotion, 37*(3)*,* 623-628. doi: 10.1007/s11031-012-9322-5

Forgas, J.P. (1995). Mood and judgment: The affect infusion model (AIM). *Psychological*

Bulletin, 117(1)*,* 39-66. doi: 10.1037/0033-2909.117.1.39

Forgas, J., Laham, S., & Vargas, P. (2005). Mood effects on eyewitness memory: Affective

influences on susceptibility to misinformation. *Journal of Experimental Social*

Psychology, 41(6)*,* 574-588. doi: 10.1016/j.jesp.2004.11.005

Herlitz, A., & Rehman, J. (2008). Sex differences in episodic memory. *Current Directions in*

Psychological Science, 17(1)*,* 52-56. doi: 10.111/j.1467-8721.2008.00547.x

Horgan, T., Mast, M., Hall, J., & Carter, J. (2004). Gender differences in memory for the

appearance of others*. Personality and Social Psychology Bulletin, 30*(2), 85-96.

doi: 10.1177/0146167203259928

Houston, K., Clifford, B., Phillips, L., & Memon, A. (2013). The emotional eyewitness: The

effects of emotion on specific aspects of eyewitness recall and recognition performance*.*

Emotion, 13(1)*,* 118-128. doi: 10.1037/a0029220

Kensinger, E., & Corkin, S. (2003). Effect of negative emotional content on working

    memory and long-term memory. *Emotion, 3*(4), 378-393. doi: 10.1037/1528-

    3542.3.4.378

Kern, R., Libkuman, T., Otani, H., & Holmes, K. (2005). Emotional stimuli, divided

    attention, and memory. *Emotion, 5*(4)*,* 408-417. doi: 10.1037/1528-3542.5.4.408

Levine, L., & Edelstein, R. (2009). Emotion and memory narrowing: A review and

    goal-relevance approach. *Cognition and Emotion, 23*(5), 833-875.

    doi: 10.1080/02699930902738863

Loftus, E., Banaji, M., Schooler, J., & Foster, R. (1987). Who remembers what? Gender

    differences in memory. *Michigan Quarterly Review, 26*, 64-85. Retrieved from

    http://projects.iq.harvard.edu/files/banaji/files/1987_loftus_mqr.pdf

Loftus, E., & Hoffman, H. (1989). Misinformation and memory: The creation of new memories.

    Journal of Experimental Psychology, 118(1)*,* 100-104. doi: 10.1037/0096-

    3445.118.1.100

Mittal, S., Singh, T., Arya, Y.K., & Tiwari, M.K. (2013). Effect of emotional arousal on

    eyewitness memory. *Indian Journal of Social Science Researchers, 10*(1), 24-30.

    Retrieved from

    https://www.researchgate.net/publication/265421485_Effect_of_Emotional_Arousal_on_

    Eyewitness_Memory.

Sharot, T., & Phelps, E. (2004). How arousal modulates memory: Disentangling the effects

    of attention and retention. *Cognitive, Affective, & Behavioral Neuroscience, 4*(3), 294-

    306. doi: 10.3758/CABN.4.3.294

Tiwari, G. (2010). Research in Eyewitness Memory: Issues and challenges. *Jigyasa, 3,* 66-71.

Retrieved from

https://www.researchgate.net/profile/Gyanesh_Tiwari/publication/262068313_Research_

in_eyewitness_memory_Issues_and_challenges/links/0c960536926f480537000000.pdf

Watson, D., Clark, L., & Tellegan, A. (1988). Development and validation of brief

measures of positive and negative affect: The PANAS scales. *Journal of Personality and*

Social Psychology, 54(6), 1063-1070. doi: 10.1037/0022-3514.54.6.1063

TABLE 1

Descriptive Statistics for the PANAS Items that Constitute Positive and Negative Affect

		M	*SD*	*N*
Interested	Fear	2.53	1.050	74
	Surprise	2.36	.993	78
	Neutral	2.54	.855	72
	Total	2.47	.970	224
Excited	Fear	1.57	.812	74
	Surprise	1.59	.959	78
	Neutral	1.57	.869	72
	Total	1.58	.880	224
Strong	Fear	2.27	1.126	74
	Surprise	2.08	1.267	78
	Neutral	2.13	1.087	72
	Total	2.16	1.163	224
Enthusiastic	Fear	1.93	1.127	74
	Surprise	1.87	1.166	78
	Neutral	1.79	.871	72
	Total	1.87	1.063	224
Irritable	Fear	1.93	1.163	74
	Surprise	1.85	1.007	78
	Neutral	1.69	.959	72
	Total	1.83	1.046	224
Alert	Fear	2.81	1.268	74
	Surprise	2.59	1.211	78
	Neutral	2.35	.981	72
	Total	2.58	1.172	224
Inspired	Fear	1.86	1.139	74
	Surprise	1.88	1.248	78
	Neutral	1.63	.956	72
	Total	1.79	1.126	224
Determined	Fear	2.43	1.240	74
	Surprise	2.55	1.438	78
	Neutral	2.22	1.324	72
	Total	2.41	1.339	224
Attentive	Fear	2.73	1.089	74
	Surprise	3.04	1.221	78
	Neutral	2.82	1.053	72

	Total	2.87	1.128	224
Active	Fear	2.26	1.111	74
	Surprise	2.18	1.287	78
	Neutral	2.19	1.083	72
	Total	2.21	1.162	224
Scared	Fear	1.38	.806	74
	Surprise	1.18	.503	78
	Neutral	1.29	.701	72
	Total	1.28	.681	224
Afraid	Fear	1.27	.727	74
	Surprise	1.19	.666	78
	Neutral	1.25	.707	72
	Total	1.24	.697	224

TABLE 2

Mutlivariate Tests of Positive and Negative Affect Items from PANAS

	Value	F	Hypothesis df	df error	p	Partial Eta^2	Noncent. Parameter	Observed Power[d]
Pillai's Trace	.129	1.215	24	422	.223	.065	29.159	.900
Wilks' Lambda	.875	1.211[b]	24	420	.227	.065	29.053	.899
Hotelling's Trace	.139	1.206	24	418	.231	.065	28.948	.897
Roy's Largest Root	.082	1.444[c]	12	211	.148	.076	17.333	.775

TABLE 3

Tests of Between-Subjects Effects for Positive and Negative Affect Items from PANAS

	Type III SS	df	MS	F	p	Partial Eta^2	Noncent. Parameter	Observed Power[m]
Interested	1.570	2	.785	.833	.436	.007	1.666	.192
Excited	.023	2	.012	.015	.985	.000	.030	.052
Strong	1.523	2	.762	.561	.571	.005	1.122	.142
Enthusiastic	.727	2	.364	.320	.727	.003	.639	.101
Irritable	2.116	2	1.058	.966	.382	.009	1.932	.217
Alert	7.846	2	3.923	2.904	.057*	.026	5.808	.563
Inspired	3.068	2	1.534	1.213	.299	.011	2.426	.263
Determined	4.130	2	2.065	1.153	.318	.010	2.305	.252
Attentive	3.850	2	1.925	1.519	.221	.014	3.037	.321
Active	.252	2	.126	.092	.912	.001	.185	.064
Scared	1.514	2	.757	1.644	.196	.015	3.287	.345
Afraid	.250	2	.125	.255	.775	.002	.510	.090

APPENDIX A

CAR CRASH CRIME SCENE IMAGE

APPENDIX B

MISLEADING QUESTIONS

1. Did you notice the disfigured blue car next to the ambulance?

2. Did you notice the driver still sitting in the ambulance?

3. Did you notice three firemen in uniform on the scene?

4. Did you notice the school buses on the scene of the crime?

APPENDIX C

MEMORY MEASURE: 12 T/F QUESTIONS

Accurate Questions	Inaccurate Questions	Misleading Questions
There was broken glass on the scene	There was a person lying on the stretcher next to the ambulance	There was a disfigured blue car next to the ambulance
Most of the people were gathered in the center of the scene	There was a shredded tire next to the police car	There was a driver still in the ambulance
There was a red tow truck on the scene	There was blood on the scene of the accident	There were three firemen in uniform on the scene
There was a fireman holding a fire extinguisher	There was a bottle of alcohol in the police officer's hand	There were school buses on the scene of the crime

APPENDIX D

DEMOGRAPHICS QUESTIONNAIRE

Age (in years)? _____

Gender? please circle one

    Male

    Female

Classification in school? (please circle one):

    Freshman

    Sophomore

    Junior

    Senior

Do you wear corrective eyewear (glasses, contact lenses, etc.)? (please circle one)

    Yes

    No

    If answered yes to the question above, are you wearing them now?

    (please circle one)

        Yes

        No

APPENDIX E

DISTRACTOR MATH TASKS

41	11	62	61	61	27
+ 59	+ 82	+ 23	+ 52	+ 28	+ 40

95	70	87	98	96	50
- 35	- 39	- 77	- 95	- 30	- 43

47	14	50	79	16	35
x 66	x 15	x 42	x 36	x 72	x 21

10)92   10)84   10)24   13)60   21)89   15)82

9	17	18	11	19
× 2	+ 10	÷ 2	× 7	+ 20

6	13	8	15	29
+ 10	× 15	× 17	+ 9	- 14

17	27	8	22	14
× 8	- 17	+ 15	- 7	× 18

195	165	29	16	120
÷ 15	÷ 15	- 13	+ 1	÷ 6

6	16	16	14	30
+ 1	+ 18	× 12	× 5	÷ 3