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The effects of positive emotions on eyewitness memory

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The Effects of Positive Emotions on Eyewitness Memory

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By
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POSITIVE EMOTIONS & EYEWITNESS MEMORY

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Abstract

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The purpose of this study was to explore the effects of positive emotions on eyewitness memory. Though little research has been done investigating this question, it has serious implications within the criminal justice system, towards our understanding of emotions, and in creating a fuller comprehension of how memory works. The current study chose two distinct positive emotions and participants were randomly assigned to one of three emotion inductions (joy, gratitude, or neutral). Participants then watched a computer video of a minor crime and responded to questionnaires testing them on their recall accuracy of central and peripheral details of that crime. I predicted that both induced gratitude and joy would enhance the accuracy of eyewitness memory for central and peripheral details of a crime compared to the neutral condition. This study used a series of multivariate analyses of variance (MANOVAs) comparing hit and false alarm rates of cued and peripheral details by emotion induction condition. Due to COVID-19 quarantines, the current study was ended prematurely, resulting in a lack of statistical power. While no statistically significant effects were found to support the main hypotheses, three individual cued recall questions were statistically more likely to be answered correctly by those in the joy and gratitude conditions compared to those in the neutral condition.

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POSITIVE EMOTIONS & EYEWITNESS MEMORY

The Effects of Positive Emotions on Eyewitness Memory

In recent years, eyewitness misidentification has become a focal point for many individuals and organizations. As of 2017, 70% of legal convictions of the wrong individual for a crime have been based primarily on eyewitness accounts (Albright, 2017). This evidence was collected from wrongfully convicted men and women who were exonerated by DNA evidence at a later date. Misidentifications by eyewitnesses has a detrimental impact on the justice system, victims, perpetrators, and society, making it important to ask- what causes someone to misidentify another person in these situations? Researchers have now spent over 100 years investigating this question, with emotions just recently being considered a potential factor in misidentification. Considerable research has been conducted studying the causal effects of negative emotions on eyewitness memory (see Christianson, S., 1992 for review), but almost no studies have considered the effects of positive emotions, leaving a notable hole in the literature. This study aims to begin filling in that gap by researching and understanding the effects of two distinct positive emotions, gratitude and joy, on eyewitness memory.

Hugo Munsterberg inspired psychological research to step into the world of law by asking one humble question: how reliable are the memories of eyewitnesses (1908)? Since then, a plethora of research has branched off this question ranging from an individual's susceptibility to false memories to the impact of negative emotion on memory (Memon, Mastroberardino, & Fraser, 2008). This research has had a large impact on our criminal justice system, shaping the way victims and eyewitnesses are interviewed, how lineups are presented, and who is considered to be a reliable witness (Brewer & Palmer, 2010). Many of these well researched concepts of eyewitness memory are relevant to the current study including,

but not limited to, the questioning method used, questioning bias, the *weapon focus effect*, and the relationship between confidence and accuracy.

Questioning Methods and Questioning Bias

Questioning bias, in the setting of a police interview, is defined as any form of bias, intentional or not, that occurs during the interview process- whether it be from the eyewitness, the interviewer, or any external stimuli in the interview room (Kraus, Zeier, Wagner, Paelecke, & Hewig, 2017). For example, the interviewer may be convinced a specific individual is the suspect and make subtle suggestions that is the case to the eyewitness throughout the interview. This bias can be picked up by the eyewitness and they may implicitly alter their memory to fit. Another alternative is that the interviewee *knows* the interviewer wants a specific answer and answers accordingly to please them. This is known as a demand characteristic (Bjorklund, Cassel, Bjorklund, Brown, Park, Ernst, & Owen, 2000). While questioning bias is crucial to avoid in any type of interview, it is especially important to avoid in eyewitness accounts as their testimony has serious effects on the lives of many and memory can be very malleable.

Kraus et al. (2017) compared the accuracy of memory recall and amount of bias that occurs in the three most commonly used questioning techniques in the real world; the self-administered interview (SAI), police officer's questioning (POQ) and written free recall (FR). In POQ a police officer conducts the interview by asking a series of open-ended questions, occasionally asking more narrow questions when in need of clarification or additional explanation. Because of variation in bias and skill between officers, there is a significant deviation in the accuracy of memory with POQ. FR asks the eyewitness to write down everything they can remember about the crime they witnessed. While providing little bias, FR by itself provides the least amount of correct recall of peripheral and central details of the crime as

well as the least number of details recalled overall. The SAI is administered on a computer, eliminating the risk of accidental implicit or explicit human bias. The program guides the eyewitness through a series of free recall, cued recall, and secondary questions about the crime witnessed. The SAI was found to provide the most accurate recall of the three questioning techniques *if* administered to eyewitnesses within 24 hours of witnessing the crime. Kraus et al. attribute this to deeper memory processes and more extensive memory retrieval being accessed along with the decreased bias from human questioning.

The Weapon Focus Effect

It has been made evident through numerous studies that the presence of a weapon during a crime will deteriorate the eyewitness's memory of other details of the crime in favor of the weapon; this is known as the *weapon focus effect* (Carlson, Pleasant, Weatherford, Carlson, & Bednarz, 2016). There is a caveat though; the weapon must be unexpected and in an unusual environment (Fawcett, Peace, & Greve, 2016.) Unexpected means that the eyewitness must not see the gun until after the crime has begun. The environment must also be unusual for the gun. An individual is more likely to be scared of a handgun pulled out at a grocery store compared to a handgun pulled out at a shooting range. Select individuals such as police officers go through professional training to learn how to avoid the *weapon focus effect*. While this significantly improves their memory, most eyewitnesses have not gone through the same training and thus are more likely to fall prey to this effect if a weapon is involved in the crime (Carlson et al., 2016).

While not discussed in Fawcett et al.'s (2016) research explicitly, it seems that the driving mechanism behind the weapon focus effect is the emotion it arouses such as emotional stress, surprise, and fear; though no research has been conducted to support this hypothesis. Regardless, it does introduce an interesting question the current study hopes to answer. How will positive

emotions interact with the *weapon focus effect*? According to Fredrickson and Joiner (2018), positive emotions broaden cognition and allow people to build resources (social and cognitive) from the external environment. This broadening effect leads me to predict that the weapon focus effect will not be as strong for eyewitnesses experiencing a positive emotion at the initiation of a crime compared to those in the neutral condition.

Confidence and Accuracy

Because of the overwhelming evidence on the relationship between confidence and accuracy, I will only review a meta-analysis completed by Krug (2007) whose study reviewed the last three decades of research on the subject. His study shows that the relationship between a person's subjective confidence of their accuracy and their true accuracy is weak to virtually nonexistent. Therefore, the criminal justice system should not look at the confidence of an eyewitness speaking as a good judgement of their accuracy but rely on facts from the case. Unfortunately, work by Koriat, Goldsmith, and Pansky (2000) show that juries are often influenced by the amount of confidence portrayed by the eyewitness.

The Relationship Between Memory and Emotions

While much of the previous research discussed has been fairly consistent, mixed results have been shown regarding the relationship between emotions and the accuracy of memory. According to Van Damme, Kaplan, Levine, and Loftus (2016) emotional memories are encoded more deeply than non-emotional memories, and therefore are more solidified and accurate than non-emotional, or neutral, memories. By becoming more deeply encoded, emotional memories are less likely to incorporate false details into memory over time. However, research conducted by Memon, Mastroberardino, and Fraser (2008) shows that too much arousal, especially in the form of stress, impairs memory. Consequently, arousal seems to form an inverted U-shaped

relationship with memory as was proposed by Yerkes-Dodson (1908). Yerkes-Dodson's model suggests that low-medium emotional arousal is the optimal level for an accurate, efficient memory. This is most likely not the state of eyewitnesses during stressful, criminal, or traumatic events. Rather, the majority of individuals in these situations are experiencing a high level of arousal which would result in less accurate memory. Perhaps by being in a positive mood just prior to witnessing a crime, an individual's shift to negative arousal once the crime began would result in a lower level of negative arousal than someone who was in a negative mood state just prior to witnessing a crime. Following this theory, because the previously positive individual was in a lower arousal state, it may follow that their memory is more accurate and efficient.

The results of Van Damme et al.'s (2017) study is furthered by another conducted by Kaplan, Van Damme, & Loftus (2016), which looked to determine what emotional factors enhance or impair memories. They found that regardless of positive or negative valence, information that *the individual* considered important was recalled with better accuracy than information they found irrelevant. This makes sense as our memory does not work like a video camera, but instead encodes details that we as the individual find relevant to our current activity.

Negative Emotions

Emotional stress has received a large amount of attention by both emotion and forensic researchers. Emotional stress has been shown to narrow a person's focus towards the object that is causing the stress at the expense of everything else (Christianson, 1992). In the event of a crime, central details such as the race and gender of the perpetrator, the type of weapon used, height of the perpetrator, etc., are typically focused on. This narrowing of focus blocks out all other information about the scene that the mind perceives as unnecessary or unhelpful to the current situation. These ignored details are usually peripheral details of the crime such as

physical descriptions of other eyewitnesses, type of shoes the criminal wore, or color of the building they were in. In other words, emotional stress handicaps encoding abilities for details that are considered not relevant at the time (LaBar & Cabeza, 2006).

Christianson (1993) distinguished common central and peripheral details of crimes as well as how they are encoded by surveying 110 witnesses of 22 separate robberies committed in Stockholm, Sweden. His study concluded that on average, central details of crimes are accurately encoded and recalled at a significantly higher proportion than the peripheral details of those crimes. Central details of a crime include gender, height, and race of the robber, what the robber said during the commission of the crime, and what the robber was wearing. Peripheral details include other information less immediate to the crime such as the day of the crime, the building/location where the crime took place, time of day, day of the week, and faces of other victims.

Recent work by Thorley, Dewhurst, Abel, and Knott (2016) asserts that it is the presence of negative emotions at *encoding* that affects eyewitness memory rather than at retrieval. When inducing negative emotions at the time of retrieval after watching a crime on video, participants had impaired memory, especially if they had been in a neutral condition while watching the video. On the other hand, memory and the number of correct details recalled were enhanced when a negative emotion was induced at both encoding and retrieval. The authors deemed this phenomenon as *mood dependent memory enhancement*. While done specifically with negative emotions, the authors suggest looking at this concept in the context of positive emotions which is exactly what this thesis aims to do. Just as negative emotional arousal enhances memory during the encoding process, gratitude and joy should also enhance correct recall and memory due, in part, to increased arousal.

Another important aspect of cognition that plays a role in negative emotions and eyewitness memory is visual working memory (Xie & Zhang, 2016; Berggren, Curtis, & Derakshan, 2017). Visual working memory allows us to take in a complete scene to gather important landmarks and encode what we find to be relevant (Matlin & Farmer, 2016). According to Xie and Zhang (2016), there are two components to working memory that interact—quality and quantity. Quality is how well encoded and clear the memory is to a person while quantity is the amount of details they can remember about a specific event.

Their research found that negative emotions, when not at extreme levels, have been found to increase the quality of memories while reducing the quantity. Considering the narrowing process of negative emotions, these results are not surprising. Specific details that are largely focused on, such as weapons, like in the *weapon focus effect*, will be clearly remembered, but at the cost of gaining additional details about the surroundings. However, research by Berggren et al. (2017) suggests this may be an effect of a *specific* negative emotion rather than all negative emotions, as state anxiety was shown to decrease visual memory performance as well as filtering efficiency (ability to ignore distracting information), suggesting that more research needs to be done.

Work by Fredrickson, Mancuso, Branigan, and Tugade (2000) suggests that there is a way to counteract this reduction in quality. Their theory suggests positive emotions undo the psychological and physiological effects of negative emotions, known as the *undoing effect*. Positive emotions such as gratitude and joy may enhance memory and recall of both central and peripheral details of a crime compared to negative emotions by undoing some of the negative effects of negative emotions.

Even with more research to be done, the literature on negative emotions and eyewitness testimony is extremely thorough and well validated through replication (Block, Greenberg, & Goodman, 2009). This is reassuring considering the numerous amounts of eyewitnesses that are interviewed immediately after a crime in an emotional state and the weight their testimony can have in court. However, with how much attention has been put on negative emotions, it is rather surprising that after extensive review, I found a limited number of articles that looked specifically at positive emotions and eyewitness memory. Perhaps this is because positive psychology, and the idea that there are discrete positive emotions, has only recently become prevalent.

Positive Emotions

Because of the dearth of research on positive emotions, positive psychology identified the study of positive emotions as one of its three main research emphases. The other two pillars of positive psychology are positive character traits and positive institutions (Watkins, 2016). In the past 20 or so years, some pioneers in positive emotion and eyewitness memory have emerged. Much of their research is based on the broaden effect of Barbara Fredrickson's *Broaden and Build Theory* (2012). According to this theory the broaden effect "rather than fueling specific action tendencies, positive emotions appear to spark broadened and expansive thought-action tendencies. They affect our thoughts and attention, and by leading to broadened and expansive attention, positive emotions fuel flexible and creative thinking and problem-solving approaches, which accumulate and build long-term psychological, physical, and social resources." (Conway et al., 2012, p. 9). Thought-action tendencies are the actions and thoughts we feel like doing/thinking when in a specific emotional state. Thought-action tendencies of gratitude include adoration, approaching others, and sharing with others (Cohen, 2006). Thought-action tendencies

of joy include free activation, feeling like celebrating and connecting to others, and free play (Watkins, Emmons, Greaves, & Bell, 2018).

This broadening of thought-action tendencies includes broadening an individual's attention to his or her surroundings, which increases the number of features they see without decreasing the quality of those memories (Talarico, Berntsen, & Rubin, 2009). This is very different from the narrowing effect of negative emotions, which leads us to surmise that there may be a difference in the effects of positive and negative emotions on eyewitness memory. Recall that negative emotions narrow focus, which decreases the number of features seen and the quality of peripheral details (Christianson, 1992). This difference in encoding and processing of details suggests that the broadening aspect of positive emotions may be more beneficial to accurate recall of peripheral information compared to the narrowing focus of negative emotions. Research in this area is imperative for understanding and determining reliable eyewitnesses in the real world as well as furthering our understanding of the distinct, subtle qualities of negative and positive emotions. Due to resources, time availability, and worries about ethically inducing strong negative emotions, the current study researched the effects of positive emotions on eyewitness memory without inducing a negative mood. A neutral condition was included as a control and results to this study can be compared to studies such as Christianson's (1992) for effects.

Two studies conducted on positive emotions and memory give us a hint about the possible effects positive emotions might have on eyewitness memory. The first comes from Talarico, Berntsen, and Rubin (2009) who compared four positive affects (happiness, love, contentment, positive surprise) to four negative affects (sadness, fear, anger, negative surprise), asking participants to recall and rate an autobiographical memory of each affect for peripheral

and central details. They found that all positive affects significantly enhanced recall for peripheral details compared to all negative affects. There are some concerns about bleed through effects for this study as all participants recalled a memory for all eight emotional aspects in a single session, but these results follow the previously discussed findings that negative emotions narrow memory while positive emotions broaden memory.

The second study comes from Yegiyan and Yonelinas (2011) who tested recognition for peripheral and central details for both positive and negative photographs while induced into either a positive or negative emotion. They found that compared to those induced into a negative emotion, those induced into a positive emotion had a larger initial recognition of central and peripheral details as well as an increase (or *broadening*) in recognition over time for both positive and negative pictures. On the other hand, those induced into a negative emotion had less recognition of peripheral details both at the initial testing and over time for both positive and negative pictures. Central details were recalled with higher accuracy than peripheral details in all negative emotion conditions confirming the narrowing effect of negative emotions. Yegiyan and Yonelinas's study used a photographic stimulus which has been shown to be less effective than video when it comes to emotional arousal (Jaillias & Gilet, 2010), but still showed significant effects of positive emotions broadening memory for central and peripheral details. This study largely influences the predictions of the current study that positive emotions will enhance eyewitness memory for central and peripheral details of the crime compared to the neutral condition.

More research must be done before a full comprehension of the effects of emotions, both positive and negative, have on eyewitness memory. Research pertaining to positive emotions and eyewitness memory has rarely been considered which leads to the purpose of the current study-

to research and understand the effects of joy and gratitude on eyewitness memory. Results of the current study have implications in the way psychologists look at emotions and eyewitness memory, on who is considered to be a reliable witness, and who the courts decide can provide relevant, accurate information. The current study induced participants into one of three emotions (joy, gratitude, or neutral) before showing them a video of a minor crime. They were then tested on the accuracy of their eyewitness memory through a series of self-report measures covering central and peripheral details of the crime. I predicted that both the gratitude and joy conditions would enhance the accuracy of eyewitness memory for both central and peripheral details of the crime compared to neutral condition as well as decrease the amount of false alarms recalled.

Methods

Overview and Design

In the current study participants were randomly assigned to one of three emotion inductions (gratitude, joy, or neutral) before witnessing a minor crime on video. They were then interviewed on peripheral and central details of the video via computer. This study used a series of multivariate analysis of variance (MANOVAs) comparing hit and false alarm rates of central and peripheral details by emotion condition.

Participants

Originally, the current study planned to run 159 Eastern Washington University undergraduate psychology students for partial course credit. Due to the 2020 COVID-19 quarantine restrictions the study was ended early with 44 participants collected, one of which had to be dropped due to being under 18 years of age. Participants were 67.4% female, 32.6% male, 62.8% White, 20.9% Hispanic, 11.6% Multiracial, 4.7% Black, and had an average age of 22.05

years (Range 18-38, $SD = 3.43$). This study was approved by Eastern Washington University's Institutional Review Board and followed the ethical standards of the American Psychological Association. Due to the inability of this study to have significant power, it should be considered a pilot study to provide guidance for further directions and possible adjustments in future studies. See Table 1 below for more demographics information.

Table 1

Demographics by Emotion Induction Condition

Variable	Emotion Induction Condition					
	Gratitude Induction		Joy Induction		Neutral Induction	
	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>
Gender	1.76	0.44	1.42	0.51	1.79	0.43
Age	22.00	3.43	21.42	4.39	22.64	2.65
Education Level	4.29	0.92	4.00	1.41	4.36	1.08

Note. Gender was coded as male (1) and female (2). Education was coded as running start (1), freshman (2), sophomore (3), junior (4), senior (5), Graduate (6), Post-Bac (7) and Other (8).

Materials

Positive and Negative Affect Scale Modified (PANAS; Watson and Clark, 1994)- The PANAS consisted of 30 emotions, half positive and half negative, that participants rated themselves on a Likert scale of 1 "Not at All" to 7 "Completely" on how they felt *in the current moment*. Because the PANAS does not contain adjectives for gratitude, the three adjectives from the Gratitude Adjectives Scales (GAS; McCullough, Emmons, & Tsang, 2002) were added to this measure. The three most commonly rated adjectives for joy according to Watkins, Emmons,

Greaves, and Bell (2018). These adjectives were randomly dispersed among the original items from the PANAS. Results of this scale were compared to the mmDES to ensure the success of the emotion induction. A validity check item was also added to this measure at the end of the instructions which read “If you are reading these instructions carefully, please circle the last word of this sentence.”

Emotion Induction- Participants were randomly assigned to either a neutral, joy, or gratitude mood induction. For the joy and gratitude conditions, participants were asked to briefly describe three events in which they had felt their respective emotion. They were then asked to pick the event *that was most significant* to them and describe their respective emotion in great detail, “as if explaining it to someone who has never felt the emotion before.” In the neutral condition, participants were asked to write three things they do almost daily. They were then asked to describe in detail the least emotional event on their list. Research on mood inductions have shown that having participants write about a personal experience is the most successful method to date (Jallais & Gilet, 2010).

Modified- Modified Differential Scale (mmDES; Izard, 1977)- The mmDES uses a Likert scale ranging from 0 (“Not at All”) to 4 (“Extremely”) and asks participants to describe how much they *currently* feel 10 positive and 10 negative emotions. This scale was modified from Fredrickson, Tugade, Waugh, and Larkin’s (2003) Modified Differential Scale by replacing the original joy adjectives to joyful, delighted, and enthusiastic. This changed was made to align with the three most commonly used adjective to describe joy (Watkins et al., 2018). A data validity check item was added to this measure halfway through this measure stating, “For data collecting purposes, please select “1” for this question.”

Crime Video- The crime video watched was originally a simulated training video of a bank robbery for employees. The author trimmed the video to only include the portion consisting of the simulated bank robbery, which all participants watched regardless of emotion condition. The video included one robber and one teller with multiple eyewitnesses and bank employees in the scene. The scene begins with a brief view of the outside of the bank before entering inside where the offender is waiting in line among other customers. When called forward, the offender slides the teller a note informing her that a robbery was occurring. He hands her a bag, which she promptly fills with the contents of the register, including a bundle of cash containing a tracking device. She hands the bag back to the offender, he promptly leaves the bank, and the teller hits a silent alarm. The video was downloaded in 1080 hp to ensure that a poor visual quality did not interfere with study and lasted one minute and 15 seconds.

Affect Grid (Russel, Weiss, & Mendelsohn, 1989)- The affect grid was given both pre and post viewing of the crime video. This grid serves as a way to measure arousal as a covariate and ensure the appropriate level of arousal was achieved to activate memory processing and real-life reactions to a criminal event. This grid is a 7x7 block covering four dimension: depression → excitement, relaxation → stress, sleepiness → high arousal, and unpleasant feelings → pleasant feelings. Please reference Appendix D to see the affect grid.

Free and Cued Recall- Participants were first given the free recall task, which asked them to describe anything and everything they remembered from the scene, regardless of perceived relevance. Participants were then asked a series of more specific, open cued recall questions to distinguish memory for central and peripheral details of the video which can be seen in Table 2. To ensure there were no order effects, questions were randomized into 5 different iterations, randomized evenly throughout the three separate emotion inductions. A validity check item was

inserted halfway through the cued recall questions which read “For data checking purposes, please write the sentence ‘The dog is brown’ in the space below.” to ensure participants were paying attention throughout the recall task.

Shipley Verbal IQ (Shipley, Gruber, Martin, & Klein, 2009) Vocabulary Scale- The Shipley Vocabulary Scale was given to ensure verbal IQ did not affect participants score when giving their recall. This scale is specifically assessing crystallized intelligence which is intelligence gained through education or experience. The Shipley provides 40 words increasing in difficulty and participants were asked to select the synonym to this word out of a list of four. For example, participants will be given the word “Talk” and the four possible synonyms are “Draw, Eat, Speak, Sleep” with speak being the synonym participants are expected to circle. The Shipley is standardized and can be used for individuals ranging from ages 7 to 89.

Demographics- This page served to attend to possible covariates to the effects of positive emotions on eyewitness memory. It asked participants about gender, age, ethnicity, education level, and how much they identified with the offender in the crime video on a Likert scale of 1 “not at all” to 7 “completely identify.” As a validity check to ensure participants fully paid attention to the video and therefore gave accurate recall information, the demographics page also asked on a Likert scale of 1 “not at all” to 7 “complete attention” how much attention participants paid to the video.

Table 2

Table of Cued Recall Questions for Central and Peripheral Details

Central Details	Peripheral Details
What gender was the offender?	How many bystanders were at the scene?
How tall was the offender?	How many employees were at the scene?
How much did the offender weigh?	What time of day did the crime occur?
Did the offender say anything while in the bank?	Was there any art behind the counter? If so, please describe it
Please describe the clothes the offender was wearing at the time of the crime.	How many exits did the bank have?
How old was the offender?	Please describe the employee who gave the offender the money.
Did the offender have any identifiable markers? (Scars, tattoos, moles, etc.) If so, please describe them.	How much money did the offender take?
What color was the offender's hair?	Was there anything placed into the offender's bag besides money?
Did the offender have a weapon? If so, please describe the weapon.	What color were the walls inside the bank?
What did the note the offender gave to the employee say?	What is the marital status of the employee that was robbed?

Procedure

Participants signed up for the current study online through Eastern Washington University's SONA Participation system. Participants were given an ID number once registered to allow them to receive credit for participating while still remaining anonymous. Once at the

lab, participants were given a brief overview of the study. Participants were then given a packet to fill out containing the PANAS, one of the three randomly assigned emotion inductions (neutral, joy, or gratitude), the mmDES, and the affect grid.

After completing the packet, participants were directed to a computer to view the crime video. Immediately after the crime video ended, participants were asked to inform the research assistant. Participants then given the final packet which contained a second affect grid, the free and cued recall tests, the Shipley Verbal IQ questionnaire, and a demographics page. Once finished, participants were thanked for their time and the research assistant debriefed the participant that the video watched was recorded with confederates, informed of the purpose of the study, and provided any information requested.

Results

Manipulation Checks

Before analyzing results related to my hypothesis, the successful manipulation of emotion and significant change in affect due to the crime video was tested as both are requirements of my hypothesis. To test the effect of the emotion induction (12 participants in the joy condition, 17 in the gratitude, 14 in the neutral condition), an analysis of covariance (ANCOVA) was run using the participants PANAS ratings for joy and gratitude as covariates, emotion condition as a fixed factor, and mmDES ratings for joy and gratitude as the dependent variables. Significance was not achieved for the joy condition, $F(4,41) = .507$, $p = .606$, $\eta_p^2 = .026$. Pairwise comparisons showed similar increases in joy for all conditions with $p = 1.0$ for all comparisons. When looking at means, those in the joy ($\bar{X} = 2.08$, $SE = 0.22$) and gratitude ($\bar{X} = 2.1$, $SE = 0.19$) conditions had higher increases in joy post emotion induction compared to the neutral condition ($\bar{X} = 1.72$, $SE = 0.21$). Analysis for the gratitude condition showed that gratitude increased significantly more for

those in the gratitude condition ($\bar{X} = 2.10$, $SE = 0.27$) compared to those in the joy ($\bar{X} = 2.08$, $SE = 0.32$) and neutral conditions ($\bar{X} = 1.72$, $SE = 0.31$), $F(4,40) = 13.901$, $p < .001$, $\eta_p^2 = .429$.

A repeated measures *t*-test on the affect grid showed that after watching the crime video, on average, participants had increased arousal, $t(43) = -3.41$, $p = .001$, unpleasant feelings, $t(43) = 3.42$, $p = .001$, excitement, $t(43) = -3.15$, $p = .003$, and stress, $t(43) = 2.99$, $p = .005$. There was a significant change in affect after watching the crime video.

MANCOVAs and MANOVAs

A MANCOVA was initially computed to test for possible covariate effects of the Shipley Verbal IQ (Izzard, 1977), gender, age, education level, level of attention paid to the crime video, and level of participant identification with the offender on the effects positive emotions have on eyewitness memory. There were no significant effects of any covariates with *p*- values ranging from .07 to .97. With no covariate effects, a MANOVA was computed to compare the positive hit rate (correct recall) and false alarms (false recall) of peripheral and central details on the cued recall task by emotion condition. Please refer to Table 2 to review peripheral and central questions. As expected with so little power, there was no significant results for any of the aforementioned dependent variables by emotion condition; central hits, $F(2,40) = .621$, $p = .542$, $\eta_p^2 = .030$, central misses, $F(2,40) = .621$, $p = .542$, $\eta_p^2 = .030$, peripheral hits, $F(2,40) = .745$, $p = .481$, $\eta_p^2 = .036$, or peripheral misses, $F(2,40) = 1.340$, $p = .273$, $\eta_p^2 = .063$.

After running a frequency analysis on the rate of hit and misses for each cued recall question, all questions that topped or bottomed out at 90% or more were removed. In other words, any question that 90% or more of participants answered correctly (topped out) or incorrectly (bottomed out) was excluded from further analyses. Out of the six questions that were

removed, four were central detail questions that topped out (questions 1, 5, 9, and 10) and two were peripheral detail questions. Question 16 topped out while question 17 bottomed out.

Another MANOVA was then computed, this time using the *adjusted* hit and false alarm rates which removed all questions that topped or bottomed out. Once again there was no significant effect of emotion condition on recall of central hits, $F(2,40) = .722, p = .492, \eta_p^2 = .035$, central misses, $F(2,40) = .344, p = .711, \eta_p^2 = .017$, peripheral hits, $F(2,40) = .920, p = .407, \eta_p^2 = .044$, or peripheral misses, $F(2,40) = .571, p = .569, \eta_p^2 = .028$. Observing means, central details were recalled, on average, more than peripheral details (CD: $\bar{X} = 2.42, SD = 2.35$ PD: $\bar{X} = 0.21, SD = 2.22$). On the other hand, false alarm rates were higher, on average, for peripheral details compared to central details (CD: $\bar{X} = 1.84, SD = 2.35$ PD: $\bar{X} = 3.07, SD = 1.49$).

The next MANOVA computed switched focus to the free recall task comparing central and peripheral hits and false alarms by emotion condition and was non-significant for hits, and, again, no significant effects were observed: $F(2,42) = 1.182, p = .317, \eta_p^2 = .056$ or misses, $F(2,42) = .943, p = .398, \eta_p^2 = .045$.

The final MANOVA analyzed the hit and false alarm rate of all 20 cued recall questions by emotion condition to explore trends. Two questions had statistically significant results and one was marginally significant. It must be stated that due to the sheer number of analyses looking for trends and patterns, these significant results could be random rather than truly significant. The first significant effect was observed with question CR11 (“How many other bystanders were at the scene?”), $F(2,40) = 4.92, p = .012, \eta_p^2 = .201$. Games-Howell post-hoc testing showed that those in the gratitude condition were significantly more likely to answer this question correctly than those in the neutral condition ($p = .017$) and those in the joy condition

were marginally more likely to be correct than those in the neutral condition ($p = .054$.) The second significant effect was observed with question CR18 (“Was there anything placed inside the offender’s bag besides money?”) $F(2,40) = 4.17, p = .023, \eta_p^2 = .173$. Games-Howell post-hoc testing showed that those in the joy condition were significantly more likely to answer correctly than those in the neutral condition ($p = .018$). The final question, CR20 (“What is the marital status of the employee that was robbed?”), showed marginal significance, $F(2,40) = 2.75, p = .076, \eta_p^2 = .125$, and therefore is worth mentioning. Games-Howell post-hoc testing showed that those in the joy condition were significantly more likely to answer correctly than those in the neutral condition ($p = .018$). These results are also depicted in Figure 1 below.

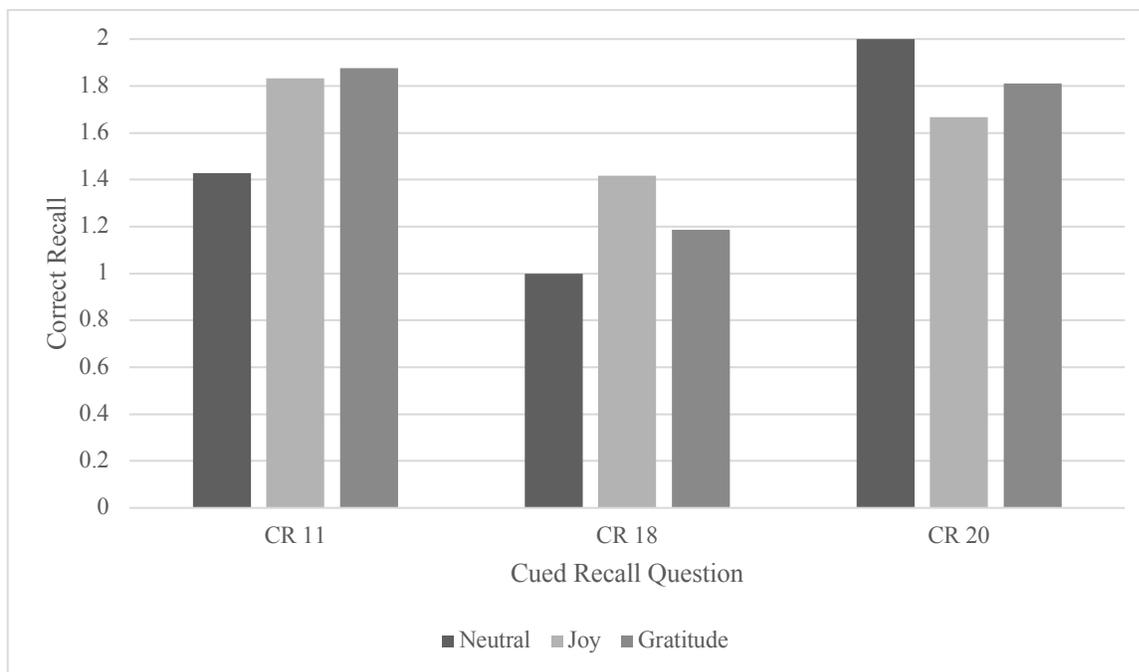


Figure 1. Average Correct Recall Rate of Cued Recall Questions by Emotion Condition.

Note. Cued recall questions were CR 11 “How many other bystanders were at the scene?”, CR 18 “Was here anything placed into the offender’s bag besides money?”, and CR 20 “What is the marital status of the employee that was robbed?”

Qualitative Analyses

The limits set on making interpretations of the quantitative analyses due to a limited population size of this study led me to conduct a few qualitative analyses as well. Six research assistants individually and blindly analyzed the free recall section of the study for emotional, behavioral, organizational, and false alarm dimensions. Assistants only had access to the free recall portion of participant's packets and therefore had no identifying information. I compiled all the notes from the research assistants and verified each observation mentioned by at least 4 research assistants by reviewing the free recall packet by their emotion condition.

Analyses of the emotional dimensions showed 41.86% of participants observed what they perceived was the emotional experience of an individual in the video. For example, participants commented that the teller was scared throughout the robbery, though it was never explicitly stated anywhere. Negative emotions were far more likely to be described in each category than positive emotions, with the teller being described as scared, shocked, distressed, etc., and the offender being described as agitated, irritated, impatient, etc. There were no differences between emotion induction conditions and the number of emotions described. A single participant noted that the bystander behind the offender looked annoyed. Interestingly, 16.28% of participants described the shift in pleasant to unpleasant emotions experienced by the teller after reading the robbery note (i.e. from calm to alarmed, cheerful to scared, etc.) while 11.63% of participants noted the lack of emotional reaction from the other bystanders and employees after the robbery. These observations were recorded by nearly half of participants without any direction to do so in the open recall directions, perhaps showing how actively and subconsciously we as human beings are always reading and trying to understand the emotions of those around us.

As with the emotional dimension, negative behaviors portrayed by the offender were recalled more often (40 times) than positive behaviors portrayed by the teller (26 times.)

Negative behaviors included participants reporting the offender as being fidgety, drumming his finger impatiently, threatening by showing a gun, etc. Positive behaviors included participants reporting the teller as being friendly, kind, helpful, positive, etc. Overall, participants organized their recall of the crime video chronologically, recording emotional, behavioral, and physical dimensions as the individuals were introduced in the video in an essay format. Alternatively, eight participants chose a listing/bullet point format for recording their recall. In general, more descriptive details such as height and clothing worn by the offender were recalled than descriptions of emotional states (such as the teller being scared or the offender angry).

There were a few elements of the video that were recalled falsely by a notable proportion of the sample. The first was the note handed to the teller from the offender which read, "This is a robbery. Put all your money in the bag. No alarms or someone will get hurt." Nearly 54% of participants falsely recalled a portion of this note. Common false alarms and details added include the note as saying "no alarms and no one will get hurt", "don't make a scene", "no police", and "don't get anyone's attention" among others. Furthermore, 60.47% of participants recalled the offender as being 6 feet or taller when the ruler in the video clearly showed him as being 5'9". Less commonly, 13.95% of participants recalled the offender either saying "please" or "thank you" while interacting with the teller, which did not happen. Last but not least, two participants recalled the offender calling the teller "sweetheart" instead of saying "good girl."

Discussion

While unfortunate circumstances cut data collection for the current study short, there is still some valuable information to take away. Even though no conclusions can be made regarding the main hypotheses of this study, the fact that the results for some individual cued recall questions were significant or marginally significant shows that a full-fledged study on the effects

of positive emotions on eyewitness memory would be a worthwhile investigation. There are also still many interesting implications and future directions worth exploring based on the results of this pilot study, the first being for the three cued recall questions that showed significant effects.

Analyses showed that only peripheral detail questions showed a significant effect of emotion induction condition, perhaps suggesting that peripheral details are more susceptible to memory variations based on an individual's current emotional state. This could be for many possible reasons. One theory is that a higher level of arousal in the emotion conditions compared to the neutral condition created a greater likelihood to notice peripheral details. Future studies could test this idea more definitively by including a negative emotion condition. Another theory is that, following the *Broaden and Build Theory* (Conway et al., 2012), participants in the positive emotion conditions experienced broadened cognition, incorporating more peripheral details into memory than those in the neutral condition. Further studies could also look into whether these peripheral details are encoded before or after the arousing induction occurs — i.e., did participants recall the wedding ring on the teller's hand before or after the robbery was initiated? The three peripheral detail questions that showed significant effects of emotion in the current study can help guide these future studies.

The first question to show significant effects of emotion induction condition was “How many other bystanders were at the scene?” Recall that those in the gratitude condition were significantly more likely to answer correctly than those in the neutral condition and those in the joy condition were marginally more likely than those in the neutral condition. A common action-tendency of both gratitude and joy is to connect socially with others. Perhaps by activating these emotions, participants in the gratitude and joy conditions were more likely to notice each bystander individually as they were looking for someone to connect to in the video.

The question “Was there anything placed inside the offender’s bag besides money?” also showed significant effects of emotion: those in the joy condition were significantly more likely to answer correctly than those in the neutral condition. Analysis of the question “What is the marital status of the employee that was robbed?” found only a marginally significant difference, but showed that those in the joy condition were significantly more likely to answer correctly than those in the neutral condition. These results are more difficult to interpret. It may be that joy is a highly activating and externally focused positive emotion and therefore enhanced the attention of participants in this condition. If this interpretation is correct, this would support the *Broaden and Build Theory* of positive emotion (Conway et al., 2012). It could be, however, that participants in the joy condition were more likely to notice this because a ring is a symbol of union between two people, and some have argued that the characteristic appraisal of joy is that “I have become united with someone/something important to me.” (Watkins, 2019). Of course, all of these interpretations are highly speculative at this point, but further research might help us understand these apparent effects.

When overviewing the post-hoc analyses of all 20 cued recall questions, a noteworthy pattern was observed. For the majority of questions, *p*- values of post hoc comparisons of gratitude and joy ranged from .6 to .9. At first, this seemed concerningly high as this study considers joy and gratitude to be distinct positive emotions. However, when looking at the cognitive side of Fredrickson’s *Broaden and Build Theory* (Conway et al., 2012) positive emotions work to broaden cognition to increase awareness and attention. As both gratitude and joy are positive emotions, it would make sense that they would perform equally well in a cognitive test such as a free recall questionnaire.

Two elements of the qualitative analysis of the free recall are worth discussing. The first being the amount of false alarms that occurred when recalling the offender's note. My theory is that participants' schemas of what a bank robbery looks like biased their memory of the crime video. According to Baron, Branscombe, and Byrne (2008), schemas are "mental frameworks that allow us to organize large amounts of information efficiently." (p. 39) When we encounter events multiple times, our memory begins to organize and utilize this information to tell us what to expect in this situation. For example, by attending multiple birthday parties as a child, an individual knows to expect cake, balloons, and presents at other birthday parties they attend in the future. Due to the large amount of television shows and media coverage on bank robberies, many individuals have developed personal schemas about bank robberies, some of which may have been activated in participants of the current study. Because most bank robberies do not end in fatalities, and no one was harmed in the film, participants substituted the note saying, "*or someone will get hurt*" with "*and no one will get hurt.*" Because the entire scene was quiet and calm, individuals also inserted phrases like "don't make a scene" and "quietly put the money in the bag" into the note that were actually not there. Many individuals also included phrases such as "no cops/police" and "don't call the police or sound any alarms" into the note that were not there due to the implicit belief in many that the police respond quickly to bank robberies.

Second, a significant number of participants also recalled the offender as six feet or taller even though there was a visible ruler next to the door the offender exited at the end of the video that measured him at 5'9". Three or so inches do not seem to be a large deviation, but it seems curious considering a ruler was provided on his exit, and thus, his height could be clearly and unambiguously observed. There are a few reasons why the offender might have been remembered as significantly taller by a large proportion of individuals. First, the offender was

taller than all other individuals in the video, possibly causing the misperception that the offender was taller. Second, the offender placed his hand on the door as he exited the building, very close to the six-foot marker on the ruler and participants may be recalling the height next to the hand placement instead of the offender's true height. Third, it may be another issue of schema-based recall: offenders are often seen as tall, scary males, and participants may have subconsciously made him taller than he was in their memory to better fit that schema.

As mentioned previously, due to quarantine restrictions, there are some limitations to this study, most stemming from a lack of statistical power due to a small sample size. Other limitations included the lack of a real-life setting for both the crime and the interviewing. Often individuals will witness a crime in person rather than on video and, assumingly, would be more aroused if they were a live witness to a bank robbery. Individuals are also often interviewed at the scene of the crime or back at a police station, neither of which look like a psychology lab in a university. Being able to incorporate real-life events and gather information from individuals who have been through real crime events will give even clearer information on how memory works under duress.

Because this is often an inaccessible option for researchers, in future studies I would recommend a more ambiguous video than the one shown in this study. Because it was originally a training video for bank tellers, some of the crime dimensions are emphasized, making recall easier than in real life crimes. For example, when the offender hands the note to the teller, the camera shifts focus specifically onto the offender's hand and the tattoo he had on it, making the tattoo more noticeable than it might have otherwise been to someone unable to view the hand from above. Other suggestions for future studies include incorporating additional positive and negative emotions into one study to better compare the effects of emotions and researching

various types of crimes to see if factors such as intensity, duration, and complexity of the crime changes the effects emotion has on eyewitness memory. Asking more comprehensive questions regarding memory of peripheral and central details of an event will assist in our comprehension of the encoding, integration, and retrieval aspects of eyewitness memory. Asking questions more analogous to a police interview format would increase external validity by better informing researchers of how individuals' memories are working in real life crime situations. A final suggestion for future studies is to test participants memory at multiple time points post viewing the crime. Many analyses can be made from this information including, but not limited to, fading effects in memory, the undoing effect of positive emotions, and the effect of emotions on the integration of traumatic events into memory.

Even though a small sample size limits the conclusions that can be drawn from this study, it is a crucial steppingstone in investigating the effects of positive emotions on memory in a variety of contexts, including eyewitness memory. The importance of understanding the accuracy of eyewitness memory still stands, and as we've seen from this study as well as others, both positive and negative emotions play a role in how memory is encoded and retrieved. Future researchers can use this pilot study as a base for what to do and what not to do as we move from the question *do* positive emotions have an effect on eyewitness memory to *what* effects do positive emotions have on eyewitness memory. While no study can provide all the answers, as the Tanzanian proverb goes "little by little, a little becomes a lot."

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Appendices

Appendix A- Consent Form

Consent Form Reactions Based on Thoughts Study

Principal Investigator: Brandy Hutton, Student, Psychology Department

Responsible Investigator: Philip Watkins, Ph.D., Professor, Psychology Department

Investigator's Statement

Purpose

My name is Brandy Hutton and I am a graduate student in the Experimental Psychology Program at Eastern Washington University. I am conducting this research to fulfill the thesis portion of my graduation requirements to receive my master's degree. This study aims to investigate how your thoughts affect reactions to a video. This study will enhance our understanding on how specific thoughts may affect our reactions to certain events. The only benefit of this study to you as a participant is extra credit in the class of your choosing.

Procedures

In this study, you will complete three emotion questionnaires as well as list three events, one of which you will describe in depth. This packet should take approximately 10-15 minutes to fill out. After completing these questionnaires, you will be asked to watch a brief video of an uncommon event, less than two minutes in length. Following the video, you will be asked various questions about your reactions and feelings on the video as well as demographic information only to be used for research purposes and containing no identifiable information. This section should take approximately 15-20 minutes to complete with the entire study taking approximately 30-40 minutes. This study is completely confidential and voluntary, and you reserve the right to choose not to participate.

Risk, Stress or Discomfort

This study may have the potential to cause minimal risk to some participants. Some emotional questionnaires may ask about sensitive issues such as "How sad, downhearted, or unhappy do you feel?" Some participants may also feel brief discomfort while viewing the video in the study. Any and all questions about the video will be answered at the end of the study. Please remember that your responses are confidential, and you reserve the right to not answer any questions that make you feel uncomfortable or withdraw from the study at any time without penalty.

Other Information

Class credit will be received for participating in this study and will be given to the class you chose when signing up on SONA. If you object to this study, you may choose to withdraw and complete the alternative assignment provided by your professor. Participation in this study is voluntary and confidential and you are free to withdraw at any time without penalty. If you have any concerns about your rights as a participant in this research or any complaints you wish to make, you may contact Charlene Alspach, Executive Director, Grant & Research Development, at calspach@ewu.edu.

Principal Investigator

Date

Responsible Investigator

Date

Subject's Statement

The study described above has been explained to me, and I voluntarily consent to participate in this study. I have had an opportunity to ask questions. I understand that by signing this form I am not waiving my legal rights. I understand that I will receive a signed copy of this form.

Signature:

Date

Appendix B- Modified Positive and Negative Affect Scale

The PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate number in the space next to that word. Indicate to what extent ***you feel that way right now, that is, at the present moment***, not necessarily how you feel generally or how you feel on average. Use the following scale to record your answers. If you are reading these instructions carefully, please circle the last word of this sentence.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

<input type="checkbox"/> interested <input type="checkbox"/> distressed <input type="checkbox"/> grateful <input type="checkbox"/> playful <input type="checkbox"/> excited <input type="checkbox"/> upset <input type="checkbox"/> strong <input type="checkbox"/> guilty <input type="checkbox"/> scared <input type="checkbox"/> appreciative <input type="checkbox"/> hostile <input type="checkbox"/> enthusiastic <input type="checkbox"/> indebted (feeling obligated to repay) <input type="checkbox"/> proud <input type="checkbox"/> amazed	<input type="checkbox"/> irritable <input type="checkbox"/> alert <input type="checkbox"/> ashamed <input type="checkbox"/> joyful <input type="checkbox"/> inspired <input type="checkbox"/> thankful <input type="checkbox"/> nervous <input type="checkbox"/> determined <input type="checkbox"/> attentive <input type="checkbox"/> jittery <input type="checkbox"/> active <input type="checkbox"/> afraid <input type="checkbox"/> amazed <input type="checkbox"/> obligated <input type="checkbox"/> delighted
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Appendix C – Emotion Inductions

Joy Induction

Please recall three events from your life where you have felt great joy (reunited with something or someone important to you):

1. _____
2. _____
3. _____

Of the events listed above, pick the one with the most significance to you. For the next few moments, please sit silently and recall the experience vividly as if for the first time. Once you have done so, please describe the experience below so that someone who had never felt joy would be able to understand and feel your joy too.

Gratitude Induction

Please recall three events from your life where you have felt great gratitude:

1. _____
2. _____
3. _____

Of the events listed above, pick the one with the most significance to you. For the next few moments, please sit silently and recall the experience vividly as if for the first time. Once you

have done so, please describe the experience below so that someone who had never felt gratitude would be able to understand and feel your gratitude too.

Neutral Condition

Recall three things you did today that you tend to do almost every day:

1. _____
2. _____
3. _____

Of the three things you listed above, please write about the one that was the least emotional to you down below.

Appendix D- Free Recall

In the space provided below, please write down everything that you can remember about the event just witnessed and the people involved as completely and accurately as possible. Feel free to write things down as you remember them regardless of the order they happened or how relevant or irrelevant you find the information. Do not leave out any details, but do not guess if you are unsure or cannot remember.

Please Continue to Next Page When All Information is Reported →

Appendix E- Demographics

Gender (Circle One): Male Female Other

Age: _____

Ethnicity (Circle all that apply):

Hispanic or Latino American Indian or Alaska Native Asian White

Black or African American Native Hawaiian or Pacific Islander Other: _____

Prefer Not to Say

Education Level (Current):

Running Start Freshman Sophomore Junior

Senior Graduate Post-Bac Other: _____

How much attention to you pay to the bank robbery video earlier in the study?

1	2	3	4	5	6	7
Not at all			Moderately			Completely

How much did you identify with the offender in the video?

1	2	3	4	5	6	7
Not at all			Moderately			Completely

Curriculum Vitae

Brandy Hutton

EDUCATION

Eastern Washington University **2018-2020**
M.S. in Experimental Psychology
 Specialization: Forensics
 Thesis: The Effects of Positive Emotions on Eyewitness Memory

Eastern Washington University **2016-2018**
B.A. in Psychology
 Minor: Sociology
 Honors: Summa cum laude

AWARDS

Dean's List, Eastern Washington University 2016 – 2020

PUBLICATIONS AND PAPERS

"It's Out of My Control" The Roles of Victimization and Depression on Locus of Control in Male Inmates

Poster presented at the American Psychology Law Society Conference, New Orleans, LA
Brandy Hutton and Kayleen Islam-Zwart 2020

What is the Appraisal Structure of Joy?

Poster presented at the Association for Psychological Science Conference, virtually
 Kahle Elliot, Philip C. Watkins, Robert A. Emmons, & **Brandy Hutton** 2020

Modifying Interpretation Biases Important to Gratitude

Poster presented at the Society for Personality and Social Psychology, New Orleans, LA
 Philip C. Watkins, Peter Munger, Andrew Mathews, & **Brandy Hutton** 2020

The Meaning of Gratitude: How Gratitude Enhances Well-Being by Encouraging Meaning and Purpose in Life

Manuscript under review by The Journal of Positive Psychology

Philip Watkins, Duncan McCurrach, **Brandy Hutton**, & Alejandra Huerta 2019

Joy and Well-Being

Article published online at George Mason University 2019

Philip Watkins, **Brandy Hutton**, & Robert Emmons

The Relationship Between Humility and Other Positive Emotions: A Prospective Study

Paper presented at the Annual Convention of the Western Psychological Association,
Pasadena, CA 2019

Brandy Hutton & Philip Watkins

Gratitude Enhances Well-Being by Promoting Meaning

Symposium presented at the Annual Convention of the Western Psychological Association,
Pasadena, CA 2019

Philip Watkins, Dan Schiebe, & **Brandy Hutton**

Positive Bias in Positive Psychology

Poster presented at the Eastern Washington University's Annual Student Symposium,
Cheney, WA 2019

Brandy Hutton, Max Barham, & Philip Watkins

Developing an Implicit Measure of Gratitude

Poster presented at the Annual Convention of the Western Psychological Association,
Pasadena, CA 2019

Paul Glanzer, **Brandy Hutton**, Alejandra Heurta, & Philip Watkins

Gratitude May Promote Well-Being by Enhancing Meaning 2019

Poster presented at Society for Personality and Social Psychology, Portland, OR

Philip Watkins, Dan Schiebe, & **Brandy Hutton**

Prospective Impact of Gratitude to God 2018

Paper presented at the Annual Convention of the Western
Psychological Association, Portland, OR

Philip Watkins & **Brandy Hutton**

Gratitude isn't a Magic Potion for Happiness: Importance of Daily Practice 2018

Poster presented at the Annual Convention of the Western
Psychological Association, Portland, OR

Brandy Hutton, Iryna Malova, Alejandra Huerta, & Philip C.
Watkins

The Benefits of Humility: Correlations with Gratitude, Happiness, and Joy 2018

Poster presented at Eastern Washington University's Student
Symposium, Cheney, WA

Brandy Hutton, Kirsha Johnson, & Philip Watkins