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Emotion, Memory, and Identity: A Study Investigating the Factors Affecting the Misinformation Effect with a Preface on the Connections Between Memory and Identity

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Emotion, Memory, and Identity: A study investigating the factors affecting the misinformation effect with a preface on the connections between memory and identity

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Preface: Memory and Identity

Human memory is an integral part of an individual's identity. It encompasses all of our experiences, and how these experiences have affected the development of the people that we have become today. Memory is an extraordinary adaptation which helps us maintain a consistent sense of self. However, it is not a perfect mechanism. There are many factors that can affect how we remember certain events—such as emotions, associations, and misinformation. These factors may cause us to forget the events, change the emotions felt during these events, or even change our memories of the events overall. Susceptibility to change is present in all three stages of memory—encoding, storage, and retrieval. This means that our perceptions of past events are always susceptible to biases and inaccuracies.

All types of memories are susceptible to these inaccuracies, including autobiographical memories of our own, personal past. These inaccuracies can be seen in our own lives, as well as in laboratory studies of autobiographical memories (Shaw & Porter, 2015). Because personal memories are such a large part of an individual's identity, how do we identify who we truly are when our memories are so easily changed? And, if we cannot identify the inaccurate memories, does this have any implications for how we define identity? These questions are being constantly grappled with in our society, with examples present in popular culture—such as in movies—as well as in psychological research, and the field of clinical and counseling psychology.

Emotions are a major factor that can affect an individual's memories of their past. In the movie *Inside Out*, memories of the main character, Riley, are literally colored by

her emotions (Lasseter et al., 2015). Though this is a fictional, animated movie, this metaphor is supported by scientific research. Emotions serve the function of organizing rational thinking and help us become better attuned to our environment in order to respond in an appropriate manner (Keltner & Ekman, 2015). Additionally, memories that are colored by emotion help us better assess the current situation by comparing emotions felt at that time to those of our memories, which also help us respond to the current situation in an appropriate manner (Keltner & Ekman, 2015).

The memories of the main character also play a factor in shaping her personality. Certain, important memories shape what are described in the movie as "islands of personality" which are characteristics of Riley's personality that contribute to the way she sees and interacts with the world (Lasseter et al., 2015). For example, the main character has strong, positive memories associated with her family, making her positive relationship with her family a central aspect of her personality (Lasseter et al., 2015). Since the memories that shape these aspects of personality are also affected by emotion, it can be inferred that both emotions and memory are imperative aspects of what shapes our personalities and identities as human beings. What we perceive as reality is filtered through our emotions. This helps us find personal meaning in our experience.

Because some emotions seem to be less pleasant than others, it is tempting to think that only positive emotions are important to the human experience and our sense of identity. However, throughout the movie it is demonstrated that all emotions have important, contributing factors to our memories and personalities, which creates a richer, more complex human experience (Lasseter et al, 2015). For example, at the beginning of

the movie, the emotion of Sadness is thought to only be a burden for the main character, especially when Sadness colors all of the character's previously happy memories with her current, sad emotional state (Lasseter et al, 2015). However, by the end of the movie it is shown that all emotions, including Sadness, serve a powerful purpose in navigating the complex emotional and social lives that we experience as human beings (Lasseter et al, 2015). This is also echoed by scientific research which postulates that the emotion of sadness actually draws people together in response to it, creating stronger social ties between these individuals (Keltner & Ekman, 2015).

We have all experienced the effect of emotions and memories on our personalities and the ways in which we interact with the world around us. We have also experienced how our current emotions may bias or change the way perceive these past memories, usually resulting in us experiencing them differently than when they were originally encoded. The fact the *Inside Out* is a children's movie speaks to the reality that this is a fundamental part of the human experience, with even young children being able to relate to these themes of emotion, memory, personality, and change.

However, sometimes memories, and the emotions that accompany them, can become too much to bear and can cause great distress in individuals who experience them. For example, individuals, who experience Post-Traumatic Stress Disorder (PTSD) often times find their lives being overtaken by their memories and the uncomfortable emotions that are associated them (Comer, 2014).

In this case, there may be a desire to remove these memories and the unpleasant emotional association that accompanies them. This is usually accomplished through a

process known as exposure therapy, where the triggering stimulus—such as a sound or image associated with the negative event—is attempted to be associated with a more harmless memory of being in a safe space such as the therapist's office (Stromberg, 2014). However, if the memory is especially engrained, it may become more difficult for this therapy to be effective (Stromberg, 2014). Recently, a drug known as a histone deacetylase inhibitor has been shown to make rats forget an association that has been created between a certain stimuli and receiving a shock (Stromberg, 2014). It is thought that this sort of drug may lengthen the time that exposure therapy is effective in humans, and may be beneficial for individuals suffering from PTSD (Stromberg, 2014). This seems to imply that the therapy will not get rid of the memories of the past, but instead make them less intrusive so that the individual does not experience as much distress from them. However, some may argue that it would be better to not remember these events at all.

This concept of completely forgetting unpleasant events that have happened in our lives is presented in the film *Eternal Sunshine of the Spotless Mind*. In the film, the main character, Joel, decides to erase all memories of his ex-girlfriend, Clementine, after their relationship ends badly (Bermann et al., 2004). However, as the procedure progresses, Joel realizes that he does not want to erase these memories because they have become a central part of who he is (Bermann et al., 2004). This plays with the idea that, though memories of experiences can often times be painful, there is something about the fact that we have experienced them that allows these memories to become a part of who we are as individuals. Memories of these experiences shape how we continue to perceive

the world and our attitudes towards it. If we are to start removing unpleasant things from our memories, we may lose incredibly important aspects of what makes us unique individuals and what is at the core of what makes us human. Having memories allows us the ability to learn from our past and continue to live our lives in a way that allows us to be who we are, based on how our pasts have shaped us.

Memories have the capacity to be altered or implanted. This is something that individuals, especially those in fields relating to psychotherapy, must be acutely aware of. Not being aware of this has the capacity to lead to great distress for individuals who are seeking treatment.

The Retro Report, a video series presented by The New York Times, demonstrated this in references to Dissociate Identity Disorder (DID) which was formally known as Multiple Personality Disorder (MPD). In this report, they investigate the case known as "Sybil". They identified this individual as Shirley Mason, a client of the psychiatrist Cornelia Wilber (The New York Times, 2014). Wilber diagnosed Mason with Multiple Personality Disorder by using psycho hypnotic drugs to help Mason access her unconscious memories (The New York Times, 2014). While under the effect of these drugs, Wilber questioned Mason about her past using specific suggestions about events that may have caused her trauma (The New York Times, 2014). This form of therapy caused Mason to remember abuse she had suffered as a child, which leads Wilber to conclude that this abuse caused her to dissociate, resulting in a diagnosis of Multiple Personality Disorder (The New York Times, 2014). After treating Mason, Wilber partnered with her friend, Flora Schreiber, to publish a book called *Sybil*, which was later

adapted to a movie (The New York Times, 2014). Once this occurred, diagnoses of Multiple Personality Disorder increased from the hundreds into the thousands (The New York Times, 2014).

Psychiatrists would often use the same techniques as Wilber in order to make diagnoses of Multiple Personality Disorder. They would administer psycho hypnotic drugs and use specific suggestions in order to recover traumatic memories which were believed to be the cause of the disorder (The New York Times, 2014). However, in the 1990s, many lawsuits began to be brought to light by people with Multiple Personality Disorder about their diagnoses (The New York Times, 2014). Many of these individuals had been diagnosed with this disorder due to "recovered" memories of abuse that they suffered as children (The New York Times, 2014). However, there was little evidence that this abuse occurred (The New York Times, 2014).

This disorder, and the history that accompanies it, are very important in understanding how our memories affect our personalities and our sense of self. Specifically, this demonstrates how easily that these memories can be changed, and what a great impact this can have on a person's sense of identity. These individuals did not only have their sense of identity changed, but had to suffer the knowledge that their parents had horrifically abused them, though this knowledge was likely false.

Knowing that memory is malleable, and knowing that it is very easy to change these memories to the point where they can totally disrupt the individuals sense of identity, the question then becomes: What should we do with this information and how

should we conduct ourselves in the face of the realization that this changing of memories is a distinct possibility?

People often seek out counseling in order to reconcile their memories, their emotions, and their sense of identity. The idea behind counseling is not to "fix" the individual, because it is not believed that any individual is "broken". By helping individuals deal with their memories, their emotions, and their sense of self, we are helping them come to terms with these aspects of themselves, rather than trying to get rid of a problem. Emotions are often very difficult to deal with, but, as we have seen in various pop culture and clinical examples, they can help organize our memories, add meaning to our experiences, and shape our identities. Counseling can help an individual come to terms with this reality, though it is often times uncomfortable.

It is also important for counselors to recognize how easily memories may be manipulated and be sensitive to this fact when questioning individuals. Though the memory may or may not be true, they can come to shape the individual's identity and how they interact with the world. Because of this, regardless of if our memories are true or not, they have a large impact on who we are as people. This is uncomfortable because these memories can be unpleasant. However, this does not make them any less important in the concept of identity. Learning to sit with these things that make us uncomfortable and coming to terms with the fact that they have affected us is an important step in learning to accept the reality that our memories are not infallible, but they still shape who we are. It is important to continue to explore the mechanisms behind memory reconstructive errors so that cases like those related to Multiple Personality Disorder do

not happen as often, and do not cause more distress. However, it is important to understand that, though we may be better able to conceptualize these mechanisms, our memories are still likely to be malleable, and this is something we must come to terms with.

Many things have the ability to affect memory and, by extension, shape our sense of identity. We are all subject to the effects of emotion, association, and misinformation on our memories. All of these aspects have the ability to change our memories, whether it be by biasing them through our current emotions, associating them with certain stimuli, or creating an entirely new memory. This concept may make us uncomfortable because this calls into question how accurately we are able to remember and perceive the world. By extension, this also calls into question how much of our identity is formed by these false or biased memories. However, I do not believe that this is necessarily a bad thing. Whether or not our memories are biased or misinformed does not change the fact that we use them in order to navigate our world, find meaning in our experiences, and shape our personality. Though these things may not be objectively correct, they have created our own, personal reality and identity. Though our memories are malleable, and it is important to be aware of their possible inaccuracies, this does not take away from the richness and complexity of the human experience and individual identity.

In order to understand the factors that affect our memory and its susceptibility to these inaccuracies, empirical studies must be conducted within the field of psychology. As we know, things like specific suggestions and emotions can change how an individual remembers an event. We must look at these factors in relation to each other in order to

come to a more complete understanding of the inner workings of our memory, how are memories can be susceptible to error, and, by extension, how these aspects shape our sense of self in relation to the world around us.

Abstract

The purpose of this study was to investigate the effects of emotion and different forms of visual stimuli on susceptibility to the misinformation effect. The misinformation effect occurs when false information is integrated into a memory of an event. There has been conflicting evidence about how emotion affects an individual's susceptibility to the misinformation effect. This may be due to discrepancies in the methodology of past studies where some studies used video stimuli while others used picture stimuli. The current study investigates this discrepancy by comparing positive and negative emotional stimuli, as well as video and picture stimuli. Sixty undergraduate participants viewed three videos and three pictures which were either positively or negatively emotionally arousing. The participants were then given a distractor task, followed by a memory test for the stimuli they initially viewed, which contained embedded misinformation in some of the questions. The participants were then given a second distractor task, and then a final memory test which tested if the misinformation had affected the participant's memory of the stimuli. There was no significant main effect of emotion or stimuli type found in this study. There was also no significant interaction between the variables. These findings suggest that there may be another factor contributing to the discrepancy in the literature that has not yet been investigated.

It has been well established that the memories that an individual possesses are malleable and changes to them can easily occur. Shaw and Porter (2015) illustrated this malleability by successfully implanting false memories of criminal and non-criminal activity occurring in the participant's adolescent years. This study demonstrates the ability to incorporate entirely fabricated events into memory. It has also been demonstrated that details about an event that did occur can be implanted or changed, which can affect how the event is remembered overall (Brainerd et al., 2008; Hoscheidt, LaBar, Ryan, Jacobs, & Nadel, 2013; Loftus, 1975; Loftus & Palmer, 1974; Paz-Alonso, Goodman, & Ibabe, 2013; Porter, Bellhouse, McDougall, ten Brinke, & Wilson, 2010; Porter, Spencer, & Brit, 2003; Porter, ten Brinke, Riley & Baker, 2014; Van Damme, & Smets, 2014).

It has been well documented that the language that is used in relation to an event can affect the memory an individual recalls about the event itself (Loftus, 1975; Loftus & Palmer, 1974). In some cases, incorrect information may be integrated into the questions about the event, resulting in a reconstructive memory error to accommodate for the new, incorrect information (Loftus, 1975). An example of this is seen in an experiment done by Loftus (1975) where participants were shown a video of a car accident and asked to estimate the speed that the car was going when it passed a barn before the accident. In reality, there was no barn present in the video, but many of the participants remembered a barn being present when asked about the video a week later (Loftus, 1975). This integration of false information into memory is known as the misinformation effect (Loftus & Hoffman, 1989).

In addition to the language used to discuss an event, the emotions that an individual is feeling may have an effect on their memory of the event. There have been conflicting findings about how emotions affect memory. Several studies have investigated the link between memory and emotion, with the results suggesting that negative emotions during an event allow for individuals to have a more accurate recall of the event that took place (Kensinger, 2007; Kensinger & Schacter, 2006; McKinnon et al., 2015). One notable experiment performed by Kensinger and Schacter (2006) measured the memory consistency and amount of detail remembered by individuals who had watched a Red Sox vs. Yankees baseball game and had a positive, neutral, or negative reaction to the game's outcome. They found that participants who had a negative reaction to the game's outcome had more memory consistency and remembered more event related details than the participants in the other emotional groups (Kensinger & Schacter, 2006). Additionally, a study investigating the memory of the passengers of Air Transat Flight 236—a flight that was in danger of crashing into the ocean—showed that the passengers on the flight recalled a larger number of details from the event as compared to less traumatic memories from the participants' lives (McKinnon et al., 2015).

However, there have also been several studies that suggest that negative emotions during an event can leave memory *more* vulnerable to reconstructive errors than if the individual is feeling positive or neutral emotions (Brainerd, Stein, Silveria, Rohenkohl, & Reyna, 2008). This has been demonstrated with the Deese–Roediger–McDermott (DRM) paradigm—a paradigm where individuals tend to falsely remember a non-presented target

word (e.g., *sleep*) that is closely associated with a list of presented words (e.g., *dream, snooze, pillow, snore, doze,* etc.), even though the target word is not present on the list (Brainerd et al., 2008). Participants falsely remembered more non-presented target words when the words presented to them induced negative emotions compared to words that induced positive or neutral emotions (Brainerd et al., 2008). This suggests that participants are more susceptible to false memories when they are experiencing negative emotions as compared to positive or neutral emotions. In this way, there is conflicting research about whether or not negative emotions improve or decrease memory accuracy.

This discrepancy is also present in the literature when misinformation is introduced to the participants. Several studies suggest that negative emotions protect against the misinformation effect (Hoscheidt et al., 2013; Paz-Alonso, Goodman, & Ibabe, 2013). In a study where participants were shown a murder scene from a movie and given a memory test containing misinformation, participants who reported higher levels of negative emotions were less susceptible to the misinformation effect (Paz-Alonso et al., 2013). However, there are several studies that suggest that negative emotions actually make memories more vulnerable to the misinformation effect (Brainerd et al., 2008; Porter et al., 2010; Porter et al., 2003; Porter et al., 2014; Van Damme, & Smets, 2014). Porter et al. (2003) exposed participants to eight positive, negative, or neutral emotional scenes using the International Affective Picture System and then introduced misinformation. Participants who were exposed to negative scenes were more susceptible to the misinformation effect (Porter et al., 2003).

One of the most notable differences between the methodologies of the studies that find negative emotions are beneficial to memory, and studies that find that negative emotions leave memory more vulnerable to errors, is the stimuli that were used in these studies. The studies that found that negative emotions protect memory from the misinformation effect used a video scene or a slide show of pictures with a story line as the stimuli, which the participants observed and were then asked leading questions about aspect of the stimuli (Hoscheidt et al., 2013; Paz-Alonso et al., 2013). In contrast, studies that found that negative emotions make memory more vulnerable to the misinformation effect used pictures as their stimuli, which the participants observed and were then asked leading questions about the presence of an object in the picture (Porter et al., 2010; Porter et al., 2003; Porter et al., 2014; Van Damme, & Smets, 2014). Furthermore, previous studies have shown that memory for videos tends to be more accurate compared to memory for pictures (Buratto, Matthews, Lamberts, 2009; Matthews, Benjamin, Osborne, 2007). Because the studies that find negative emotions to be protective from the misinformation effect use videos, and studies finding that negative emotions make an individual more susceptible to the misinformation effect use pictures, the discrepancy in the findings may be due to the use of different stimuli.

In the current literature, there has not been a study conducted that compares the susceptibility of the misinformation effect while inducing positive and negative emotional states using video and picture stimuli in the same study. The purpose of the current study is to compare the misinformation effect of video stimuli versus picture stimuli, as well as the effect that positive and negative emotions have on the

misinformation effect for these stimuli. This will be an attempt to empirically test if the discrepant results in the current literature stems from the type of stimuli—either videos or pictures—that are employed to test the misinformation effect.

It is hypothesized that there will be a main effect of type of stimuli such that when the participants view video stimuli, they will be less susceptible to the misinformation effect than when they view picture stimuli. This hypothesis is based on previous research that has demonstrated that memory accuracy of video stimuli is higher than for picture stimuli (Buratto et al., 2009; Matthews et al., 2007). It is also hypothesized that there will be a main effect of emotion such that participants that are exposed to positive stimuli will be less susceptible to the misinformation effect than the participants that are exposed to negative stimuli. This hypothesis is based on the premise that—though there is conflicting research about how negative emotions affect memory accuracy—a larger number of studies suggest that negative emotions increase the susceptibility to the misinformation effect (Brainerd et al., 2008; Porter et al., 2010; Porter et al., 2003; Porter et al., 2014; Van Damme, & Smets, 2014). It is predicted that there will be a significant interaction, such that positive videos are more susceptible to the misinformation effect than negative videos, but negative pictures are more susceptible to the misinformation effect than positive pictures.

Method

Participants

The participants in this study were 60 Regis University undergraduate students between the ages of 18 and 23 (M = 19.60, SD = 1.5), 46 of whom were female and 14 of

whom were male. The participants were recruited through the Psychology & Neuroscience Subject Pool, where they fulfilled a course requirement or received extra credit for their participation. Other students outside of the subject pool participated as volunteers and did not receive any compensation.

Materials

Picture stimuli. The picture stimuli were chosen from the International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 2008). Many studies have used this database to induce positive and negative emotional response (Porter et al., 2010; Porter et al., 2003; Porter et al., 2014; Van Damme, & Smets, 2014). The pictures chosen for the negative emotional group were IAPS numbers 6838, 9415, and 9429 (Lang et al., 2008). The pictures chosen for the positive emotional group were IAPS numbers 2217, 2342, and 4542 (Lang et al., 2008). Based on the method of a previous study (Porter et al., 2003) pictures were chosen from the database that had been rated to induce an above average emotional response for the positive emotional condition and a below average emotional response for the negative emotional condition. The valance level was rated on a scale of one to nine (Lang et al., 2008). The mean valance rating for the negative emotional group was 2.65. The mean valance of the positive emotional group was 6.26. The pictures in the negative and positive emotional conditions were matched on the level of arousal, content, and number of details. The arousal ratings for the pictures were 5.44 and 4.40 for the negative and positive emotional conditions respectively. This was done to ensure that the level of arousal did not become a confound in the investigation of the difference between the positive and negative emotional groups, where valance was used

as the measure for emotional response. Arousal was also rated on a scale of one to nine. Additionally, the pictures were chosen based on the contents of the picture. Pictures were only considered if they contained people, had content that is appropriate for research (i.e., not disturbing, threatening, offensive, or explicit), and had a visible background, meaning that the aspects of the background could be seen clearly and easily identified. These criteria were all based on the methods of Porter et al. (2003).

Additionally, the number of details that were depicted in the pictures was controlled for. The number of objects for each scene was analyzed using the "Analyze Particles" function in ImageJ software, as described in a previous study investigating the number of details in pictures (Miyamoto, Nisbett, & Masuda, 2006). Pictures were chosen that had a similar number of objects in order to eliminate the confound of having more objects present in some pictures than in others. In the negative emotional condition, the pictures contained an average of 503.6 objects. In the positive emotional condition, the pictures contained an average of 474.33 objects.

Video stimuli. The video stimuli were chosen from the LIRIS-ACCEDE database which contains video clips that have been rated based on emotional response and arousal in a similar manner to the International Affective Picture System (Baveye, Dellandrea, Chamarte, & Chen, 2015). The videos chosen for the negative emotional condition were LIRIS-ACCEDE numbers 379, 2183, and 2585 (Baveye et al., 2015). The videos chosen for the positive emotional condition were LIRIS-ACCEDE numbers 838, 4395, and 8594 (Baveye et al., 2015). These stimuli were chosen based on the rating indicating either an above average emotional response for the positive emotional condition or a below

average emotional response for the negative emotional condition. Valance was rated on a scale of one to five. The average valance rating was 1.35 for the negative emotional condition and 3.62 for the positive emotional condition. Emotional arousal was also controlled for by selecting videos with a similar arousal rating. The average arousal ratings for the videos were 3.48 for the negative emotional condition and 2.78 for the positive emotional condition. Arousal was rated on a scale of one to five as well. These procedures ensured that the emotional response and arousal were similar for both the videos and the pictures. Similarly to how the pictures were selected, videos were only considered if they contained people, had appropriate content for research, and had a visible background. Additionally, videos were only considered if they were not animated, did not have scene changes, and the dialogue was in English, if there was dialogue present. As with the pictures, the number of objects in the videos were analyzed by taking a frame from the video and analyzing it using the ImageJ software in order to eliminate the confound of having more objects in one video than another, similar to the procedure used to select the pictures (Miyamoto et al., 2006). The mean number of objects in the negative and positive emotional stimuli were 145 and 177 respectively.

Distracter tasks. The participants completed a total of two distracter tasks. Based on a procedure of a previous experiment (Porter et al., 2003), these distracter tasks were a composition of several personality tests grouped into two different personality inventories. The first distracter task consisted of several different positive psychology questionnaires (Brown & Ryan, 2007; Diener, 2007; Kashdan, Gallagher, & Silvia, 2007; Lyubomirsky, 2007; McCullough, Emmons, & Tsang, 2007; Robitschek, 2007; Snyder,

2007; Sodergren & Hyland, 2007; Steger, Frazier, Oishi, & Kaler, 2007) as well as a free online personality questionnaire based on Jung's Typology (Humanmetrics Inc, 2015). The second distracter task consisted of two free online personality inventories ("Similar Minds"). Data from these distracter tasks were not analyzed.

Memory tests. Participants completed a total of two memory tests for the stimuli they viewed. The first was given to the participants after the first distracter task and contained embedded misinformation within some of the questions (Appendix A & B). There are five questions for each of the pictures and videos that were viewed, three of which contain misinformation. The questions with and without misinformation were presented in a random order for each of the stimuli that was determined by a random number generator (Random.org). The second memory test was administered after the second distracter task and contained questions that tested if the misinformation presented in the first memory task had an effect on the participant's memory of the stimuli (Appendix C & D). These questions for each of the stimuli were also presented in a random order determined by a random number generator (Random.org).

Procedure

Because the variable of emotion was between-subject, participants were randomly assigned to either view the positive or negative stimuli. This was determined using a random number generator in order to determine which participants would view positive stimuli and which would view negative stimuli (Random.org).

The variable of the type of stimuli viewed was within subject, so the order of the type of stimuli that was viewed—either picture or video first—was counterbalanced in

order to eliminate possible carry-over effects. This was done based on the order in which the participants signed up, and the emotional condition to which they were assigned, with the first participant in the positive condition viewing the pictures first, and the second participant in the positive condition viewing the videos first. This pattern continued for both emotional conditions until all of the participants had been tested.

When the experiment began, the experimenter first obtained consent from the participant and collected the consent form. It was explained to the participant that they would be viewing six different stimuli, three videos and three pictures. The experimenter then asked the participant to view the stimuli that were presented to them on the computer screen. The pictures were shown to the participant for ten seconds each. This was done because the average length of the video clips was ten seconds. This controlled for the amount of time the participant was exposed to each type of stimuli. The participant also viewed the video clips for the length of the entire clip, which averaged ten seconds. All of the stimuli were presented to the participant on a Power Point slide show. After the participant viewed both the videos and the pictures, they were asked to complete a personality inventory. The participant performed this task for 20 minutes as a distracter task. If the participant finished the personality inventory before the end of the 20 minute time period, they were asked to check over the answers for the remainder of the time. After the distracter task was complete, the participant was asked to take a memory test on the stimuli which they viewed at the beginning of the experiment. Some of the questions were leading questions, meaning that they contained misinformation about the stimuli. After they were finished with the memory test, the participant was

asked to take another personality inventory which also took 20 minutes to complete. Again if the participant finished the distracter task early, they were asked to check over their answers for the remainder of the 20 minutes. Finally, the participant was asked to take the second memory test on the stimuli that they viewed at the beginning of the experiment. In this test, the participant was asked direct questions related to the misinformation that was present in the first memory test. This tested if the misinformation was integrated into the participant's memory of the stimuli that they had viewed.

After the participant had completed the final memory test, they were debriefed and the true nature of the study was explained to them. The participant was also given a feedback sheet describing the study and a blank copy of the consent form that they signed earlier.

Results

The mean number of questions that were answered incorrectly for the questions that did not test for the effect of misleading information were $M = 0.22$; $SD = 0.17$ for the picture stimuli and $M = 0.33$; $SD = 0.23$ for the video stimuli. The mean number of questions that were answered incorrectly for the questions that did test for the effect of the misleading information were $M = 0.56$; $SD = 0.26$ for the picture stimuli and $M = 0.56$; $SD = 0.24$ for the video stimuli. The fact that participants were almost twice as likely to answer the questions testing the misinformation effect incorrectly compared to the questions that were not testing for the misinformation effect suggests that the

manipulation of the misinformation was effective and did affect the way in which the participants remembered the stimuli.

The means and standard error of the emotional and stimuli conditions are presented in Figure 1. There was no significant main effect of emotional condition, $F(1, 58) = 0.11$, $p = 0.74$; $\eta^2_{partial} = 0.002$, indicating that there was no effect of emotion on the susceptibility to the misinformation effect. Additionally, there was no significant main effect of stimuli type, $F(1, 58) = 0.05$, $p = 0.82$; $\eta^2_{partial} = 0.001$, indicating that there was no difference between the videos and pictures on susceptibility to the misinformation effect. There was no significant interaction between emotional conditions and stimuli type, but there was a small effect size found, $F(1, 58) = 0.832$, $p = 0.365$, $\eta^2_{partial} = 0.014$.

Discussion

Inconsistent with the hypotheses, there was no significant difference found between the positive and negative emotional conditions, or the video and picture stimuli types. Additionally, there was no significant interaction between the emotional conditions and the stimuli conditions.

In the current study, it was found that both positively and negatively emotionally arousing stimuli made participants equally susceptible to the misinformation effect. Previous studies have indicated conflicting findings about the effect of emotion on the susceptibility to the misinformation effect. Some literature indicates that negative emotional stimuli are protective against the misinformation effect, making the participants less susceptible to having misinformation inserted into their memories of an event (Hoscheidt et al., 2013; Paz-Alonso et al., 2013). Other studies have indicated that

negative emotional stimuli can make participants more susceptible to the misinformation effect (Brainerd, et al., 2008; Porter, et al., 2010; Porter, et al., 2003; Porter, et al., 2014; Van Damme, & Smets, 2014). However, the type of stimuli used in these studies was not consistent, with some studies using video stimuli (Hoscheidt et al., 2013; Paz-Alonso et al., 2013), and other studies using picture stimuli (Brainerd, et al., 2008; Porter, et al., 2010; Porter, et al., 2003; Porter, et al., 2014; Van Damme, & Smets, 2014). The purpose of the current study was to investigate if this discrepancy was due to methodological differences in previous studies by investigating how the type of stimulus which was shown to the participants may have affected their recall ability.

Previous research has demonstrated that video stimuli are more accurately recalled than picture stimuli (Buratto et al., 2009; Matthews et al., 2007). This implies that there is an intrinsic difference in how these types of stimuli may be remembered. By comparing these two types of stimuli in the same study, and how they relate to the susceptibility to the misinformation effect, we are better able to understand the differences in memory for these different types of stimuli. In order to investigate these differences, factors that are known to affect memory recall were controlled for. It was ensured that both the video and picture stimuli had a comparable number of objects, in order to control for the confound that may have affected recall if more objects were present in one form of stimuli than the other. The participants were also exposed to each type of stimuli for the same amount of time so that the amount of exposure would not affect the participants' recall ability. Additionally, the similarity of the stimuli was controlled for in the way that all of the videos and pictures contained people and had a

visible background in order to ensure that recall would not be affected by the type of information that was seen. These factors were controlled for in order to ensure that any differences seen between the stimuli conditions stemmed from the stimuli themselves rather than confounding factors known to affect recall. However, the results of this study did not find a significant difference between these two types of visual stimuli, suggesting that the discrepancy in the literature cannot be explained by this methodological factor.

This lack of significant findings may indicate that there is an outside factor that was not investigated in the current study that is influencing the discrepancy in the literature on the effect of emotion on the susceptibility to the misinformation effect. The current study suggests that the type of stimuli which is presented to participants does not necessarily affect their susceptibility to the misinformation effect for either positive or negative emotional stimuli, because there was no significant difference between the measure of susceptibility for the picture and video stimuli. Future studies should identify and investigate other differences in methodology between studies that indicate that negative emotions protect against the misinformation effect, and those that indicate that negative emotions make an individual more susceptible to the misinformation effect, in order to further investigate this discrepancy in the literature.

Additionally, limitations in the current study may have affected the results. The sample size of this study was small in comparison to the previous study which the methodology was based off of, with the current study having a sample size of 60 participants and the previous study having a sample size of 90 participants (Porter et al., 2003). This may have made a significant difference or interaction between the variables

harder to detect. Significant findings may also have been harder to detect due to a possible floor effect of the results because there was a limit to the number of questions that a person could answer incorrectly. This means that some participants may have had more susceptibility to the misinformation effect than others, but this could not be detected because more questions were not presented. Finally, though the questions were as similar as possible, a confound of the study may be that the type of information the question asked about affected the participants' recall ability. For example, some questions asked about objects that were possibly present in the picture while others asked about a person or a word that was possibly present in the picture. Future studies should control for these limitations in order to gain better understanding of how these may have affected the participants' susceptibility to the misinformation effect.

The current study has investigated the misinformation effect and the factors of emotion and type of stimuli which may affect an individual's susceptibility to the misinformation effect. It is important to gain insight into this phenomenon in order to better understand the mechanisms behind memory and the factors that may change the memory of events.

It is important that this phenomenon of the misinformation effect continues to be investigated in order to better understand the factors that influence it. This has important implications for things such as eyewitness testimony, where the misinformation effect has the potential to affect the witness's report of an event (Loftus, 1975). By better understanding the factors that may affect the misinformation effect, we are better able to

control them and prevent this phenomenon from taking place, especially in situations where false memories may have legal implications.

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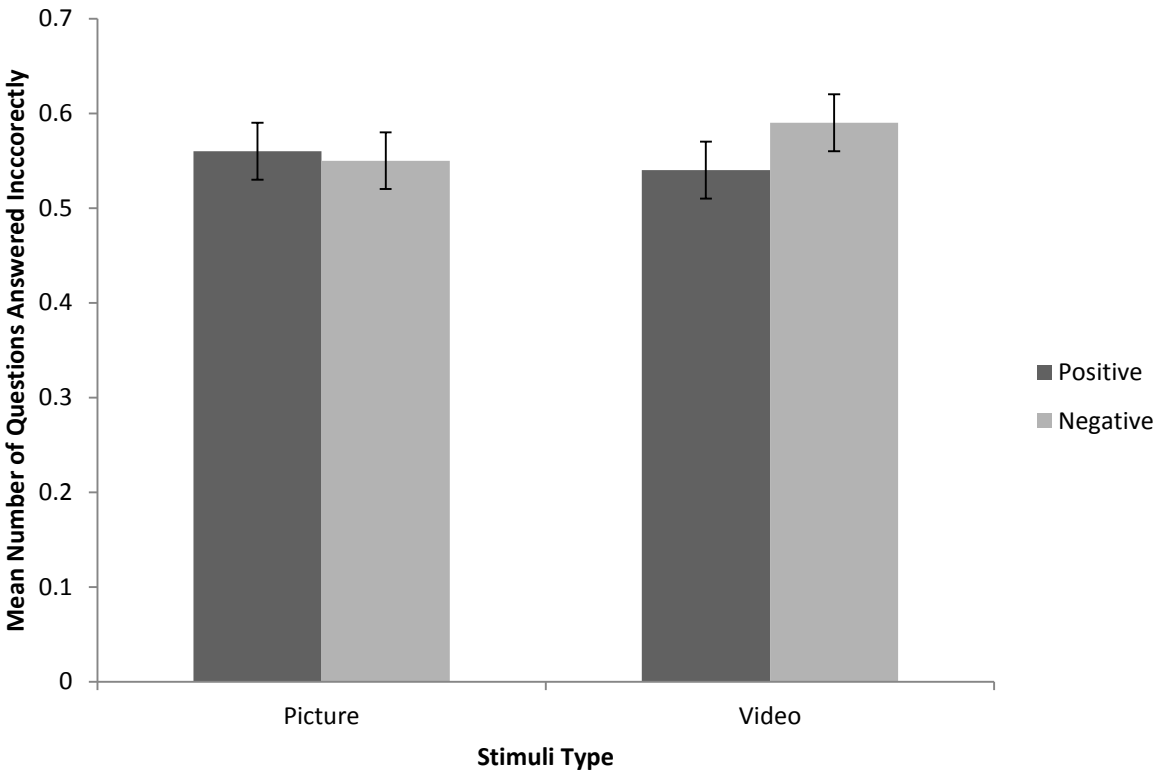

Figure 1. Means and standard error of the number of questions answered incorrectly for the positive and negative emotional groups for both the video and picture stimuli.

Appendix A: Initial Memory Test for the Positive Emotional Group

* denotes embedded misinformation

Memory Test 1

Picture 1

1. What color was the flower in the drawing on the board behind the police officer's head?*

2. Was the word "STOP" in the octagon written in black or white letters?*

3. Was the police officer smiling or frowning in the scene?

4. Was the calendar hanging on the wall behind the police officer yellow or red?

5. What color was the baseball hat that the child in the first row was wearing?*

Picture 2

1. Was the child sitting on the ground in the background of the scene wearing glasses?*

2. Was the child eating ice cream who was clearly visible in the background wearing a hat?*

3. Was the dog sitting at the feet of the people in the background black or white?*

4. Was the package of birdseed that the girls in the picture had red or blue?

5. Did the girls in the picture have light or dark hair?

Picture 3

1. How many people were playing volleyball behind the three men in the foreground of the scene?*

2. What were the colors of the umbrellas located in the background of the scene?

3. What color were the shorts of the man that was farthest to the right in the foreground of the scene?

4. What color was the towel that the woman was lying on, who is clearly visible behind the three men in the scene?*

5. Was the man who was visible in the background of the scene wearing sunglasses?*

Video 1

1. How many coats were hanging on the coat rack next to the door?*

2. What color was the man's shirt in the scene?

3. What color were the flowers sitting on the counter in the scene?*

4. Was the umbrella sitting to the side of the door black or white?

5. What scene is depicted in the painting that is clearly visible on the right hand wall in the scene?*

Video 2

1. Was the tie that the man was wearing blue or green?*

2. Was the hair band the women in the scene was wearing black or white?

3. What color were the flowers on the plant behind the two people in the scene?*

4. What was the slogan on the coffee mug that was sitting on the table between the two people?*

5. What shape were the decorations hanging in the window behind the two people in the scene?

Video 3

1. What color was the tool box sitting on the floor under the bench?*

2. What tools were laying on the ground near the bench?*

3. What color hat was the man in the scene wearing?*

4. Was the man in the scene wearing a green or red shirt?

5. Was the woman in the scene wearing a black or white hat?

Appendix B: Initial Memory Test for the Negative Emotional Group

***** denotes embedded misinformation

Memory Test 1

Picture 1

1. What color was the truck carrying the RV in the background of the scene?

2. Did the blond police officer have calm or hostile body language?*

3. Was the dog in the background of the scene sitting or lying down?*

4. Did the young girl in the scene look scared or calm?

5. What color was the shirt of the person sitting in the driver's seat of the car?*

Picture 2

1. Was the first person in line walking or sitting down?

2. Did the women in the white dress in the background on the side of the road look calm or upset? *

3. What color jacket was the young boy wearing that was standing to the side of the line of men?

4. Was the toddler in the background of the picture on the side of the road wearing shoes or not?*

5. What kind of animal was standing in the background on the side of the road?*

Picture 3

1. Was the camera man in the background of the scene wearing a jacket?

2. What color shirt was the man running towards the camera wearing?*

3. What color was the dog running in the background of the scene?*

4. What kind of bird was visible on the right side of the scene on the ground?*

5. What color jacket was the woman on the right side of the scene wearing?

Video 1

1. What kind of car was clearly visible in the background of the scene?*

2. What color were the flowers present behind the man in the scene?*

3. What color shirt was the man in the scene wearing?

4. What color was the women's hair in the scene?

5. What color shirt was the child in the background of the scene wearing?*

Video 2

1. What piece of furniture, other than the couch, is clearly visible on the right side of the scene?*

2. What color were the glasses the man on the left was wearing?

3. What scene was depicted in the painting behind the couch?*

4. Was the man on the right wearing an analog or digital watch on the hand he held the gun with?*

5. What articles of clothing were on the couch behind the men?

Video 3

1. Was the woman walking in the scene wearing pants or a skirt?

2. What did the sign say that was clearly visible on the far wall next to the door?*

3. What color was the women's hair that was lying on the ground?

4. Was the "Exit" sign above the door red or green?*

5. Was the gun lying next to the women on the ground small or large?*

Appendix C: Final Memory Test for Positive Emotional Group

* denotes test of misinformation

Memory Test 2

Picture 1

1. Was there a child in the scene wearing a baseball hat?*
2. Was the police officer smiling in the scene?
3. Was there a calendar visible on the wall?
4. Was there a drawing of a flower visible in the scene?*
5. Was the word "STOP" present in the picture of the octagon?*

Picture 2

1. Was there a dog present in the scene?*
2. Was there a package of birdseed visible in the scene?
3. Was there a child sitting on the ground in the background of the scene?*
4. Was there a child eating ice cream visible in the scene?*

5. Did the girls in the foreground of the scene have dark hair?

Picture 3

1. Was there a women lying on a towel visible in the scene?*

2. Were there umbrellas visible in the background of the scene?

3. Was there a man visible in the background of the scene?*

4. Was the man farthest to the right of the scene wearing yellow shorts?

5. Were there people playing volleyball present in the scene?*

Video 1

1. Was there an umbrella visible in the scene?

2. Was the man's shirt green?

3. Were there flowers visible in the scene?*

4. Is there a painting visible in the scene?*

5. Was there a coat rack present in the scene?*

Video 2

1. Was there a coffee mug visible on the table in the scene?*

2. Was the woman in the scene wearing a hair band?

3. Was the man in the scene wearing a tie?*

4. Were there flowers visible on the plant in the scene?*

5. Were there decorations visibly hanging from the window in the scene?

Video 3

1. Was the man in the scene wearing a hat?*

2. Were there any tools visibly lying on the ground in the scene?*

3. Was the woman in the scene wearing a hat?

4. Was the man in the scene wearing a green shirt?

5. Was there a tool box visible in the scene?*

Appendix D: Final Memory Test for the Negative Emotional Group

*denotes test of misinformation

Memory Test 2

Picture 1

1. Was there a person sitting in the driver's seat of the car in the scene?*
2. Was there a truck carrying an RV visible in the scene?
3. Was there a blond police officer visible in the scene?*
4. Was there a young girl present in the scene?
5. Was there a dog present in the scene?*

Picture 2

1. Was there a toddler visible in the background of the scene?*
2. Was the first person in the line of people sitting down?
3. Was there a young boy standing to the side of the line of men?
4. Was there a women wearing a white dress present at the scene?*

5. Was there an animal present on the side of the road in the scene?*

Picture 3

1. Was there a dog present in the background of the scene?*

2. Was there a woman visible on the right side of the scene?

3. Was there a bird visible on the ground in the scene?*

4. Was there a man running towards the camera in the scene?*

5. Was there a camera man in the background of the scene?

Video 1

1. Were there flowers present behind the man in the scene?*

2. Was there a child visible in the background of the scene?*

3. Did the women in the scene have blond hair?

4. Was the man wearing a black shirt in the scene?

5. Was there a car visible in the background of the scene?*

Video 2

1. Was the man on the left side of the scene wearing glasses?

2. Was there clothing visible on the couch in the scene?

3. Was there a painting visible behind the couch?*

4. Was there another piece of furniture visible in the scene?*

5. Was the man on the left side of the scene wearing a watch?*

Video 3

1. Was there a gun lying next to the women on the ground?*

2. Was there a sign visible on the wall next to the door?*

3. Was the woman walking in the scene wearing a skirt?

4. Was there an "Exit" sign visible above the door?*

5. Did the woman who was lying on the ground have black hair?