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Arguing Against Yourself: Exploring the Relationship Between Conflicting Episodic Memories

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By

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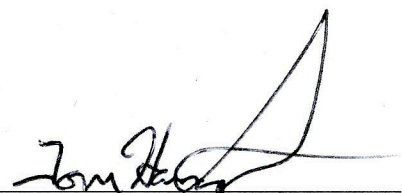
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ARGUING AGAINST YOURSELF: EXPLORING THE RELATIONSHIP BETWEEN
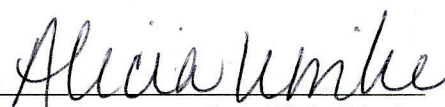
CONFLICTING EPISODIC MEMORIES

A THESIS

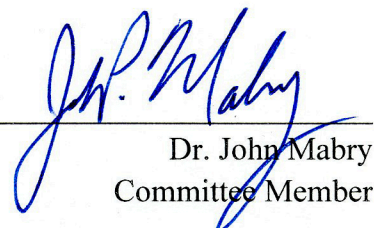APPROVED FOR THE DEPARTMENT OF PSYCHOLOGY

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Abstract

The current study is an attempt to evaluate how participants' memory is altered by information either congruent or incongruent to their original testimony. False memory research consistently shows that exposure to post-event information affects how a specific memory is recalled. However, these manipulations are given without receiving any testimony from the participants. This is a two-part study requiring participants to return a week after their first participation to answer questions based on their testimony. Initial accuracy of statements did not differ between the misinformation and control conditions. In addition, no differences were found between conditions on responses regarding the control questions; however, when misinformation was present, a different pattern emerged. Participants significantly agreed with misinformation more than they denied it. These results varied significantly from responses to the control statements. In addition, whether the initial statement was accurate or inaccurate affected how participants' responded to the misinformation. Confidence was overall lower for manipulated statements, indicating the willingness to testify even during uncertainty.

Acknowledgments

I have been fortunate to have been surrounded by the incredibly talented faculty who not only dedicated their time and efforts, but also continued to encourage me throughout this entire process.

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I would like to thank my family for their unconditional support and encouragement in everything I do. This time it happened to be pursuing a master's degree half way across the country. They never stop believing in me and I couldn't be more thankful.

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TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

False Memories

The idea of stable, unchanging memories has been challenged. The current understanding about the malleability of memory has driven researchers towards explaining memory as a "synthesis of experiences" rather than a device that provides accurate play-back of events (Loftus, 2003). This synthesis of experiences encompasses the input of multiple influences. These influences include leading questions that prompt a specific answer (Loftus, 1975), exposure to post-event information either through the media, other witnesses of the same crime (Gabbert, Memon, & Allen, 2003), and defense lawyers (Dodd, & Bradshaw, 1980), or the individuals' own creations (Roediger, Jacoby, & McDermott, 1996). This acquisition of new information contaminates the original memory of the event, reconstructing it (Loftus, 1991, 2002, 2003; Loftus & Hoffman, 1989; Loftus, Miller, & Burns, 1978).

The idea of a reconstructive memory contradicted the prevailing thought that suggested that once a memory is created, it is permanently stored and able to be accessed in its original form (Atkinson & Shiffrin, 1968; Chechile, 1987). Loftus (1979) began to study the idea of "false memories," specifically, the impact of suggestion on the elicitation of false memories of events that never happened. This idea has been supported in many psychological studies that have consistently shown that it is virtually impossible to tell the difference between a real memory and one that has been created due to some other influence (e.g. Loftus, 1979, 2002; Loftus & Palmer, 1974).

To test this theory about the perceived reality of false memories, physiological responses that individuals with traumatic false memories have has been compared to Vietnam veterans

recalling their traumatic war experiences. Physiological symptoms such as heart rate, facial muscle tension, and skin conductance show no difference between individuals who have conjured up traumatic false memories and the veterans' responses during recall. In other words, the lack of difference in physiological responses indicates that the individuals who believe their false memories are reacting physiologically as if the events did happen (McNally, 2004).

False memories occur by incorporating new material into a preexisting memory. Incorporating false information into an original memory changes that memory and therefore modifies what people believe they experienced. The combination of the original information and new information acquired after the fact fuse into one seamless memory which makes differentiating between the source and sequential presentation of facts difficult (Loftus, 2002). Information presented after the fact not only can alter one's memory, but also create memories that never existed. Altered memories can transpire by receiving information through different stimulating channels such as when the original event is largely visual (e.g. witnessing a crime) and the new information is verbal (e.g. being asked a leading question). The magnitude of research on false memories by Loftus led to important cognitive theoretical advances that are usually offered when attempting to explain the creation of false memories. These cognitive theories that address the underlying mechanisms of false memories include a source monitoring theory (Johnson & Raye, 1981), the fuzzy trace theory (Brainerd & Reyna, 1998), and the activation monitoring theory (Roediger, Watson, McDermott, & Gallo, 2001).

1. Source Monitoring Theory

Source monitoring theory, or error, is when the origin of information is misattributed to an incorrect source. It is essentially an extension of reality monitoring which is the process of distinguishing the origination of a memory – either from an internal or external source (Johnson & Raye, 1981). If the memory came from an outside (external) source, one must also be able to differentiate between different possible sources (e.g., a newspaper article, a friend, news from TV, etc.). When information is presented, the source of the information is usually not tagged as salient; therefore, the source is lost and the content of the information is stored (Leding, 2012). By not remembering the original source, attributions and misattributions are made.

The process of making source judgments can be relatively automatic (heuristic judgment process) or a more strategic process (systematic judgment process; Johnson, Hashtroudi, & Lindsay, 1993; Mitchell & Johnson, 2000). The heuristic process takes features of the memory and compares it to features normally associated with a certain source. For example, if a false memory is perceptually and contextually rich, it may be misattributed to a source from an experienced event (Leding, 2012). The systematic judgments require more cognitive resources and may be able to distinguish between a false memory and real experience. However, if the plausibility of the event happening is high, incorrect attributions can be made.

2. Fuzzy Trace Theory

The fuzzy trace theory elaborates on the gist and verbatim memory model by Brainerd and Reyna (1998). False memories are a form of distortion in episodic memory in which people report day-to-day events as if they actually occurred when they did not (Holliday, Brainard, & Rayna, 2011). Episodic memory can be considered autobiographical memory, or a memory of a

specific time, place, or event. With every new memory created, there are two parallel traces (gist and verbatim). The verbatim trace stores every piece of incoming information specifically, whereas the gist trace stores the general meaning of the information. This theory states that false memories occur from encoding information based on the salience of it to gather the gist of the information, or from allotting more cognitive resources to the information to remember specific parts verbatim. Gist memories are formed when items are remembered based on the semantic relations between them. For example, when attempting to remember household items such as clothes, cars, fruits, and so on, their group is understood; therefore, the gist of its contents is remembered – what is expected to fit – and not the exact item itself. The retrieval and recognition of gist memories support the false recall of items that merely fit the gist (household items) and were not actually present (Reyna & Lloyd, 1997).

Verbatim memory is the memory of exactly what was present when witnessed. If a list of musical instruments is provided, verbatim memory would recall exactly what was on the list. However, verbatim memory would only be able to recognize a number of the items, not all of them. Because the items are all semantically related, gist memory would include additional musical instruments that may affect verbatim memory's ability to distinguish between a false memory and an item that was originally there (Brainerd, Reyna, Wright, & Mojardin, 2003; Gallo, 2004). Therefore, it is difficult to correctly recall every aspect of an event or series without error because gaps are naturally being filled in with other related information (Holliday et al., 2011).

The fuzzy trace theory suggests that the verbatim trace decays rapidly whereas the gist trace lingers for much longer. Therefore, when recalling information, the gist trace is being used which only stores the meaning-based information and not item specific information. The

4

reliance on gist trace storage can result in an error in recall.

3. Activation Monitoring Theory

The activation monitoring theory states that semantic memories are created through the activation of a semantic network (Gallo & Roediger, 2002; Roediger, Balota, et al., 2001; Roediger, Watson, McDermott, & Gallo, 2001). The activation monitoring theory is similar to the source monitoring theory in regards to the person being unable to correctly track the original source of information. Also similar to the gist memory theory, if two words are semantically related, the second word is activated contingent upon the activation of the first word; if semantic or episodic memory causes the activation of a related concept, false memories are created and believed to be real due to the spreading activation. The Deese_Roediger_McDermott (DRM) (Roediger & McDermott, 1995) paradigm is used to explain this activation theory. This paradigm presents someone with a list of semantically related words (e.g., bed, rest, awake, tired . . .). The word "sleep" is not mentioned, which is a critical word related to the list (Deese, 1959; Roediger & McDermott, 1995). During the recall task, many people say they saw the word "sleep" when it was not present. Due to the semantic relations, sleep was triggered because it is closely related to the rest of the words in the group.

Legal Applications

When applied to a legal context, these theories addressing the underlying mechanisms of false memories help demonstrate the malleability of an eyewitness's memory. If source monitoring errors occur, any extraneous or incorrect information is likely to be reported along with or in replace of the facts. According to the fuzzy trace theory, when a crime is witnessed, two parallel traces of memory are created – the verbatim trace, which creates a truthful representation, and the gist trace which stores the semantically based information. Immediately

after witnessing the crime, the verbatim trace can more accurately report what the person saw; however, in many cases, the witness may not be interviewed for up to weeks later. According to this theory, other meaning-based information could be incorporated into memory when only the gist trace is intact. This external influence may alter memory enough to change the accuracy of the eyewitness's testimony and potentially lead to a wrongful conviction.

The source activation and monitoring theory helps outline a potential scenario regarding eyewitness testimony (Leding, 2012). If an eyewitness is questioned by a police officer and asked if a weapon was present when there was no weapon, this piece of information may activate items in semantic and episodic memory and infiltrate the witness's memory of the event. When testifying in court, the witness may recall this information and misattribute the origin. It is also possible that the witness may have been told about a potential weapon, it was suggested by a detective, or even imagined by the witness (Leding, 2012). All of these scenarios are applicable examples of post-event information affecting the memory of an eyewitness.

Eyewitness testimony is a powerful tool, and knowing how malleable memory is, this tool may not be the most reliable in court. Small errors in memory typically do not significantly affect regular day experiences; however, it is important to consider the effects of this inaccurate memory recall when applied to the legal system. Because memory is consistently unreliable, questions about the validity of criminal convictions based primarily on eyewitness testimony can be raised. In the time between witnessing an event and being questioned about it, witnesses may be exposed numerous ways to information that has the ability to alter their memory of the event. New information related to the crime can present itself in numerous forms such as coming from the news, conversations with people, or leading questions about the witnessed event. All of the information from different experiences (i.e., original and post-event misinformation) is

synthesized into one memory, and the likelihood of recalling the original memory decreases. A reconstructed memory combining fact and fiction might be sufficient for everyday life, but it is inadequate for legal purposes (Loftus, 2002). It is this issue that Loftus has extensively studied, and has gained her the title of pioneer in the field of false memory.

Misinformation Effect

In 1979 Elizabeth Loftus began her seminal work on the malleability of memory. The malleability of memory was tested by introducing new events or information to participants during a recall test. These events never happened; however, through suggestion they became believable. This concept was named the misinformation effect. Loftus claims that although the misinformation effect does not explain the impairment of memory, it does provide information about the creation of new memories, specifically how malleable memory is (Loftus & Hoffman, 1989). Numerous studies have supported the ability of the misinformation effect to alter memory (e.g., Loftus, 1975, 1977, 1979; Loftus et al., 1978; Loftus & Greene, 1980). The misinformation effect is usually approached using a three-stage process. First, the participants are exposed to some event and then receive new information about that event. Finally, they will take a memory test about the initial event. Results supporting the misinformation effect show discrepancies in the answers given in the final recall task; that is, people report seeing objects as part of the original event when that memory was really produced by the manipulation (Loftus, 1991). This effect is produced by the highly active process of constructing new memories from multiple sources.

An example of the misinformation effect can be seen through multiple experiments in (Loftus et al., 1978). In one experiment, participants viewed approximately 30 slides of a car driving to a stop sign and stopping. Participants were divided into three groups that each

completed a 20 question survey. One of the questions was manipulated across groups. The two

manipulated groups were asked either if another car passed the depicted car in the slides, or if the

car stopped at the yield sign. The third group received all information consistent with what they

actually saw. After completing a distractor task, the experimenter provided the participants with

two slides side to side and asked them to choose which one they had originally seen. Compared

to participants who did not have any manipulated questions, when the intervening questions

provided misleading information, participants were significantly less likely to choose the correct

original picture. The misinformation provided to them between the original exposure to the

pictures and the final recall test had been confused with the information in the original pictures

and resulted in an inaccurate recall.

Leading questions also affect accurate memory recall (Loftus, 1975). Participants viewed

a video of an accident and were asked ten questions following the video. The manipulation was

administered when the participants answered the question about how fast the car was going when

it passed the barn on the road when there actually was no barn in the video. One week later

participants returned to answer additional questions. One of the questions asked if they had seen

a barn in the video. Participants had integrated the exposure to the barn in the questionnaire the

previous week and 17.3% compared to 2.7% of participants reported seeing the barn. This

inaccurate recall resulted in a significant effect of the manipulation.

CHAPTER 2

The Current Study

This current research is addressing an important part of a study by Loftus and Palmer's (1974) on the interaction between language and memory. Participants viewed a video of an automobile accident and were primed with a certain implied speed in questioning. Loftus and Palmer requested their participants to provide a free recall after viewing the video of the automobile accident. This recall was made before any manipulation. There is no mention of analysis of these reports before or after the manipulation, and it does not appear that this piece of the misinformation effect has been explored.

The current experiment is addressing this missing piece. It is designed to test whether false information provided immediately before recall affects memory when the manipulation is derived from the participants' own written testimony versus when the manipulation is administered without knowing what the participants initially remember. When misleading information is presented immediately before a recall test, the impact is greater than when presented immediately after the event (Loftus et al., 1978); however, this misleading information has not been taken directly from an already written statement about a witnessed event. The misinformation effect has been extensively studied and supported; that is, new information affects memory recall. However, does it apply when an original testimony is considered and altered? Specifically, will participants commit perjury and provide information that contradicts their original testimony? By obtaining a testimony from the participants, their original memory of the event is able to be assessed and subsequently compared to their recall a week later. Obtaining a testimony also allows for a brief content analysis which leads to the ability to

address the correct and incorrect pieces of the testimony differently.

Eyewitness confidence and accuracy is generally not reliably correlated (Kassin, Rigby, & Castillo, 1991; Smith, Kassin, & Ellsworth, 1989; Wells, & Murray, 1984). However, conflicting evidence is available in terms of small but significant correlations between accuracy and confidence for witnesses giving a testimony ($r = .29$, $p < .05$; Wells, Lindsay, & Ferguson, 1979). Engelhardt (1999) suggested that confidence is often higher for misleading information than for the correct information. These ratings will be obtained to assess the confidence-accuracy issue and see if different patterns emerge based on the quality of information provided in the participant's testimony.

Hypotheses

This study follows the general misinformation effect paradigm. Participants will be exposed to new information, receive false information, and be tested on the original information. The difference lies in obtaining a testimony from the participants before they are exposed to any misinformation and then using this testimony to create conflicting statements.

Hypothesis 1. Consistent with previous research (e.g. Loftus, 1991, 2002, 2003; Loftus & Hoffman, 1989; Loftus, Miller, & Burns, 1978) it is predicted that manipulating a given recall statement will affect memory when being asked about those statements a week after witnessing an event.

Hypothesis 2. It is expected that differences in the accuracy of recall will emerge based on whether the participants' original statement was accurate or inaccurate. This difference will be seen with the statements that include misinformation – they conflict with the original testimony.

Hypothesis 3. It is predicted that confidence ratings for statements that include

misinformation during the second week will be lower than statements that have not been manipulated. Regardless of having lower confidence for conflicting statements, it is expected that participants will still choose "yes," indicating that they remember the statement to be true.

CHAPTER 3

Method

Participants

Ninety-five undergraduate psychology students from the University of Central Oklahoma participated in this experiment in exchange for course credit. Participants from an introductory psychology course enrolled for the study online using SONA-Systems which is a research participation system used to recruit students. The majority of participants were freshman between the ages of 18 and 25 as indicated on a prescreening questionnaire on SONA.

Materials

A 58 second video from the fictional television series NCIS (Naval Criminal Investigative Service) is shown to each participant. This video is from season 2, episode 9 (Forced Entry), and portrays a man who has entered a woman's house without her knowledge. Participants were required to give a written testimony based on this video (free recall), or answer a set of 10 questions (cued recall). Participants also completed a demographic questionnaire assessing their gender, age, year in college, and response to whether they have ever been asked to give an eyewitness testimony to the police. Participants also completed a mental paper folding task. This task took approximately 10 minutes to distract the participant from the content in the video. The second week session used information from the original testimonies to create 10 recall statements (see Appendix A for questions used to create statements).

Procedure

This study is a 2 (misinformation condition vs control) X 2 (accurate vs inaccurate) X 2 (agree vs disagree) mixed factorial design. This study required two separate days of

participation a week apart. All participants gave informed consent before participation. Participants were assigned to be in the misinformation condition or the control condition and to give either a free recall or answer a set of 10 questions (cued recall). All participants received statements on their return the second day that either contained conflicting information or not.

Week 1 participation. On the initial day of participation, all participants were given verbal instructions and then proceeded to watch the video, complete the demographic questionnaire, and complete the mental paper folding task. The researcher instructed the participants to let them know when all three of those tasks were complete. After completion of the paper folding task, participants read further instructions on the computer and proceeded to give a free recall or complete the cued recall questions.

The participants assumed that this was a testimony given to the police and to include as much detailed information as they could recall. The instructions for the free recall condition provided suggestions of topics to cover in their testimony such as characteristics of the suspect, weapon, or environment. These suggestions ensured that all participants mentioned the same key topics to be used during their participation in week two. In addition to the participants reading the instructions, the researcher verbally stressed the importance of including as much detail as the participant could recall. A confidence rating of their testimony followed the testimony. Participants typed their statement and confidence rating on the computer.

Week between participation days. In the week prior to the participants coming back, the testimonies were read and reviewed for content to create the set of 10 statements. When participants returned the second week, these are the statements they heard. These statements were the answers to the cued recall questions (Appendix A). The content in these statements varied between individuals; however, the statements all answered the same 10 questions. In

other words, the different participants' statements all described the same topics, but the way they were explained varied slightly based on what each individual remembered. Appropriate statements were extracted from the participants' free recall testimony to fit the ten prompts.

Week 2. Participants returned between six and eight days after their first participation to assess statements based on their testimony of the video. The dependent variable of accuracy was measured as a categorical variable (yes/no). This yes or no decision was based on whether or not the participant recalled a statement as being true or false. "Yes" signified that the statement was remembered as being true, and the participant was willing to testify using that statement. "No" signified that the statement, or parts of it, was false and the participant was hesitant to use that statement as part of their testimony. Participants made this assessment for all 10 statements. The manipulation of the participants' testimonies is what determined either how accurately they recalled information or whether memory was altered when exposed to conflicting information a week after watching the video. Confidence ratings of one through six were assigned to each statement with one representing not confident and six representing very confident.

Questions that were answered as a "no" or are marked as anything less than a 6 on confidence were revisited and questioned as to what caused the hesitation or uncertainty. The researcher recorded these oral responses on the confidence rating sheet. After all of the necessary questions had been revisited, the researcher asked the participants whether they referenced the video or their original testimony when hearing the 10 statements and while making their yes/no decision. Their yes/no answers were also recorded on the confidence rating sheet. The experiment continued until all statements had been read and additional explanations had been given. The researcher thanked the participants for their time and asked if they had any questions. If there were no further questions, they were debriefed and released.

Control condition. All of the statements that the control condition heard were congruent with their testimony. Statements were read back to the participant regardless of whether they accurately depicted the video or not. For example, if the video showed a cat and participants wrote that it was a dog, they were read a statement congruent with their written testimony (dog) even if it included false information. This study tested memory recall based on the initial written testimonies given by participants rather than testing the accuracy of their original testimony. This control condition was used to establish a base for how participants respond when the statement they hear is congruent with their initial testimonies. By understanding how participants respond when nothing changes, it helps to show if misinformation presented during week two changes the pattern of how participants respond.

Misinformation condition. The misinformation group heard statements both congruent and incongruent with their testimony. These 10 statements consisted of three incongruent statements and seven congruent statements. Participants in the misinformation condition whose initial testimony was accurate heard three statements that provided false information incongruent with their initial testimony and seven statements that remained unaltered (congruent). However, if incorrect information was present in any of the initial three statements that were being manipulated, participants heard a statement that was congruent with the video, and therefore incongruent with their testimony. The statements congruent with the video attempted to push their initial false memory back to the original facts. All other statements were left congruent with their original testimony.

CHAPTER 4

Results

Out of 95 students who participated in the study, missing data caused four cases to be removed. This subtraction resulted in 51 participants in the misinformation condition and 40 in the control condition. The hypothesis stated that providing participants with false information during the recall test will affect their memory of the original event. To answer this question and analyze the current data, the data needed to be coded based upon the participants' condition, original accuracy of the statements, manipulation (or not), and the participant's response to the statement (whether they agreed or disagreed). This coding process resulted in eight groups that each of the participants' statements could satisfy (see Appendix B for flowchart of groups). These groups outline how participants' responses to the 10 statements during recall are related to their initial testimonies. For example, if the first statement was from someone in the misinformation condition, it was initially accurately recalled, a manipulated statement, and the participant agreed with the statement read to him/her, that statement fell into a category that indicated that the participant agreed with the new false information, and therefore their original memory for that statement was able to be altered. Proportion scores were created from the eight groups to compare them to each other and across conditions (see Table C1 and Table C2 for descriptive statistics by group).

Before testing the hypotheses for this study, a few preliminary tests assessed the quality of the control statements to establish that there was no difference in responses when no manipulation was present. A Multivariate analysis of variance (MANOVA) examined initial accuracy of the statements and no significant difference was found between groups $F(1, 89) =$

.03, $p = .86$. That is, the baseline for accuracy was not any different between the misinformation

condition (*M* accurate = .86, *SD* = .13, *M* inaccurate = .14, *SD* = .13) and control condition (*M*

accurate = .85, *SD* = .14, *M* inaccurate = .15, *SD* = .14); therefore, any subsequent changes are

not due to one group outperforming the other initially. Figure 1 indicates the percentage of

participants' statements that were initially accurate compared to inaccurate.
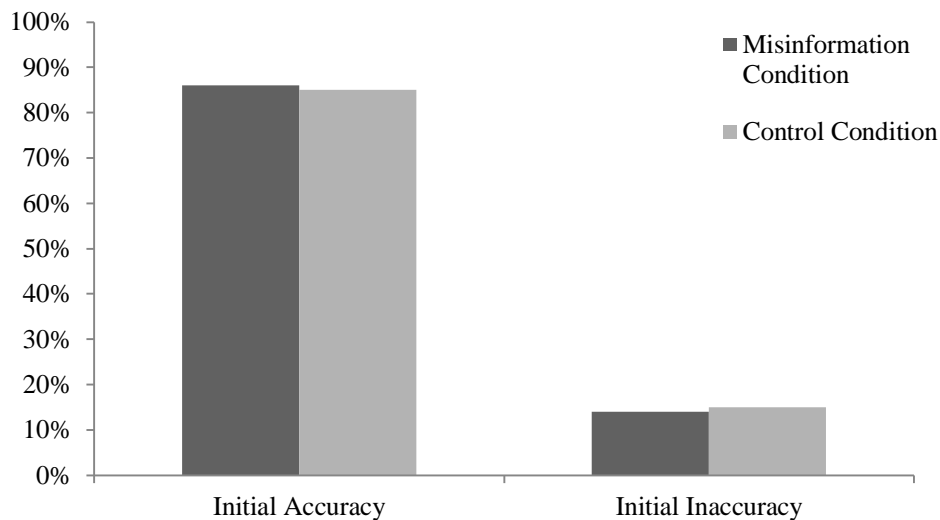

Figure 1. This figure illustrates the mean differences between groups on initial accuracy of

testimony.

The misinformation condition has seven built in control statements, and a MANOVA was

used to establish the quality of these statements as a control. They were compared to the control

condition and no significant difference was found between conditions for the initially accurate

statements $F(1, 28) = .66$, $p = .42$ or the initially inaccurate statements $F(1, 28) = 2.92$, $p = .10$.

This result is not surprising because no manipulation was made to any of the examined

statements. Both groups initially recalled the video without much variation. The homogeneity

of recall statements is able to establish that the control questions did not vary from initial recall

across conditions (misinformation and control).

Hypothesis one stated that manipulating a given recall statement will affect memory when being asked about those statements a week after witnessing an event. In order to test this hypothesis, A MANOVA was used to see how the manipulation affected each group. Within the misinformation condition ($n = 51$), four of the eight groups contained target questions. These questions are the ones of importance that contained information conflicting with the participants' original testimony. First, the group of statements that were initially reported as accurate was compared within and between groups. The within group analysis compared data found only within the misinformation condition. The between group added the control condition for a cross condition analysis. There was a significant difference between how participants responded when hearing statements that included misinformation $F(1, 77) = 117.52$, $p < .00$. Sixty-five percent of participants' responses agreed with the false information ($M = .65$, $SD = .36$) compared to 35 percent that did not ($M = .35$, $SD = .36$). In other words, 65 percent of statements that conflicted with participants' original testimony were recalled as being accurate. This difference confirms the hypothesis that hearing manipulated statements would impact recall for those statements.
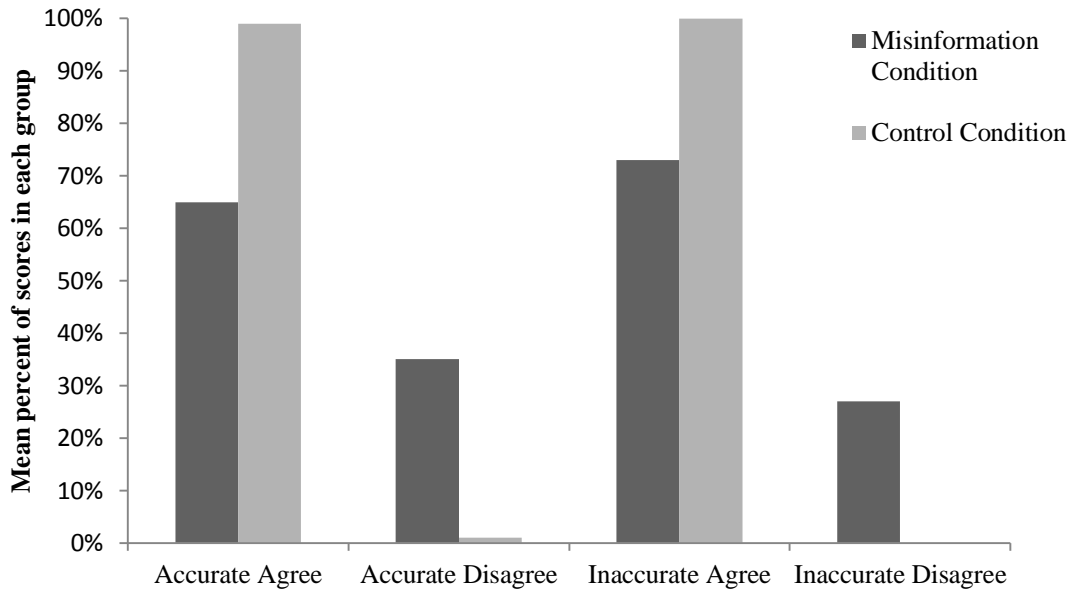
In addition, an interaction between conditions was found, indicating that there was a significant difference in how participants in the misinformation condition responded to the three statements with misinformation, and how participants in the control condition responded to the same three statements sans misinformation $F(1, 77) = 33.16$, $p < .00$. In the control condition, because the statements read to participants mirrored their original testimony, the majority of responses agreed with the statements during recall ($M = .99$, $SD = .05$) compared to disagreeing with them ($M = .01$, $SD = .05$).

Similar results were found when analyzing the group of statements that were initially recalled incorrectly. More participants were likely to agree with the false information presented

to them during recall ($M = .73$, $SD = .43$) than not agree with it ($M = .27$, $SD = .43$) $F(1, 54) = 75.37$, $p < .00$. A two-way interaction also occurred between how participants responded to the recall statements and their condition (misinformation or control) $F(1, 54) = 9.97$, $p = .00$. In the control condition, the statements read to participants were congruent with their original inaccurate testimony. Every participant agreed with the statement during recall ($M = 1.00$, $SD = .00$).

Figure 2 shows the interaction between conditions and the responses to target statements based on initial accuracy. This figure includes the responses from participants in the control condition as well as the misinformation condition. The accurate agree condition refers to initially accurate statements that were later recalled as being accurate. In the control condition, there was no manipulation so the recall statements are congruent with the original testimony. However, in the misinformation condition this percentage refers the percent of statements that were agreed with when information in that statement actually conflicted with their original testimony. In the accurate disagree condition, participants in the misinformation condition are disagreeing with the manipulation, or, essentially agreeing with their original testimony. The same applies to the inaccurate groups. When participants agree with the manipulated statements, they are agreeing with a statement that contradicts what they originally gave in their testimony. The inaccurate disagree condition refers to participants who are disagreeing with the factual information provided in their recall statement and are essentially saying that their original incorrect memory was right.

Figure 2. This figure depicts the interaction between conditions and responses to target

statements based on initial accuracy.

The second part of the first hypothesis stated that differences in the accuracy of recalling

statements that include misinformation are expected to emerge based on whether the

participants' original statement was accurate or inaccurate. Accuracy of recall did differ

significantly between the initial accuracy (p <.00). Figure 3 is only comparing responses to

statements containing misinformation. If participants were initially accurate before any

manipulation, they were less likely to agree with the statements containing conflicting

information than the group that was initially incorrect. In other words, it is harder to push people

away from the truth than to push them back to the truth.

Overall, statements that contained information that contradicted the original testimony

were significantly more likely to be agreed with than disagreed with.   Agreeing with the

conflicting statement indicates that the new false information affected memory recall more often

than it did no
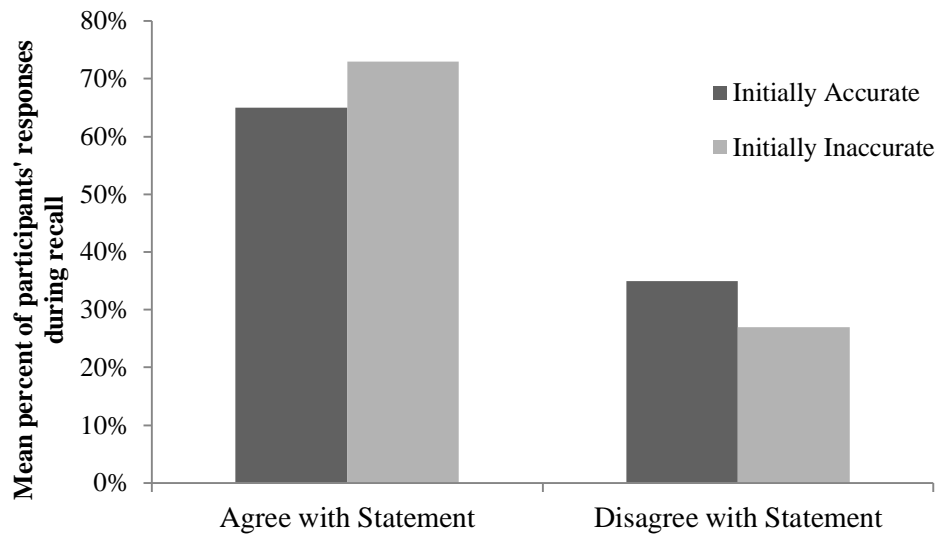
Figure 3. This figure illustrates how participants with initially accurate or inaccurate statements responded to manipulated recall statements.

Current research shows that confidence and accuracy are not reliably correlated (Kassin, Rigby, & Castillo, 1991) and this study addressed this issue by obtaining confidence ratings after the initial testimony and after each recall statement. Hypothesis 3 predicted that confidence ratings for statements that include misinformation during the second week will be lower than statements that have not been manipulated. This hypothesis was tested by averaging confidence ratings for all participants who recorded a confidence score after day one (N = 90) and averaging all confidence ratings from the recall statements on day two. These general scores include both the manipulated and not manipulated groups, and confidence between the first and second day correlate at a medium strength $r = .46$, $p < .00$. However, when split by condition, the relationship between the misinformation condition and the initial confidence ratings were not as strong as the control condition ($r = .41$ and $r = .50$ respectively). This weaker correlation

indicates that there is not as strong of a relationship between the confidence ratings after the initial testimony and during recall for the misinformation condition compared to the control condition. However, an independent samples t-test showed no significant differences between the average confidence ratings on recall statements between the misinformation and control conditions $t(89 =.15, p =.88)$.

Further analyses indicate that the three manipulated statements on average were rated with lower confidence than the same statements in the control condition ($M = 4.86$ and $M = 5.19$ respectively). While the means for the target statements are lower, they are not quite statistically different than the same three questions in the control condition $t(89= -1.92, p = .06)$. The three target statements weakly relate to initial confidence from the first day $r = .25$ and are not significant ($p = .08$). This correlation is weaker than the same three statements in the control group ($M = 5.2$) $r = .46, p < .00$. These results confirm our hypothesis that manipulated statements will be rated with lower confidence than control statements; however, while they are lower, they aren't quite significant. Increasing the total N may increase significant results.

For comparison, participants' confidence scores were fairly equal across groups on the seven statements that were not manipulated. The average confidence rating for the not-target statements in the misinformation condition was 5.45 ($r = .41, p < .00$) and the same seven statements in the control condition had a mean of 5.29 ($r = .42, p < .00$).

While this study is not attempting to prove the relationship (or lack thereof) between confidence and accuracy, these results provide a more sensitive variable and allow the participants' answers to the recall statements (agree or disagree) to be assessed and compared to the corresponding confidence ratings.

CHAPTER 5

Discussion

General Discussion

By obtaining an original testimony from the participants, the original memory of an event was able to be assessed and subsequently compared to their recall a week later. The control (not-manipulated) condition provided a base to see how consistent memory is over a week-long period when nothing has been changed or manipulated. After a week, approximately 98% of participants who were originally accurate agreed with statements that were congruent with their original testimony. The same pattern was found for statements that were initially inaccurate (82%), which suggests that an overwhelming majority of participants agree with their initial incorrect memory of the event. It appears that if participants hear the same information that they initially gave, they choose to stay with that story regardless of accuracy.

One hypothesis predicted that if participants' statements were originally correct and they heard misinformation during recall, they would accept this information and choose "yes" indicating that they remember it to be true. The data supported this hypothesis and is consistent with previous research (e.g. Loftus, 1991, 2002, 2003; Loftus & Hoffman, 1989; Loftus, Miller, & Burns, 1978). When information inconsistent with their original testimony was given to participants, it significantly impacted memory recall. This inconsistent information was more liklely to be agreed with in place of information that was consistent with the original testimony. If the original memory was accurate, participants were more likely to accept information that was incongruent with their original testimony than deny it (65% to 35% respecitvely). In other words, the manipulation of the original testimony, and the presentation of false information

worked. While this was expected, it contradicts the finding within the control group that people are more likely to agree with information congruent with their testimony. The fact that the majority of statements including misinformation are agreed with suggests that it does not take much external influence to impact memory.

This study contributes to literature by assessing statements that were initially incorrect, and testing memory based on these statements. The pattern of accepting incongruent information is consistent whether the initial testimony was accurate or inaccurate (73% to 27%). This decision represents the idea that they are comfortable using these statements as part of their testimony even when it includes information that was not in their original testimony. A significant difference was found between manipulated and not manipulated statements as well. This suggests that the difference that we see between manipulated statements and control statements can be attributed to the presentation of new or false information.

The participants whose statements were intitially accurate follow the misinformation effect (exposure to event, receive false information, recall of original event). However, the unique and curious aspect of this study is the group who initially gave incorrect statements about the video. In the manipulated condition, rather than presenting new false information, we attempted to push the participants' memories back to the truth. While more participants agreed with the new information (73%), 27% of participants disagreed with the factual information and stayed with their original incorrect testimony. Other studies have not analyzed this aspect of the misinformation effect before, yet it presents an important issue. Why are almost one-third of participants refusing to accept the truth when it is given to them?

Eyewitness research has shown that when a victim is initially incorrect and chooses an incorrect suspect from a line-up or photo array there are multiple factors that contribute to

solidifying their memory. Repeated exposure to the suspects, number of times asked to view the suspects, and cues from the investigators such as confirmation that the right suspect was chosen or informing the victim that they chose the same person two separate times all help to substantiate the victim's incorrect claim and boost their confidence. In a scenario such as that, the person is getting prolonged exposure or positive feedback to help solidify their statement. However, in this study, participants are only exposed to the video one time and receive no feedback about their testimony until questioning during day two. This inability to recognize the truth when it is presented carries a great legal impact, specifically since the statement is recalled with no prior confirmation.

Previous research (e.g. Loftus, 1991, 2002, 2003; Loftus & Hoffman, 1989; Loftus, Miller, & Burns, 1978) would predict that memory, regardless of initial accuracy, could be altered similarly. This study was able to test this theory and found that initial accuracy affected the rate at which misinformation could influence memory. Initially incorrect statements that were changed to include accurate information had a higher percentage of acceptances than initially accurate statements with false information. This agreement to misinformation indicates that it is easier to alter memory when the initial memory is inaccurate and accurate information is presented.

Overall confidence was lower for the manipulated statements than the control statements. This confirms our hypothesis which stated that confidence ratings for the incongruent statements would be lower than statements that are congruent with their original testimony. Regardless of having low confidence, participants still agreed with the statement that contained new or false information significantly more often than not. This decision shows not only the unreliability of memory, but the willingness to testify with statements that are recalled with uncertainty.

Confidence and accuracy research is fairly clear when addressing this issue related to eyewitness testimony; however, this current study draws attention to the willingness to testify as an eyewitness even when the new testimony contradicts the original testimony.

Significance of Findings

The importance of knowledge gained from this study is the ability to be applied to our legal system. Eyewitness testimony is a powerful tool in court, and knowing how malleable memory is, this tool may not be the most reliable. Since our memory is consistently unreliable, questions about the validity of criminal convictions based primarily on eyewitness testimony are raised. In the time between witnessing an event and being questioned about it, the witness may be exposed numerous ways to information that has the ability to alter their memory of the event. This external influence may alter memory enough to change the accuracy of the eyewitness's testimony and potentially may lead to a wrongful conviction.

This experiment assessed an area of false memory research that hasn't been explored. The results of this study imply that even when an event is initially recalled and reported correctly, errors still occur in subsequent recall when false information is present – even when this information is based on the original testimony. Also, consistent with previous research, confidence is not an indicator of accuracy; however, this data suggests that people are willing to testify regardless. The new piece of research is taking the participants' initial testimonies before introducing false information. This allowed us to examine how initially incorrect memories are able to be manipulated. It is not as easy as one might think to convince someone of the truth. This adds a new dimension to false memory research and opens up the opportunity for further research.

Future Research

This study was the first of it's kind and while we designed and executed it as well as we could, there are a few limitations that we encountered. For example, the nature of the data that we collected does not yeild to giving the experimenter much control over the number of people or scores that end up in a certain group. While we initially had control over the total number for each condition, this became an issue as participants started not showing up for the second week of participation. Our two conditions were uneven, and this may have affected some between group comparisons. We saw a similar issue once the data was broken into the eight subcategories. These groups are based on how particpants respond, and while that alone tells us something, comparing groups may only be significant due to the vast difference in group size. Replication is suggested to increase the total N.

Also, a structured content analysis was not completed, and any observations were made anecdotally; however, this additional information appears to be a beneficial piece in understanding the thought process during recall. A content analysis is recommended in future research to be conducted on the questions that were asked about any statement that was not marked as "yes" and fully confident. This analysis adds another dimension to the confidence and statement data. It not only allows the researchers to understand the reasoning behind the confidence ratings, but also to determine whether the new information affected memory recall or greater affected confidence. For example, if a manipulated statement was accepted as the truth but the confidence was low, what did the participant say about why they hesitated with being fully confident? Was it simply due to being unsure, or did they refer to their initial contradicting memory as the point of uncertainty yet still agree with the new information in low confidence regardless?

This study should also be run as a double-blind. While there were no intentions of biasing participants during recall, human error on the experimenter's side doesn't lend to perfect performance. A double-blind design would help eliminate any biasing error while reading statemets to the participants.

It is hard to tell for certain whether the memory of an individual is being altered, or whether they are agreeing with the statements to not be confrontational. We did attempt to control for this issue by asking questions about every statement that was not marked as accurate or was not completely confident. This gave us insight into what the participant was thinking while answering that question. Whether the participants' memories were truly altered or they simply agreed with the statements but with low confidence, the end result is the same. However, knowingly contradciting themesleves raises the issue of perjury. In court, it is almost impossible to know if someone is deliberately lying (e.g. contradicting their original statement) without them admitting to it. False memory research, this study included, shows that memory can be easily altered. While it may appear that a witness is committing perjury, the conflicting statement may be due to the suggestibility of memory rather than an intentional mirepresentation of information. Regardless of intent, if a witness contradicts their own statement in court it can be detrimental. Future research should address the relationship between false memories and perjury in order potentially distinguish between the two.

Finally, research should continue to investigate the groups of statements that were initially recalled incorrectly. What can this population of people tell us about memory recall? Is it possible to increase the number of people who will revert to the truth when faced with facts? Would a repeated exposure to the "false" information increase the number of accurate responses?

Conclusion

In summary, when there is no manipulation given before a recall test, individuals tend to agree with information that is congruent with what they originally remembered about an event. This applies to both accurately and inaccurately recalled information. However, once false information is provided to participants before recall, the majority of people will agree with this new (incongruent) information. This indicates that false information affects memory recall. Individuals are more likely to agree with the false information, but their confidence is lower than when rating statements that are congruent with their original memory and testimony. Regardless of having lower confidence, individuals are still willing to testify using these statements. In the inaccurate group, the manipulation did not work for approximately 30% of statements. Even though this statistic follows the same pattern as the accurate group, the implications are different. It is important moving forward to further assess this group and how inaccurate memories are able to be manipulated.

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Appendix A

Questions Used to Create Recall Statements

Describe the environment in which this attack took place (rooms, lighting, etc.).

Describe the appearance of the victim including clothing and physical characteristics.

Describe the events that happened prior to the victim being attacked?

What was the victim doing when she was attacked?

Describe the appearance of the perpetrator including clothing and physical characteristics.

Was there any dialogue between the perpetrator and victim, and if so, what was it?

What was the physical interaction between perpetrator and victim; how did the perpetrator handle the victim?

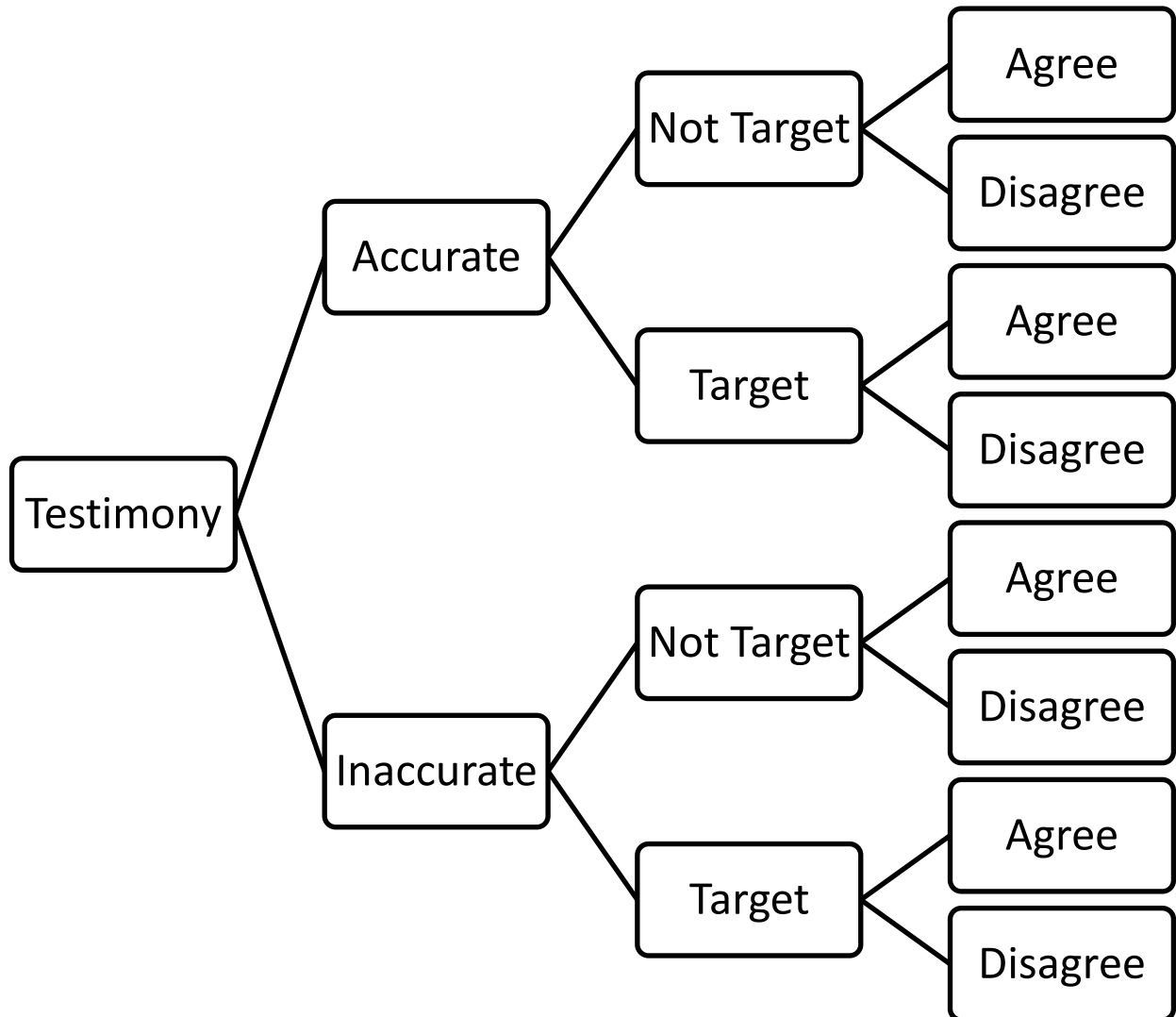How was the perpetrator acting prior to being shot?

Where did the victim get her weapon?

How many shots were fired?

Appendix B

Flowchart Outlining Participants' Recall Statements

Appendix C

Descriptive Statistics for Misinformation and Control Condition

Table C1

Total number and mean for statements in the misinformation condition

Misinformation Condition	Target Statements		Not Target Statements	
	N	Mean	N	Mean
Accurate Agree	50	0.65	304	0.98
Accurate Disagree	28	0.35	6	0.02
Inaccurate Agree	32	0.73	19	0.72
Inaccurate Disagree	10	0.26	5	0.28

Table C2

Total number and mean for statements in the control condition

Control Condition	Target Statements		Not Target Statements	
	N	Mean	N	Mean
Accurate Agree	78	0.99	239	0.97
Accurate Disagree	1	0.01	8	0.03
Inaccurate Agree	35	1.00	20	0.96
Inaccurate Disagree	0	0.00	1	0.04