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Cognitive Processes and Memory Differences in Recall and Recognition in Adults

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Walden University

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Laura Fitzgerald

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Walden University
2015

Abstract

Cognitive Processes and Memory Differences in Recall and Recognition in Adults

by

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MS, Walden University 2007

BA, Rutgers University, 2005

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Psychology

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Abstract

Eyewitness testimony is critical in both criminal court and civil court, so determining the most reliable method to gain information from witnesses is imperative. Past research in this area has focused on false memory, assisted recall, stress, and event perception. A gap exists in the current literature regarding the best method to gain the most accuracy in recall. The purpose of this study was to evaluate free recall, cued recall, and recognition, in an attempt to examine the accuracy of eyewitness memory. The study utilized a quantitative design to assess the accuracy of eyewitness memory as measured by results on free recall, cued recall, and recognition tests. The theoretical foundation for this study was the theory of information processing, which contends that information is processed in stages and combines visual cognition, memory, and memory recall; therefore, this theory applies to the study by helping determine the most accurate way for individuals to recall events. Introduction to Psychology students were shown a video, then asked to recall what they saw using either free recall, cued recall, or recognition. A one-way between-subjects analysis of variance was utilized to determine whether there were significant differences in the number of items recalled as a function of recall format. Results suggested that participants were more accurate with the utilization of recognition techniques for recall, as opposed to the free or cued recall. The importance of evaluating effective methods to promote accurate eyewitness testimony is to advance forensic science. The implications for social change include the ability to have more effective methods to gain accurate eyewitness testimony, thereby assisting with proper outcomes during trials.

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Dedication

I dedicate this dissertation to all of those individuals in law enforcement, who have one of the hardest jobs out there—keeping the rest of the population safe from harm.

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Table of Contents

List of Tables	iv
List of Figures	v
Chapter 1: Introduction to the Study.....	1
Introduction.....	1
Background	2
Statement of the Problem.....	4
Purpose of the Study	6
Research Question and Hypotheses	6
Theoretical Foundation	7
Nature of the Study	7
Definition of Key Terms.....	7
Assumptions.....	9
Limitations	10
Significance of the Study	11
Summary	11
Chapter 2: Literature Review	14
Introduction.....	14
Description of Literature Search.....	15
Information Processing Theory.....	15
Background	15
Components of Memory	17

Past Research	21
Long-Term Memory	21
Assisted Memory	23
Recall versus Recognition.....	25
Stress and Memory Recall	28
Types of Recall	29
Event Perception	31
False Memory	32
Recollection of Traumatic Events.....	37
Repetitive Testing	42
Best Time to Recall Events.....	45
Witness Factors.....	46
Interview Types	50
Summary	57
Chapter 3: Research Method.....	58
Introduction.....	58
Research Design and Approach	58
Population	59
Sampling and Sampling Procedures	59
Procedures.....	62
Data Collection	62
Data Analysis	63

Hypotheses	63
Validity	64
Protection of Human Participants	65
Summary	66
Chapter 4: Results	67
Data Screening	67
Descriptive Statistics	68
One-Way ANOVA	70
Kruskal-Wallis One-Way ANOVA	71
Summary	71
Chapter 5: Discussion, Conclusions, and Recommendations	72
Interpretation of the Findings	72
Limitations of the Study	78
Recommendations	79
Implications	80
Social Benefits	80
Individual Benefits	81
Conclusions	81
References	83
Appendix A: Free Recall Paper	91
Appendix B: Cued Recall Questions	92
Appendix C: Recognition Multiple-Choice Questions	94

List of Tables

Table 1. Frequencies and Percentages of Gender by Recall Format	68
Table 2. Descriptive Statistics of Age by Recall Format.....	69
Table 3. Descriptive Statistics of Correct Responses by Recall Format.....	69

List of Figures

Figure 1. Power as a function of sample size.....	60
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Chapter 1: Introduction to the Study

Introduction

Between 1974 and 2008, 203 individuals were convicted of crimes based on unreliable eyewitness testimony. These convictions were overturned based on DNA evidence that exonerated the individuals between 1989 and 2011 (Gould & Leo, 2010). Researchers have suggested the number of actual wrongful convictions based on eyewitness testimony may be higher than 203, possibly due to a loss of DNA evidence that might have consequently freed other individuals who were wrongly convicted (Wells & Quinlavin, 2009). If eyewitness testimony can wrongfully convict individuals, then it stands to reason that by discovering a more reliable method to gain accurate eyewitness testimony, wrongful convictions will decrease and legitimate convictions will increase. Eyewitness testimony is critical in not only criminal court, but also in civil court, so determining the most reliable method to gain information from witnesses is imperative (Wells & Quinlavin, 2009; Wise, Fishman, & Safer, 2009). By utilizing and understanding cognitive psychology, future eyewitness testimony may become more reliable.

Past researchers (Fisher, Geiselman, & Amador, 1989; Ihlebaek, Love, Eilertsen & Magnussen, 2003; Yuille & Cutshall, 1986) have studied different ways to elicit information from eyewitnesses; however, these different ways have never been combined in one study. Free recall has been studied utilizing the cognitive interview (CI), developed by Geiselman and Fisher in the early 1980s (Fisher et al., 1989) in an attempt to improve police interviewing techniques. CI uses cognitive techniques to assist in

memory retrieval, the basis being that the individual should be directed to recall anything and everything he or she believes he or she witnessed (Geiselman et al., 1984). Prior to the CI, free recall has been underutilized in research. Cady (1924), Yuille and Cutshall (1986), and Wilford, Chan, and Tuhn (2013) used free recall in their studies; however, they were the exception among current researchers. The research by Yuille and Cutshall yielded a median percentage of correct details of 82.93%.

Most interviews and studies have been based on open-ended or closed-ended questions, with closed-ended being more prevalent due to the ease with which they can be asked and then analyzed (Geer, 1991). The majority of the studies researched as background for this study used either all closed-ended or a combination of open-ended and closed-ended questions (Christianson & Hübinette, 1993; Schooler, Gerhard, & Loftus, 1986). Wilford et al. (2013) conducted a study that utilized free recall and cued recall; however, to date, it does not appear there has been research that included free recall, cued recall, and recognition response options.

This chapter will introduce the concept and processes of cognitive psychology and explain how these processes can impact eyewitness testimony. Additionally, this chapter will present the research problem and the purpose of the study, define key terms, review the assumptions and limitations of the study, and describe the significance of the study.

Background

Understanding the factors that influence memory, and therefore the accuracy of eyewitness testimony, is paramount to effective use of eyewitness testimony in legal

proceedings (Malpass, Ross, Meissner, & Marcon, 2009). Corsini (2002) defined eyewitness testimony as reports from individuals of a particular activity and claimed that individuals have often accepted that eyewitness testimony is better than circumstantial evidence. Many cognitive processes affect eyewitness testimony: the sensory register (Tulving & Craik, 2000), short-term memory (Loftus, 1980), long-term memory (Hunt & Ellis, 2004), explicit and implicit memory (Corsini, 2002), false memory (Hunt & Ellis, 2004), and selective attention (Smith & Kosslyn, 2007). Eyewitness testimony, memory, and memory recall have been extensively studied; other research has been conducted on how memories are recalled, how they can be manipulated, and if types of events or psychological types can influence perception of events (Christianson & Hübner, 1993; Christianson & Loftus, 1987; Loftus, 1979, 1992; Loftus & Hoffman, 1989; Wise et al., 2009). The majority of research on memory recollection has focused on individuals being given misinformation to determine if their recall is, in fact, correct. By providing misinformation, researchers have not discovered the most accurate way to obtain the correct information, only explained how easy it is to manipulate an individual's memory. Many times, witnesses are not aware they have been given misinformation, so they are unaware what they are recollecting is not correct (Cutler & Penrod, 1995; Loftus, 1979; Loftus & Hoffman, 1989; Wise et al., 2009). Eyewitness testimony is often necessary during legal trials; therefore, because eyewitness testimony is frequently used, it is important to discover the most accurate way to extract information from those individuals who are eyewitnesses.

Stress is a factor that contributes to memory recall, particularly in the case of eyewitness memory (Christianson & HübINETTE, 1992). Memory is worse when an event is stressful; however, when witnesses were questioned following a series of bank robberies, anywhere between 4 and 15 months after the event, their responses were consistent with prior reports to the police directly following the robbery, showing that stress does not necessarily have a negative impact on long-term memory recall (Christianson & HübINETTE, 1992). Extensive research has been conducted, particularly via psychological investigation of eyewitness testimony, in forensic situations; a meta-analysis of the accuracy of eyewitness recall when under stress concluded that higher stress impacts those individuals asked direct questions more than those who are allowed free recall (Deffenbacher, Bornstein, Penrod, & McGorty, 2004).

In 1924, Cady conducted a study to determine if free recall was better than cued recall. The results of the study showed those who just wrote a narrative of the event omitted more details than those who were given questions to answer (Cady, 1924). What remains unknown is how false information influenced the outcome of this study; therefore, it is pertinent and timely to conduct a study assessing the accuracy of free recall versus cued recall and recognition with regards to obtaining accurate eyewitness testimony.

Statement of the Problem

Extensive research has been conducted on eyewitness testimony in forensic situations (Chan, Thomas, & Bulevich, 2009; Christianson & HübINETTE, 1993; Fisher et al., 1989). There has been a lack of research that examined whether memory is more

accurate when individuals are allowed to recall events freely or when prompted with choices. Deffenbacher et al. (2004) conducted a meta-analysis on various studies that addressed eyewitness testimony; however, he reported that only one prior study addressed free recall. Past research (Christianson & Hübnette, 1993; Deffenbacher et al., 2004; Schooler et al., 1986) has encompassed each area separately. Research has been conducted on free recall and utilizing multiple-choice questionnaires, but, with the exception of Cady's study in 1924, these methods have not been combined in a single study. There are positive and negatives when it comes to utilizing short-answer and multiple-choice formats for testing. While scoring short-answer tests is more time consuming, multiple-choice tests do not always elicit the most accurate thought processes (Kim et al., 2009). Another negative consequence of multiple-choice tests is that having other choices available to see can cause the misinformation effect at a later date (Roediger & Marsh, 2005). Other studies have focused on misleading information and false memories, but not necessarily the most accurate way to extract the correct information from eyewitnesses (Loftus & Hoffman, 1989; Schooler et al., 1986). Due to the lack of research on free recall, this study was an avenue to discover if there is a more accurate method to recall event information. Past studies (Christianson & Hübnette, 1993; Loftus, 1992; Loftus & Hoffman, 1989; White, Leichtman, & Ceci, 1997) have focused on the effects of false memories, leading information, or the level of trauma of an event; thus, a focus on the most accurate possible way to obtain information has been pushed aside. Preliminary investigation of memory recall in relation to eyewitness testimony has given some indication of techniques that can be utilized to gain accurate

information; however, the problem is that many discrepancies remain when it comes to eyewitness testimony. Yuille and Cutshall (1986) conducted a case study that utilized free recall. In addition to having subjects describe what happened in their own terms, two misleading questions were incorporated into the study (Yuille & Cutshall, 1986). The present study investigated the relationship between different types of recall, without any type of misleading information.

Purpose of the Study

The purpose of this quantitative study was to determine if there was a statistically significant difference in the amount of information participants recalled, based on how they were asked to recall information. The independent variable was recall type, with three levels: free recall, open-ended questions, and multiple-choice questions. The dependent variable was the number of correct items on each response form.

Research Question and Hypotheses

Is there a statistically significant group (free recall, open-ended questions, and multiple-choice questions) difference in total recall for adults between the ages of 18 and 25 years of age?

Null Hypothesis (H_0): There is not a statistically significant group (free recall, open-ended questions, and multiple-choice questions) difference in total recall for adults between the ages of 18 and 25 years of age.

Research Hypothesis (H_1): There is a statistically significant group (free recall, open-ended questions, and multiple-choice questions) difference in total recall for adults between the ages of 18 and 25 years of age.

Theoretical Foundation

The theoretical foundation for exploring memory recall in the context of cognitive psychology is based on the information processing theory, proposed by Neisser (1967). The information-processing theory deals with memory retrieval, or how to utilize information previously stored (Wescourt & Atkinson, 1975). Cognitive psychology studies the processes of the mind, specifically perception, memory, and reasoning (Hunt & Ellis, 2004). Cognitive processes not only affect how individuals perceive the world around them, but also affect individuals' memory and recall (Hunt & Ellis, 2004). Cognitive psychology concentrates on how the human mind processes the information received, the input, and how it will form the necessary responses, the output (David, Miclea, & Opre, 2004).

Nature of the Study

In this quantitative research study, I examined differences in memory recall. The participants were recruited from an introductory psychology class in a large East Coast university. The data were obtained during one class period and analyzed following the class, in my office. The independent variable was recall type, with three levels: free recall, open-ended questions, and multiple-choice questions. The dependent variable was the number of correct items on each response form.

Definition of Key Terms

Cognitive psychology: Cognitive psychology is the study of the processes of the mind, dealing specifically with perception, memory, and reasoning (Hunt & Ellis, 2004).

Explicit memory: Explicit memory is long-term memory that can be consciously recalled and explained to other people, such as events or facts.

Eyewitness testimony: Eyewitness testimony is an account by individuals who have seen a specific activity (Corsini, 2002).

False (forced) memory: False memory is the act of having a clear recollection of an event, individual, or place that never transpired (Corsini, 2002).

Free recall: Free recall is the option to recall a sequence of events, words, pictures, and so forth, in any order (Tulving & Craik, 2000).

Implicit memory: Implicit memory is the unconscious form of long-term memory, or memories that individuals know, but cannot express how they know, such as how they know how to ride a bike or drive a car (Smith & Kosslyn, 2007).

Long-term memory: Long-term memory is the storage location for information that begins in short-term memory and includes both explicit and implicit memories (Hunt & Ellis, 2004). Long-term memory is believed to be almost limitless in size, is relatively permanent, and contains various types of information, including factual knowledge, skills, and habits (Terry, 2009).

Memory: Memory is the capability to recall past experience based on the process of learning and can be discussed in terms of short-term and long-term, explicit and implicit, and false memory (Corsini, 2002; Hunt & Ellis, 2004).

Perception: Perception is the knowledge of having one's senses stimulated; the ability to choose, organize, and understand sensory experiences (Corsini, 2002). It can be

visual, tactile, intellectual, or by verbalization. For the purposes of this study, perception was refined to visual and intellectual awareness of events.

Reasoning: Reasoning is how an individual reaches certain conclusions, and how he or she evaluates the validity of those conclusions (Hunt & Ellis, 2004).

Selective attention: Selective attention is the inclination of individuals to notice only what pertains to them and ignore everything else (Corsini, 2002).

Sensory register: Sensory register is the storage area in the brain that retains a comprehensive account of sensory stimulation (Corsini, 2002).

Short-term memory: What one is thinking about at that particular moment. Short-term memory is brief and has limited capacity, holding only a few items (Terry, 2009). Short-term memories can be converted to long-term memories, if an individual feels the information is important enough. Information is rehearsed in short-term memory in order to enable encoding into long-term memory (Terry, 2009).

The von Restorff effect: The von Restorff effect is isolating a particular item in order to enable the learning of that item (Loftus, 1980).

Assumptions

Research has shown eyewitness testimony to be unreliable (Cutler & Penrod, 1995). There are many factors that can influence eyewitnesses, including stress, perception, and time of recall. Stress is a factor when it comes to how an individual remembers and that includes the difference between real-life situations versus laboratory situations (Ihlebaek et al., 2003). There are three differences between what individuals may experience in real life versus in an experimental setting (Ihlebaek et al., 2003).

Assumptions of this study had to include these three differences. The first was that there is more than likely to be higher emotional arousal when witnessing a crime first hand.

Second, each individuals' physical location may be different during a live crime, versus viewing a scene in a controlled environment, and third, it may be difficult to obtain a proper representative sample in an experimental setting (Ihlebaek et al., 2003). Assumptions about perception have to include that the participants in the study would approach the questionnaires in a serious manner and the participants would pay attention to the video being shown. In this study, the participants were given the questionnaires to complete immediately following the video. The assumption was that in a real life situation, an eyewitness would be questioned immediately, which may not always be the case, so this could influence outcomes in real-life situations. Other assumptions included the following: the questionnaires measured what they were supposed to measure; the participants were able to complete the questionnaire without interruption; and the participants were not coerced into participating in the study.

Limitations

Limitations of the study included age and mental ability. There are differences between how an 18-year-old views an event versus how a 65-year-old views that same event. The participants in this study were between 18 and 25 years of age, so it was not possible to determine if age was a factor when determining accurate memory recall. Additionally, it did not account for how a younger individual views events. This study was conducted in a university setting; therefore, there was a natural presumption of the ability to remember items, which is not able to be controlled in a real-life situation.

Significance of the Study

It is vital in criminal cases that correct testimony be obtained in order for judges and juries to make the correct determinations and to prevent unjust convictions. This is not only important for the first line of trials, but also important if a case has to go up to an appellate court (Wise et al., 2009). Police officers, judges, and attorneys need to be able to assess if eyewitness testimony is valid, and if there may be a more efficient and reliable method for retrieving information from individuals, it should be investigated. By examining three different ways for individuals to recall information, the goal of this study was to provide additional insight into the best way to obtain accurate information. This will produce the possibility for more accurate eyewitness testimonies. The information generated from this study can provide positive social change by altering the way eyewitnesses are questioned and how accurate this information is, which in turn could lead to more accurate outcomes in court proceedings. The world is more sophisticated than it was in 1924, with new technology and new challenges. Because of this new technology, the mind is forced to focus on more, thus people's responses may have changed since Cady's original 1924 study.

Summary

Eyewitness testimony can be studied under the microscope of cognitive psychology, best described as the processes in which the mind comprehends events. Many factors influence the cognitive process involved in memory recall including stress and emotional arousal, new technology and challenges, and the way in which a witness is questioned about his or her perception of an event.

Past studies of memory recall have included multiple choice questions, open-ended questions, and free recall. Research has excluded the use of all three of these methods in one study to determine which method of obtaining evidence from eyewitnesses produces the most reliable account and has thus provided an opportunity to further study an individual's memory and recall during an event. By incorporating free recall, open-ended questions, and multiple-choice questions in a controlled study environment, the goal of this study was to provide a deeper understanding of what type of questioning technique will evoke the most accurate testimonies.

Christianson and Hübnette (1993) and Schooler et al. (1986) have conducted studies that utilized either all closed-ended or a combination of closed- and open-ended questions; however, there has not been a study that combined the use of free recall, open-ended questions, and closed-ended questions.

In a controlled environment, eyewitnesses who have viewed an event were divided into three groups, each group being asked to respond to a questionnaire related to the event. Each group utilized only one method of recall. The results of this study will hopefully render a more efficient and factual method to retrieve information from individuals. Results from this study can provide positive social change by changing the way eyewitnesses are questioned and how accurate the information obtained is. It is imperative that judges, attorneys, and even juries know they are relying on eyewitness testimony that is correct; therefore, it is important to learn the most accurate way to obtain that testimony. Chapter 2 includes a review of the pertinent research and provide and in-depth discussion of cognitive psychology as it relates to memory recall. The

chapter will explore the differences in types of memory, how individuals view and perceive events, and what influences these actions. Chapter 3 presents the research methods utilized in this study, including research design and approach, setting and sample, instrumentation and materials, data collection and analysis procedures, and measures taken to protect the participants' rights. Chapter 3 also justifies the use of a quantitative research design.

Chapter 2: Literature Review

Introduction

Eyewitness testimony is an important aspect of not only criminal investigations, but also for civil investigations. However, eyewitness testimony has been known to be unreliable (Cutler & Penrod, 1995); therefore, it is important to find an accurate way to obtain reliable eyewitness testimony. The purpose of this study was to determine that most accurate way.

This chapter begins with a description of the literature search strategy. The review of the literature begins with a review of information processing theory. This is followed by a review of differences between short- and long-term memory, types of memory recall, historical information that includes past research, and an examination of event perceptions, witness reactions, and interview methods. Further, the literature review will focus on the background of cognitive psychology and memory, past research on eyewitness testimony, event perception, false memory, traumatic events, witness factors, and types of interviews. The literature review includes research conducted from the 1920s (Cady, 1924) and into the present decade (Thomas, Bulevich, & Chan, 2010). Free recall, which is found mostly in the Cognitive Interview (CI), will be discussed by focusing on research conducted by Aschermann, Mantwill, and Köhnken (1991), Fisher et al. (1987), and Geiselman et al. (1984). Studies utilizing open- and closed-ended questions have been conducted by Christianson and HübINETTE (1993) and Schooler et al. (1986), to name a few. Information pertinent to memory and memory recall is presented, including different aspects that may affect memory.

Description of Literature Search

Articles and book chapters with relevance for this study were obtained through Walden University online library databases. Databases searched included PsycINFO and PsycARTICLES. Key search terms included the following: *eyewitness testimony*, *false memory*, *memory recall*, *memory*, *free recall*, *multiple choice*, *cognitive retrieval*, and *cognitive interview*. The publication dates for the literature search ranged between 2006 and 2012. Older works reviewed were relevant to establishing background on the topic of memory recall and eyewitness testimony, or are historically prominent theoretical works. Articles and book chapters were filed for later use if they met the criteria for one of the keywords used, fit effectively into the topic, seemed to provide the most recent and relevant information on my topic, and referred back to the key concepts of the theoretical framework.

Information Processing Theory

Background

The theoretical foundation for exploring memory recall in the context of cognitive psychology was information processing theory, proposed by Neisser (1967). The information processing model asserts information is processed in stages. Information is first encoded, stored and organized, and, if necessary, retrieved (Neisser, 1967). Information processing is a combination of visual cognition, memory, and memory recall. Individuals see an item or items, and from these, they form a type of visual memory. Each new item adds new information to the memory. When an individual recollects an event he or she witnessed, he or she not only reconstructs what he or she saw, but may fill

in any gaps with past experience, perceptions, beliefs, or information of comparable events. This causes an individual's memory to construct a description of the event that appears whole and consistent, but may contain errors (Wise et al., 2009). Because information processing is a combination of cognition, memory, and memory recall, it is important to understand how it works in an effort to determine the most accurate way for individuals to recall events.

Perception is a process of construction; however, it is how the information is received that plays a part in that construction. Perception can occur from visual cognition, in that relevant information is viewed and then stored. This does not mean that everything seen is stored, as some things viewed are similar to items already stored in long-term memory. Information processing and recall is utilized by mentally reconstructing something viewed with items that are already a part of long-term memory (Neisser, 1967).

Cognitive psychology focuses on investigating the specificity of stimuli—not just individuals' responses to it—how the mind organizes experiences, and how an individual arranges stimuli received from the environment (Schultz & Schultz, 2004). The sensory register is the beginning stage of memory. This begins via the stimulus reaching the brain. All memory starts with some type of image or signal entering sensory memory. This stays briefly unless it is transferred to short-term or long-term memory (Tulving & Craik, 2000). Sensory memory includes visual or iconic, auditory or echoic, tactile, and even taste (Tulving & Craik, 2000). Of sensory memories, hearing appears to last slightly

longer than visual. Once the sense is acquired, the brain then determines where it will be stored next (Loftus, 1980).

Components of Memory

The Baddeley-Hitch model posits there are three storage buffers and a control system (Smith & Kosslyn, 2007). The three buffers include one for verbal information, one for visuospatial information, and the third is an episodic buffer. If one of the first two buffers is engaged in storing information, the other can be employed to maximize memory. The episodic buffer can integrate the first two buffers in addition to being available when the other two are overloaded (Smith & Kosslyn, 2007). Because the subjects in the current study were not tested previously on their individual memory capacities, it was impossible to control for their ability.

In earlier research, Kintsch (1970) noted a two-process model of memory. This model purports recall and recognition are controlled by different memory processes, as opposed to the trace-strength model, that purports they are controlled by the same process. Kintsch noted recognition is verifying the familiarity of an object, while recall is more of a search process that ceases when an item is completely retrieved. Recall involves a deliberate retrieval activity by an individual (Kintsch, 1970). Since Kintsch noted recall and recognition are two separate processes of memory, further research confirmed this theoretical view: there are individuals who have intact recognition memory, but decreased recall memory (Moscovitch, 1989), and those who have intact recall memory but decreased recognition memory (Delbecq-Derouesne, Beauvois, & Shallice, 1990).

The major characteristics of short-term memory are considerably short duration and high level of accessibility (Smith & Kosslyn, 2007). Short-term memory is the ability to sustain small amounts of information for a short period of time (Terry, 2009). Because there are limitations on the amount of information that can be retained at one time, in order to retain new information, there has to be displacement of another item (Terry, 2009). Short-term memory is related to focus of attention. While many items can be held in short-term memory at the same time, it is the focus of attention that determines if that memory will be further stored (Loftus, 1980). In short-term memory, information is generally retained for approximately 30 seconds (Loftus, 1980). Short-term memory is useful when it is known that the information will not be needed in the future; for example, if calling a restaurant to make reservations, and not having to call again, it is not necessary to remember the phone number.

When information obtained in short-term memory is retained, it moves into long-term memory (Smith & Kosslyn, 2007). One purpose of studying long-term memory is to discern what accounts for memory retention versus memory loss (Hunt & Ellis, 2004). Long-term memory has been compared to a large library where all memories can be stored for future use, categorized like books on a shelf (Loftus, 1980). The concept of long-term memory concentrates on the distinct processes that are: connected with memory preservation, based on the presumptions that memory trace is a part of perception and understanding, and that memory retention is directly connected to meaning (Hunt & Ellis, 2004). Long-term memory consists of items individuals want to transfer from short-term memory to long-term memory. This occurs when information is

held and rehearsed in short-term memory until it has been repeated enough to become a long-term memory (Loftus, 1980).

Long-term memory also has what is known as the serial position curve. This refers to the primacy and recency effect (Corsini, 2002). Primacy effect is when an individual recalls the first thing from a list or event, where recency effect is when an individual recalls the most recent thing they heard or saw (Corsini, 2002). For example, an individual may recall individuals entering a bank and telling everyone to get on the floor, primacy effect, and then may recall them grabbing a bag of money and running out, recency effect. What is not remembered is anything that may have been said by the robbers, or what they were wearing. The primacy effect is essentially what was first stored into long-term memory, and recency effect is what happened at the end of the event and is still sitting in short-term memory. Understanding the serial position curve is important to the study because it may help explain any discrepancies in the responses, based on when the event occurred in the video. The one deviation from this is known as the *von Restorff* or isolation effect (Corsini, 2002). If in a series of items, an item is in complete contrast with other items, the unusual item is more likely to be recalled. For example, during the middle of the robbery, if a shot is fired, that would most likely be remembered. The most common way of retrieving information from long-term memory is by using cues. Cues can be virtually anything: sights, sounds, or smells. One problem with retrieval cues could be if a false cue is given, which could lead to a false or forced memory (Loftus, 1980).

Explicit and implicit memories have been utilized in cognitive psychology research and can be connected with eyewitness testimony. Explicit memory is knowledge about facts, or the ability to intentionally remember facts of an event (Corsini, 2002). Implicit memory on the other hand is the ability to perform acts or remember information without consciously meaning to (Corsini, 2002). For example, remembering what one had for dinner the previous night would be explicit memory, while remembering how to ride a bike is implicit memory.

Another aspect of memory studied in cognitive psychology is memory failure, more specifically in the form of forgetting and false memory (Hunt & Ellis, 2004). Theories have been proposed in an attempt to explain why forgetting occurs. These theories include decay theory, which states stored information has vanished from memory, and interference theory, which states forgetting results from the competition between responses and cues (Hunt & Ellis, 2004).

Investigation of false memory has indicated the normal use of previous information can influence perception and thus can affect an individual in their ability to demonstrate accurate memory (Hunt & Ellis, 2004). It has been noted that perhaps the most important contribution of research in false memory is that memory is not stored as a completely accurate representation of what an individual observes, but involves processes of interpretation, such as perception and comprehension (Hunt & Ellis, 2004).

Selective attention is the encoding of images, although some of these images are encoded better than others (Smith & Kosslyn, 2007). For example, if looking at a picture taken at a family function, one person may focus on the decorations, while someone else

may notice the food on the table (Smith & Kosslyn, 2007). Perception and recall is based on what is important to the individual; therefore, what gets stored in one's memory is not just what was witnessed, but the meaning an individual gives to it (Wise et al., 2009).

This relates to eyewitness testimony, as everyone reacts differently in times of stress and may notice something different about what occurred than the individual next to them.

Recollection is the ability to recall details about a specific event (Smith & Kosslyn, 2007). Studies have shown there are differing levels of recollection, but currently there is a lack of evidence of whether recollection varies depending on the types of questions being asked (Kosslyn, 2007).

Past Research

Memory, memory recall, and eyewitness testimony have been researched in depth (Christianson & Loftus, 1987; Christianson & Hübner, 1993; Loftus, 1979). There has been considerable research conducted on how memories are recalled, how they can be manipulated, and if certain types of events or psychological types can influence the perceptions of events (Christianson & Hübner, 1993; Loftus & Hoffman, 1989; Loftus, 1992). The majority of research on memory recollection is based on individuals being given misinformation to determine if their recall is in fact accurate (Cutler & Penrod, 1995; Loftus, 1979; Loftus & Hoffman, 1989). The research that has not been conducted thoroughly is whether or not free recall is better than cued recall.

Long-Term Memory

Researchers (Christianson & Loftus, 1987; Goodman & Schaaf, 1997) have attempted to discover the accuracy of long term memory. Goodman and Schaaf (1997)

explored children's memory, and its accuracy, and how to help a child clearly recall past events. Issues with recalling events, especially with children, are observed when investigators ask leading questions, or when prompting for answers occurs. Researchers (Goodman & Schaaf, 1997; White et al., 1997; Wright, Loftus, and Hall, 2001) have shown that some leading questions are inevitable, and may assist an individual to recall part or the entire event. However, leading questions should be used carefully in order to not produce false memories (Goodman & Schaaf, 1997).

When information is added or deleted to a situation, this can alter an individual's memory of that situation (Wright et al., 2001). This information is called post-event information (PEI) and research has shown that memories for a whole event can be both implanted and inhibited. PEI can occur in three different forms: biased questioning, re-describing the event, and information presented by another person (Wright et al., 2001). When information is presented following an event, does that information replace the original memory, or does the original memory stay intact? Research (Wright et al., 2001) has shown, after viewing an event, when individuals were asked specific questions about items not actually in the scene, they would respond those items were there, believing they had to have seen the items, if they were being asked about them (Wright et al., 2001).

One study involved a scene of a bedroom and items that were located throughout. The photo showed a typical bedroom scene with a bed, bookcase, and a number of university sweatshirts scattered throughout the room. When individuals were asked if they saw a specific university sweatshirt, they replied in the affirmative. When asked later if they saw *any* university sweatshirt, they responded with the original answer,

ignoring the fact there were many other university sweatshirts in the room. By activating the memory for one specific item, the others were overlooked (Wright et al., 2001).

Assisted Memory

Wright et al. (2001) attempted to determine if one person's report could affect the memory of another person and thus, change their report. Researchers used two different methods to approach this study. The first method involved pairing 40 individuals, having them view cars and then being tested on what they saw. Of the pairs, there were 10 mixed gender pairs, five pairs with two males and five pairs with two females. Results did not show significant gender differences. Fifty photos of cars were chosen to show the individuals, 30 of which would be seen by both individuals in the pair; with the other 20 being divided and only having each participant see 10 of them, so each individual saw 40 photos in all. The participants were told they were both seeing the exact same set of photos. After viewing the photos, the pairs were given a filler task for 20 minutes before being shown the photos again. Following the filler task, 100 photos were shown to the pairs simultaneously. For the first 50 photos, one individual responded if they had seen the car in their original set of 50 photos. For the second 50 photos, the second individual responded if the car had been in their original 50 photos. The questions the researchers wanted answered for this portion were: does one witness's report affect another's; is the impact the same for both accurate and inaccurate PEI; and, are these results comparable with past research. Results did show that what one individual stated affected the other's report as well; accuracy was higher when one person provided correct information and accuracy was lower when incorrect information was provided. When one individual in

the pair reported correct information, the second individual also reported that same correct information; however, when one individual reported incorrect information, the second individual also reported that same incorrect information (Wright et al., 2001).

The second method in this study also involved 40 individuals divided into pairs. This study utilized a storybook containing 21 pictures which involved a woman stealing a wallet. One individual in each pair saw a version where the woman was clearly seen with an accomplice, while the other individual in each pair saw the woman standing alone. Immediately following the storybook, participants were given a 16 item questionnaire to complete. The questions were all true/false questions and also included a 0-10 confidence scale. The crucial question was: “Did the thief have an accomplice?” (Wright et al., 2001, p. 196). Following a 5-minute filler task, the pair was asked to describe together, the events that occurred as if they were reporting it to the police. They were advised to focus on the sequence of events and what different individuals were doing. Each pair discussed whether or not the thief was alone. Following the narration, individuals were given the 16 item questionnaire again. Following the initial questionnaire, 39 out of 40 individuals correctly reported whether there had been an accomplice or not. However, following the narration with their partner, 15 of 19 pairs came to an agreement, which shows that individuals changed their minds based on what their partner reported (Wright et al., 2001). This research shows that PEI memories can be altered based on another’s view. This research is important for the present study, in that it is important to know how another individuals’ perception can possibly skew the perception of another individual.

While the present study will not present direct misleading questions, there will be incorrect information presented on the multiple-choice portion of the study.

Recall versus Recognition

Two types of recall are free recall and cued recall. Free recall is typically a task that requires an individual to view a list of items and then attempt to recall as many of them as possible (Terry, 2009). It is considered free recall, because the information does not have to be recalled in any particular order (Terry, 2009). Cued recall is where, in order to assist with recalling information, cues are given. Recall requires individuals to recall learned information, where recognition provides individuals the learned information along with distractor items to determine if a previously studied item can be detected (Terry, 2009).

Wilford et al. (2013) note free recall is also utilized when it comes to criminal investigations and an individual calling 911 is asked to “tell everything” (p. 1). Additionally, free recall is utilized in other types of interviews, such as the CI (Fisher & Geiselman, 1992) and the Stepwise Interview (Yuille, Hunter, Joffe, & Zaparniuk, 1993). Wilford et al. (2013) conducted three experiments on retrieval-enhanced suggestibility (RES). The research examined if suggestibility is increased based on the type of questioning utilized. In the first experiment, 60 undergraduate students viewed an 8-minute video of a museum burglary, and then half of those students took a cued recall test containing 18 nonleading questions. Each question contained a neutral, peripheral, or central item. After each question, they were to indicate on a scale of one to five, their confidence in their answer (Wilford et al., 2013). They were given 10 minutes to

complete the task. The other half of the participants played a video game for 15 minutes. The participants who completed the test then played that same video game for five minutes. Following the filler task, all participants listened to one of two narratives. The narratives were indistinguishable with the exception of 12 pieces of misinformation interjected in one. After listening to the narrative, all participants then took a final cued recall test, identical to the first one (Wilford, et al., 2013). Overall, results showed no effect on the prospect of misinformation affecting the recall of central items, although the misinformation did affect the peripheral items. Additionally, those who took the initial cued recall test had increased misinformation on the second test for peripheral items, than those who did not take the first test (Wilford, et al., 2013).

In the second experiment, 120 undergraduate students watched the same video utilized in Experiment 1. Half the participants were then given 20 minutes to write down what they remembered from the video. They were urged to utilize the whole 20 minutes and to be as detailed as possible. The participants who were in the no-test group were asked to write down a childhood story they had viewed (e.g., *Snow White and the Seven Dwarfs*; p. 6). This was utilized to approximate the level of processing as the test group (Wilford et al., 2013). After the 20 minutes had passed, all participants watched a 22 minute distractor film before listening to the audio narrative with the misinformation. After another distractor task, all participants were then given the cued recall test from Experiment 1 (Wilford et al., 2013). The results from this experiment demonstrated taking the initial free recall test increased the account of misinformation in the cued recall test. However, similar to Experiment 1, the increased misinformation was for peripheral

items, not the central items (Wilford et al., 2013). In the third experiment, 120 students participated, with 60 in either test or no-test condition. The procedure was similar to Experiment 2 except the distractor video was shortened to 18 minutes; and both the initial and final tests were free recall, and the second test time was increased to 25 minutes. So, all participants watched the event, either took the initial recall test or recalled a childhood story, watched the distractor video, listened to the misinformation narrative, then took the final free recall test (Wilford et al., 2013). In this experiment, incorrect recall of central items remained low, although those in the initial testing group increased false recall on the peripheral items after hearing the misinformation (Wilford et al., 2013).

Multiple-choice tests fall into the area of recognition, as these questions are specifically designed with the answer given, and able to be retrieved utilizing recollection of cues (Ozuru, Briner, Kurby, & McNamara, 2013). In a study to determine comprehension of text by utilizing open-ended and multiple-choice questions, Ozuru et al. (2013) had 41 undergraduate students read a text and then answer questions utilizing either an open-ended questionnaire or a multiple-choice questionnaire. The multiple-choice questions were developed from the open-ended questions by adding four answer options. Each answer option contained a correct answer and three distractors, including a near-miss option, which is an answer that appeared in the original text, but is out of context for the question (Ozuru et al., 2013). One of the goals of this study was to determine the performance between those who answered the open-ended versus the multiple-choice questionnaire, predicting there would be very little difference between the two. While it was noted there were no significant differences in performance between

the two types of questionnaires, they felt there was still research that needed to be conducted, specifically to examine the relationship between different types of processing, as this study only focused on one type of processing (Ozuru et al., 2013).

Stress and Memory Recall

Another factor contributing to memory recall is how it is affected by stress. Christianson and HübINETTE (1993) studied the effects of stress on recall. Prior research has shown memory is worse when an individual is confronted with a stressful event, so Christianson and HübINETTE (1993) conducted research utilizing individuals who had been eyewitnesses or victims in one of 22 bank robberies that were committed in Stockholm in between 1989 and 1990. There were 58 witnesses, 12 men and 46 women. Twenty of these were victims (bank tellers), 25 were fellow employees, and 13 customers. The age range for these witnesses was between 18 and 82. These witnesses had been interviewed immediately following the original incidents and the study occurred between 4 and 15 months after the event. The participants were asked to fill out a questionnaire pertaining to both their memory of the original event and their emotional state during the original event. There were 31 items on the questionnaire: 16 multiple choice questions regarding action, people, and object descriptions; and four multiple and fill in the blank questions of details about the robbery (date, time, etc.). After completing the questionnaire, witnesses were asked to rate their emotional state during the robbery; describe their physiological reactions; and measure the vividness and quantity of detailed information they remembered from the robbery. Results of the study revealed the answers were consistent with what had been reported to the police directly following the robbery, showing that

stress does not necessarily have a negative impact on memory recall (Christianson & HübINETTE, 1993). While the study showed that stress does not necessarily affect memory, it should be noted that Christianson and HübINETTE (1993) did mention that some of the differences in accuracy of scores could be the result of the different perspectives of each of the witnesses; for example, where they were located while the robbery was occurring. While the present study is designed to have subjects watch a video of an event, not participate in an event that could be stressful; individuals may experience stressors while watching and it is important to understand how this stress could affect the outcome of the study.

Types of Recall

Extensive research has been done, particularly via psychological investigation of eyewitness testimony, in forensic situations. Where research seems to be lacking is examining if memory is more accurate when individuals are allowed to recall events freely, or when prompted with choices.

Yuille and Cutshall (1986) conducted a case study that utilized free recall. This study utilized actual witnesses from a previous crime that had occurred in Canada. This research was able to be conducted due to the fact that there were multiple witnesses and due to the circumstances of the crime that this case was not going to court. The witnesses were asked to describe what had happened in their own terms. This was followed by the witnesses being asked specific questions to either clarify details or solicit additional details. Additionally, departing from typical police procedure, two misleading questions were incorporated into the study (Yuille & Cutshall, 1986). Yuille and Cutshall also

added questions regarding more descriptive details from the actual event, details that the police were not interested in, but details that could be useful for determining the accuracy of eyewitnesses. The median percentage of correct details from the study was 82.93%, which was very close to the median percentage of correct details from the original police interview, which was 81.82%.

Cady (1924) conducted a study to determine if free recall was better than cued recall. The study involved three psychology classes at Northwestern University. The instructor advised the class a government official would be coming in to make an announcement and offer a test that may enable them to qualify for government service. The gentleman entered the classroom and advised the class of some government service jobs that were going to be made available. Following his announcement, he handed the instructor two bundles of paper to be distributed and filled out by the students. One half of the students were given papers labeled Test A, asking the individual to write an account of what had happened since the gentleman arrived in the room, including his appearance, and that no detail was too small. The second half of the students was given papers with instructions to answer each question with as much detail as possible. The results of the study showed those who just wrote a narrative of the event omitted more details than those who were given questions to answer (Cady, 1924). What this study did not take into account was any false information that could have been introduced on the questionnaires. This study was the closest to the present study that could be found as it focused on free recall, as well as forced memory.

Event Perception

There are three distinct stages of how individuals perceive events: acquisition, retention, and retrieval (Loftus, 1979). The acquisition stage begins with the perception of the event, where the information is first placed into the memory system (Loftus, 1979). The retention stage is the period of time between the occurrence of the event and when the memory needs to be recalled, and the retrieval stage is where the information is brought out of the memory and recalled (Loftus, 1979). The acquisition stage is probably the most difficult stage in this process, as the observer must decide what the most important information is to be stored for later recollection. In addition to deciding what information should be kept, it is important that accurate information is stored (Loftus, 1979). In terms of eyewitness accounts, good recollection also needs to be accurate.

Two main factors affect the perception of events: event factors and witness factors (Loftus, 1979). Event factors are influenced by five separate factors: exposure time, frequency, detail salience, type of fact, and violence of event (Loftus, 1979). Exposure time is the length of time an individual has to view the event. The longer an individual has to view the event, the more accurate their perception of that event will be (Loftus, 1979). Frequency of an event is the number of times an individual can view an event; the more often it can be seen, the better recollection will be. The problem with frequency is, in a real life event, an individual will only see the event one time. It is not possible to ask drivers to recreate an accident so you will be able to recall it better (Loftus, 1979). When an incident or event occurs, certain details will more accurately be remembered, which is called detail salience (Loftus, 1979). For example, in the case of a bank robbery, a

witness would be more likely to recall what was said by the robber, as opposed to what type of shoes they were wearing. Detail salience is the detail that has the higher probability of being recalled by the most people, although, it will differ as every individual has different points of view or focuses (Loftus, 1979). The type of fact includes items such as height, weight, car color, speed. Problems with type of fact reports can be subtle differences in color, establishing correct height or weight, identifying speeds and distances, and determining time (Loftus, 1979). Most distance, speeds, and times, tend to be overestimated. The last event factor is the violence of the event. The less violent the act, the better the individual seems to remember (Loftus, 1979).

False Memory

Most research has focused on either the creation of false information for events, presenting misleading information about events, and asking leading questions about events to get the answers (Loftus & Hoffman, 1989). Loftus and Hoffman noted there are four distinct possibilities when individuals give false information following an event: (a) the individual may not have seen the object being referred to, but mentions the item because he remembered hearing about it, (b) the individual may have remembered the correct item, but believed someone else's memory more than their own, (c) the individual may have not seen or heard about any item, but when questioned took a wild guess, or (d) the individual remembered the initial object, but when a second item was mentioned, they forgot about the original item.

Loftus (1992) noted four questions about misinformation that typically occupy researchers:

1. When are people particularly susceptible to the damaging influence on recollection of misleading information, and when are people particularly resistant?
2. What groups of people are particularly prone to having their recollections be modified, and what groups are resistant?
3. Does misinformation actually impair a person's ability to remember details of an event? Put another way, what happens to the original memory after exposure to misinformation?
4. Do people genuinely believe in the misinformation? (p. 121)

Schooler et al. (1986) conducted a series of studies that included specific misinformation. In the first of five experiments, 175 individuals participated in an experiment where they each saw 20 color slides. Half of the subjects saw slides in which one showed a red car at a yield sign. The other half of the subjects saw slides with the same red car, but there was no yield sign. After viewing the slides and completing a 15 minute filler task, received a 17-item questionnaire. Each question required a "yes" or "no" answer and they were also asked to specify their confidence in their answer. For the individuals who viewed the slides in which there was no yield sign, one of the questions asked "Did another car pass the red Datsun while it was stopped at the yield sign?" (Schooler et al., 1986, p. 173). Following the questionnaire, the subjects were given a 5-minute filler task and then asked to complete a second questionnaire to determine if the subjects saw six specific objects in the slides. All of the questions were in the form of "Did you see the...?" (Schooler et al., 1986, p. 173). The sixth question on all of the questionnaires asked if the yield sign was

seen. If the subjects responded they had seen at least three of the objects, they were asked to describe in detail three objects the experimenters chose, including the yield sign, if the subject responded affirmatively they saw the yield sign. Results showed of the 85 subjects for whom the yield sign was suggested, a significant 25% of them reported seeing it, although they were less confident about seeing the sign than those who had actually seen the sign.

The second experiment investigated whether specific wording about misleading information would determine how an event was recalled. The second experiment utilized 177 high school students who viewed 20 color slides portraying a car accident. Fifty-three of the subjects saw a red Datsun at an intersection with a stop-sign, while the other 124 subjects saw the red Datsun at the intersection, but the stop-sign was not in the slide. Immediately following viewing the slides, the subjects were given a piece of paper and pencil, asked to number the paper from 1 to 7, and asked seven questions about the slides they just viewed. In this case, question 4 was the critical question: for the 53 subjects who saw the stop-sign, this question did not mention it; however, for the 124 subjects who did not see the stop-sign in the slides, were asked one of two questions that implied there was a stop-sign. One group (suggested/intersection) was asked “Did another car pass the Datsun while it was at the intersection with the stop sign?” and the other group (suggested/red) was asked “Was the Datsun the same color red as the stop sign?” (Schooler et al., 1986, p. 175). The seventh question asked of all subjects if they had seen the stop sign. Following the questionnaire, the subjects were asked to describe any objects they had just stated they saw. Results showed of the 53 subjects who saw the stop

sign in their slides, 87% stated they saw it and gave a description of it. Of the 67 suggested/intersection subjects, 58% stated they saw the stop sign and described it, and of the 57 suggested/red subjects, 54% stated they saw the stop sign and described it. The results found that wording of the suggestion can affect real and suggested memories (Schooler et al., 1986).

The last three experiments focused on if individuals would be able to differentiate between real or implied memories. The results of all of these experiments suggested that while information can differ from actual memories, it is difficult for individuals to distinguish between what was real and what was false (Schooler et al., 1986). False information is important to study in conjunction with free recall versus cued recall, because the slightest misinformation given can change an individual's outlook on an event. For example, when an individual is asked if an item was blue or green, if they mistakenly answer green, this will be the memory they will keep in their mind. This study is important to the current study as it can help with ensuring the wording in the study does not lead the subjects in their recall.

White et al. (1997) studied the effect of repetitive and misleading questioning of children and memory recall. Twenty children, between the ages of 3.3 and 5.5 years, in pairs participated in a modified game of Simon Says. To prepare for this study, the researcher spent five hours over the course of three weeks with the children in their classrooms to establish rapport with them. For the activity, the children were paired together in mostly same sex pairs, with two pairs being mixed sex. During the activity, each child would get a chance to be the observer and the experience, switching halfway through the

activity. Following the researchers direction, the children performed actions such as “rub your stomach” and “stomp your feet” (White et al., 1997, p. S41). The children alternately watched their partner perform these actions and then participated in the actions themselves. Additionally, the children either watched or participated in actions involving nonthreatening physical touches between the children and the researchers, such as “touch your partner’s foot” (White et al., 1997, p. S41). Each child watched and experienced 12 events each. There were two separate sets of interviews, the first set 20-25 days following the event and the second 45-52 days following the original event. There were two interviewers; one conducted the first set of interviews and the one conducted the second set. Both interviewers had an extensive history of working with children. The interviewers were advised the children had all participated in a Simon Says type event in pairs, and their job was to obtain the most accurate recall of the event from the children. The interviewers were given a one page report on each child and advised the report contained information about events that may have occurred during the game. Each report had 12 components of information, six that addressed actions the child performed, and six that addressed actions the child observed. In each report, half of these components were true and half were false. Interviews were conducted individually with each child, with the interviewer asking the children direct questions only about the specific components from the report. Results showed the reports about events experienced, as opposed to witnessed, were more accurate during the first set of interviews than the second set. Additionally, reports on observed events were more accurate in the second set of interviews as opposed to the first set. Probably the most

interesting result noted was that when children were asked a question that was inaccurate, they would respond properly, but then would elaborate on the answer inaccurately. For example, if asked “Did you kiss the researcher?” they would respond in the negative, but then elaborate by adding, “but the researcher kissed me” (White et al., 1997, p. S46). These elaborations also occurred when the children responded incorrectly to the misleading question. Overall, the results showed while there were instances of children responding correctly to the inaccurate questions, over time, many were convinced the wrong answer was correct (White et al., 1997). Misleading information can change the perception of children as well as adults. While this information does not directly affect the present study, it is important to recognize that misleading information affects children as well as adults.

Recollection of Traumatic Events

Is there a difference in how an event is perceived based on how stressful the event is? The Yerkes-Dodson Law shows that some level of arousal can be detrimental to recalling events. It appears mild levels of arousal increase the ability to recall events; however, there is a point of high-level arousal that will prove detrimental to the recollection (Loftus, 1979).

Christianson and Loftus (1987) conducted three experiments to compare memories of traumatic events versus memories for nontraumatic versions of the same event. Experiment 1 consisted of 60 subjects, all of whom were undergraduate students. None of these subjects had a psychology background or had participated in prior psychology experiments. Two sets of 15 slides were the stimulus, one series of slides

contained a traumatic event and the other set a neutral event. The subjects were assigned to one of four conditions: traumatic event/20 minutes, neutral event/20 minutes, traumatic event/two weeks, or neutral event/two weeks. The subjects were asked to write down distinguishing items from each slide. Following the slide viewing, the items the subjects wrote down were collected and a 15 minute filler task was assigned. The subjects were then questioned either 20 minutes after viewing the slides, or two weeks after viewing the slides. The subjects who were tested after 20 minutes were asked to write down as much as they recalled from the slides. The same was done for the half who returned after two weeks. Following the tests, each group was given a questionnaire which measured the pleasantness-unpleasantness of the slides viewed. Results showed the subjects who were questioned 20 minutes after viewing the slides showed better retention than those questioned two weeks after. However, in both intervals, those who had viewed the traumatic event had better recollection than those who viewed the neutral event (Christianson & Loftus, 1987).

Experiment 2 was to determine if subjects given the list of words obtained from the first experiment would recall the traumatic words or the neutral words better. The subjects for this experiment were 60 students, who had not taken place in the first experiment. Each subject was given a word list of the words (in the same order) that were written from the first experiment. They were given 45 seconds to review the list. The list was taken and a three minute filler task was given. Following the filler task, the subjects were asked to write down as many words as they could remember from the word list. The results showed there was no significant difference in the recollection of traumatic versus

neutral words. This could show the difference in recollection of memory from Experiment 1 was based on the visual cues, not the written cues.

Experiment 3 was broken into two parts. Experiment 3a, utilized an initial 164 subjects who viewed a 2.25 minute film depicting a bank robbery. The group was divided in half with half of the subjects viewing the film which contained a traumatic ending, while the other half viewed the same film with a neutral version of the ending. Immediately following the viewing, participants were asked to rate on a scale of 1 to 5, how upsetting the contents of the film had been. The subjects then performed other tasks unrelated to the film, had their personal information collected and left the experiment. Subjects were contacted 6.6 to 7.8 months later for additional information. Of the original 164 participants, 88 were able to be reached and were asked questions concerning the original film. It was determined that of the 88 subjects contacted, 41 had seen the traumatic version of the film and 47 had seen the neutral version. Of those who saw the traumatic version, only 19 recalled the spirit of the film, and only 10 of those who saw the neutral version, recalled the spirit of the film. The only direct question asked of the subjects regarding the film was the length of it. While all of the subjects overestimated the length, those who saw the traumatic version thought it was significantly longer than those who saw the neutral version. The results also noted those who had seen the traumatic version had rated it as more upsetting following the initial viewing than those who saw the neutral version.

Experiment 3b utilized 42 of the subjects from the original 60 in Experiment 1 who were able to be contacted by phone. Twenty-three of these subjects had viewed the

neutral slides, while the other 19 had viewed the traumatic slides. They were only reminded that they had participated in a previous experiment and were asked to recall what the experiment had been about. Of the 19 who had seen the traumatic slides, 17 were able to remember the spirit of the slides, while only 12 out of the 23 who viewed the neutral version were able to do so. Results of both parts of Experiment 3 showed those who had viewed traumatic versions recalled the event better than those who viewed neutral events (Christianson & Loftus, 1987). This study is important to the present study in that it supports that individuals who are questioned immediately, versus a few weeks, appear to have better recall.

Ihlebaek et al. (2003) conducted an experiment to determine if memory was more accurate in participants who witnessed an event “live” versus participants who watched a video of the same event. Ihlebaek et al. (2003) noted three factors which influence the difference between memories of individuals who view a live event versus those who view an event in a controlled environment. The first factor is the heightened arousal state of an individual who views an event in person. The second factor is the geographical location of individuals during an event. During a live event, it is more likely individuals are in different positions during an event, as opposed to participants in an experiment that are typically sitting in relatively similar positions within a room. The third factor is individuals participating in an experiment may not be representative of individuals who may witness an event live. The study compared a “live” condition and a “video” condition. For the “live” condition a robbery was staged at a store (the participants were told they were going to view a staged robbery just prior to its occurrence). Two robbers

ran into a room and shouted that it was a robbery and to get down. One robber was masked, the other unmasked, and one had a revolver, the other had a pistol. The robber demanded money from a cashier, yelling the entire time, and even got “physical” with a witness by removing a watch. This “live” event occurred seven times and was videotaped each time. One of these videos was then utilized for those participants to view. The video chosen was based on which “live” event recorded with the best sound and visual qualities. There were 62 participants in the “live” condition, full and part-time employees of banks and service stations, with two of those participants having been victims in real robberies. Immediately following the staged robbery, participants were given a response form and asked to fill it out individually. Following the response form, participants were debriefed. For the “video” condition, there were 65 participants, which included not only employees of banks and service stations, but also students and staff of the University of Oslo. The participants watched the video of the staged robbery and then filled out the same response form as those from the “live” group. The biggest difference between groups was in the reporting of details: the video group reported more detailed descriptions of the robbers, and overall a higher accuracy of details than those in the “live” group. Ihlebaek et al. (2003) note some of these differences may be accounted for by the “live” group not having a good view of the event, that they may have interacted with the robbers by handing over personal property, or by having to get down on the ground.

Repetitive Testing

Studies show that prior testing can, not only benefit memory retrieval of tested information, but may assist in the recall of information not presented on a test, but presented within the material (Chan, McDermott, & Roediger, 2006). This research is important in the study of memory retrieval, as it may assist investigators in learning different ways to garnish information from eyewitnesses. Chan et al. (2006) conducted three experiments to determine how initial testing of material subsequently affects memory for material not presented in the test, but provided in the initial material. Experiment 1 utilized 84 undergraduate students, divided into three equal groups of 28. The experimental conditions were testing, extra study, and control. All individuals were given an article to read that had been written specifically for the experiment, and were given 25 minutes to read it. Participants were advised that if they finished the article before the time was up, to re-read the article as time allowed. Following reading the article, those in the testing condition answered 22 questions on a computer. This occurred twice, back-to-back, with the same questions in different order. The participants in the extra study condition were given 22 statements to read through twice, with the second time being in a different order. Those in the control group were dismissed immediately following the initial reading. The following day, all the participants returned to the testing site and took a 40 question test (Chan et al., 2006). Results showed those in the testing condition who had answered the 22 questions immediately following the reading, performed better on the test on day two, than those in both the extra study and control groups. The other two experiments were similar to the first, with minor variations.

Overall, the results were similar; those individuals who were tested immediately following the reading, performed better on the test 24 hours later (Chan et al., 2006). This could be pertinent to the study of eyewitness testimony in knowing that individuals who are able to talk about an incident immediately following said incident, should have better recollection of that same event the following day, versus individuals who are not allowed that opportunity.

Multiple studies have been conducted to determine if memory and retention can be increased by repeated retrieval; however, more recent studies that have shown that multiple testing can increase the propensity of misleading information (Chan et al., 2009). Research conducted by Chan et al. (2006) (noted above), showed that immediate testing increased accuracy on later recall, which should make individuals less impressionable when it comes to misinformation. Chan et al. (2009) conducted three experiments to test that hypothesis. Experiments 1A and 1B were conducted to determine if findings that pertained to younger adults would be similar to those of older adults. Experiment 1A utilized 36 undergraduate students, divided into two groups of 18. The subjects watched 40 minutes of a taped television program, and were then separated. The testing group took an immediate test requiring them to recall 24 details from the video. The nontesting group played Tetris for the same amount of time the other individuals were working on the recall test. Following this, both groups completed a demographic response form and two additional filler tasks. When all of the participants had completed these tasks, approximately 25 minutes, they listened to an 8-minute audio narrative recap of the video, which contained misinformation (although the participants were not told

this). The misinformation provided was always a plausible replacement for the real information. After the narrative, all the participants took the exact same recall test the first group had taken earlier. When the first group took the immediate recall test, there was a 64% success rate on accuracy. Interestingly, the final test results showed that the first test did not reduce the misinformation effect on the second test, but actually increased it. Experiment 1B was conducted to determine how misinformation affected older adults. For this experiment, sixty healthy, older adults, average age of 72.57 years, were utilized, with 30 individuals in each group (Chan et al., 2009). The materials and procedure were the same as in Experiment 1A, with two notable exceptions. The first exception is that the tests were taken on paper and not a computer, and their distractor task was different from that of the young adults. The older adults in the testing group had a 40% accuracy rate on the first recall test they took. Additionally, like the young adults, the older adults were more susceptible to misinformation, even after having taken the initial recall task (Chan et al., 2009).

For Experiment 2, the same procedures were utilized as in Experiment 1A, with the exception of the utilization of a modified-modified free recall design. The modified-modified free recall designs instruct individuals to recall everything that is associated with a cue, regardless of when it was learned. Forty-eight undergraduate students, in two equal groups of 24, were utilized for this experiment. The same television episode was utilized. The procedure was the same as Experiment 1A until the final test; this is when the MMFR instructions were given to the participants. Participants were advised to recall everything they could for every question, in spite of accuracy or source of the

information (Chan et al., 2009). The results of this experiment were similar to those of Experiment 1A and 1B, subjects who took the initial test recalled more misinformation than those who did not take the initial test. So while immediate testing after viewing an incident may result in better recall, it also appears to enhance the susceptibility to misinformation.

Best Time to Recall Events

Chan et al. (2009) showed while testing directly following the viewing of an event may result in better recall, it may also increase susceptibility to misinformation or the retrieval-enhanced suggestibility effect. In an effort to determine if this holds true when individuals are warned about possible misleading events Thomas et al. (2010), conducted two experiments testing the retrieval-enhanced suggestibility. Experiment 1 was meant to determine if the retrieval-enhanced suggestibility would be less if the subjects were warned there may be misinformation. Eighty undergraduate students from two universities were utilized as subjects for this experiment. The experiment was a mixed design, 2 (*warning: no warning; warning*) x 2 (*testing: single test; repeated test*) x 3 (*item type: consistent; control; misleading*; (Thomas, et al., 2010). All subjects watched a 40 minute video, following the viewing; subjects in the repeated test condition took a test immediately recalling 24 details from the video. Those in the single test condition played a video game for 12 minutes. Following the test and video game, all subjects performed filler tasks; and following the filler tasks, listened to an eight minute narrative describing the earlier video. Subjects in the no-warning group were advised it was just a narrative of the video. Subjects in the warning group were advised that while the narrative was of the

video they had watched the source and therefore the accuracy of the narrative could not be verified. Results showed those groups that received warning of possible misleading information, did better on the test than those in the no-warning group, showing that misinformation can be lessened if the knowledge is there. However, in the repeated testing/warning group, the warning increased accurate recall for both true and misleading information, showing that even with warning the RES effect is still an issue.

Experiment 2 utilized 66 undergraduate students and the protocols were the same with the exception of the test being a recognition test as opposed to cued recall. Results for Experiment 2 were consistent with results from the first experiment. Those individuals who were warned, did perform better on the test; however, part of the reason for this could be that those who were not warned responded to questions more quickly, possibly increasing the amount of incorrect information.

Witness Factors

Three main witness factors can affect memory and recall: stress, expectations, and perceptual activity (Loftus, 1979). Stress becomes a factor because based on the Yerkes-Dodson Law, some levels of emotional arousal creates a detriment to learning. This point is related to the difficulty of the task. It appears mild levels of arousal increase learning, but when the arousal levels reach too high a point, regardless of whether or not it is a pleasant or unpleasant arousal, the performance level decreases (Loftus, 1979). During times of high stress, individuals tend to focus on just a few items and not taking in an entire situation. Even what Loftus (1980) refers to as "life stress," recent life changes such as loss of a job or the death of a friend; it can impede how an individual will be able

to remember events. Higher levels of anxiety can hinder memory, probably because if an individual is anxious, they tend to pay less attention to what is occurring around them (Loftus, 1980).

Four different types of expectations can influence how an individual perceives events: cultural, past experiences, personal prejudices, and temporary biases (Loftus, 1979). Cultural expectations or stereotypes are any belief or set of beliefs held by a group of individuals (Loftus, 1979). While stereotypes tend to be accepted, they also normally tend to be incorrect. Stereotypes can be a problem when trying to recall an event, as what an individual perceives, may be influenced by that stereotype and not what actually occurs (Loftus, 1979).

Past experience expectations occur when an individual views events and makes presumptions based on something that had happened before (Loftus, 1979). For example, an individual sees a friend walking down the street with a girl. The next day, seeing his friend's girlfriend, he comments on it, only it wasn't her; past experience led him to believe it was her. So how an individual expects to see something can influence what they truly see, which can be difficult when trying to get an accurate recollection (Loftus, 1979).

Personal prejudice is similar to cultural prejudice, but it is associated with one individual and how they feel versus how an entire population feels about certain groups (Loftus, 1979). Similar to cultural prejudice, this is normally an untrue view of an overall group (Loftus, 1979). A good example of this would be a woman who views all tall men as being aggressive towards women; through this type of prejudice an individual may see

an event happening and may misinterpret it. For example, an individual witnessing a car accident may see the accident in its entirety, but when the drivers get out of their vehicles, he may see a male and female, and although he knows what he saw, and how the accident occurred, he may place the blame on the woman, because he perceives women are notoriously poor drivers. In this case, his recollection of the accident may be incorrect based on his personal prejudice.

Temporary biases are perceptions that may affect how an event is viewed, but usually only in a one-time incident, not because of an ingrained prejudice (Loftus, 1979). The best example of this is given by Loftus; hunting accidents fall into this category. There have been many cases of hunters being shot by another hunter because they thought it was a deer they were shooting (Loftus, 1979). This is a temporary bias because the expectation is any noise coming through the woods must be a deer, not a person. In the case of a bank robbery, an individual may expect to see a weapon in the hand of the robber, and this is what they report, however, the actual case may be there was no weapon at all. Temporary bias can be very difficult to overcome when trying to get an accurate report of an event because people are convinced of what they saw, even though it may not be true (Loftus, 1979).

Perceptual activity refers to what parts of an incident an individual focuses on, thereby shaping what parts of an incident are remembered and what it is not noticed (Loftus, 1979). A good example of this would be the person who focuses on what an individual looks like during an event, but maybe not necessarily what that individual was actually doing. Perceptual activity also takes into account the context in which an event

or individual is perceived (Bower & Karlin, 1974). For example, an individual witnessing a car accident would not expect to see a child behind the wheel of the car involved, and therefore could just presume it was a very short adult that could not see over the wheel well enough to avoid an accident.

Constructive errors are errors that occur when an individual remembers certain facts of an event and then constructs what they believe happened during the rest of the event. Once these inferences have been made, individuals tend to believe this is their true memory. Individuals will fill in gaps with what they presume should have happened (Loftus, 1980). For example, a witness sees a man with a mask enter a convenience store, and hides behind a cooler. Later the witness recalls seeing a gun, even though they only saw the person entering the store. However, based on what they presume should happen, they think they saw a gun.

False memories are different from constructive errors in that constructive errors are those where an individual forms their own ideas on what occurred during an event, false memories are recollected when an individual is given misleading cues (Loftus, 1980). For example, instead of asking “how fast was the car going at the time of the accident?” the question might be, “how fast was the blue car going when it smashed into the pole?” Two misleading cues are included in this example, the named color of the car and the word “smashed.” By telling an individual the color of the car, they will then presume that is the correct color and by using the word “smashed,” it could give the false impression on how fast the car was going. When asked to later recall the event again, the individual will more than likely mention the car was blue and it was going very fast when

it “smashed” into the pole. The more artificial cues an individual is fed, the more they will become part of the memory (Loftus, 1980).

Interview Types

There are different ways for individuals to be questioned with regard to what they have viewed. Interviewers can ask an individual to tell them what they saw, they can ask open ended questions, or they can give the interviewee multiple choices to choose from.

The CI was designed to develop “cognitively based retrieval-enhancement techniques” (Geiselman et al., 1984, p. 74). The CI instructions are outlined:

1. Context Reinstatement - have the witness attempt to remember everything they can about what they witnessed; including what they saw, heard, smelled, felt, and thought. This is thought to be the most important part of the CI.
2. Report everything – have the witness report everything they believe they witnessed, including anything they may not feel is important or what they may only remember a portion of.
3. Adopt a different perspective – have the witness recall the event from different points of view, such as what another witness may have seen from where they were standing.
4. Change the order – have the witness recall the events in a different order, such as starting at the end or the middle of the event (Geiselman et al., 1984)

Geiselman et al. (1984) conducted research in which the staged experiment scenario had one experimenter in with an introductory psychology class and explained to them that they would have to memorize a list of words which would be projected on a screen, one

at a time. After a portion of those words had been shown, the other two experimenters entered the room, turned on the lights, and informed the first experimenter that they were there to retrieve the projector that was needed by another professor. During the conversation between the experimenters, pertinent information was exchanged, such as the name of the individual who needed the projector and the room number where the projector would be taken. The projector was removed from the room and the entire exchange between the experimenters took approximately 20 seconds. This was repeated three times with different subjects. After 48 hours the subjects were randomly assigned to one of two groups. Both groups received booklets that asked both open-ended questions and direct questions, but only one group received the CI instructions (Geiselman et al., 1984).

When using the CI technique, the interviewee is advised of the four retrieval techniques and is not only asked to utilize these techniques, but will also have a list of the techniques in front of them to assist them (Aschermann et al., 1991). The interviewee is first asked to recall the events witnessed freely, and then this is followed up with specific questions. The open-ended question asked the individual to write as much detail about the event they remembered. The individuals who were part of the CI group had the four techniques written on a board to remind them of the techniques so they could utilize them while answering the question. Following the open-ended questions, subjects were given three sets of pointed questions: the first set related to information about the intruders, such as sex, race, and age. The second set of questions asked the subjects to recount if there were objects that were carried in or out of the room, and the third set of questions

asked the subjects to recount other parts of the incident, such as any conversation that happened. The subjects who were in the CI group were given more explicit instructions with the pointed questions that were asked. Results showed for both the open-ended and pointed questions, subjects in the CI group gave more correct answers with regards to persons and events, but lower with regards to objects. Statistically, the results also showed that the CI group produced no more incorrect answers than the control group; however, results also show that for both groups, incorrect answers were higher with the use of pointed questions versus open-ended questions. The results of this particular study show that use of the CI can enhance a subject's ability to correctly recall information from an event (Geiselman et al., 1984).

While it has been determined that the CI elicits better recall than traditional interview, it was felt that the CI could be enhanced. In 1987, Fisher et al., set out to re-examine the CI and enhance it. A limitation with the original CI was that while instructions were given at the beginning of the interview, no further instruction was given throughout the remainder of the interview. Additionally, it was determined that there should be guidelines as to the order of the interview. Some other suggestions for a better interview included: more time between questions, no interrupting the eyewitness during questioning, and phrasing questions in the positive. Two of the original principals of the CI were kept: have the interviewee mentally re-establish the original physical and psychological aspects of the event, and to recall the original event both forward and backward. Two other principles were incorporated into the revised CI: make the

interview compatible with the interviewee's mental process, and use focused memory retrieval with the eyewitness.

When Fisher et al. (1987) studied previous taped police interviews; they noticed that the questioning was designed with the interviewer in mind, not the eyewitness, which is why the first new principle was addressed. Additional analysis of these taped interviews revealed the interviewers often engaged in actions that inhibited eyewitnesses from accessing their memory in a focused method. These actions included interrupting the narration and the overuse of direct questions (Fisher et al., 1987). To determine if the enhanced CI was a better version, Fisher et al. (1987) designed a study to compare the two different versions. Sixteen subjects, male and female were assigned randomly to one of two groups, eight in each group. Each group would receive a different interview technique. Three novice interviewers were utilized for the study, two high school students and one undergraduate college student. None of the interviewers had any formal interviewing skills prior to the study. To train the interviewers, they were first instructed on how to use the original CI by listening to sample interviews from the previous study. Additionally, they received the same 30 minute training also taught during the previous study. The interviewers then practiced this technique by conducting interviews with family and friends. This training took approximately a month. During the second phase of training, the interviewers were asked to watch taped interviews to observe effective and ineffective interview techniques. The interviewers also received two sessions on how to use the revised CI and viewed a sample interview. They then practiced using the revised CI, again with family and friends. Following the training, the study was run. For the

study, two different films were utilized, both depicting a violent crime. Each subject viewed one of the two films, were asked not to discuss the film with anyone, and asked to return in 48 hours. When the subjects returned, they were interviewed by one of the three interviewers. The interviewers were not told which film the subject had seen, only that they had seen a film depicting a violent crime two days prior. Eight subjects were given the original CI and eight the revised CI. The results of the study showed the revised CI garnered 45 percent more correct information than the original CI. Overall, the revised CI obtains more correct information than the original without increasing the error rate (Fisher et al., 1987).

In 1989, Fisher et al. conducted a study to determine how well CI worked in the field. Sixteen detectives from Miami, Florida were utilized for this experiment. All the detectives were knowledgeable police officers and had a minimum of five years in the Robbery Division (Fisher et al., 1989). The detectives were asked to record several interviews, utilizing their normal interview techniques. The cases to be recorded had to have the following criteria: the case had to be serious enough to warrant a thorough interview; at least one witness had a good chance to have observed the event; and each interviewee had to be relatively fluent in English. This portion of the experiment took approximately four months to complete, with each detective recording between five and seven interviews (Fisher et al., 1989). The detectives were then divided into two equal groups; one group trained with CI techniques and the other serving as the control group.

The training for the CI technique was conducted in four 1-hour group sessions which included lectures regarding the procedures and demonstrations for good and bad

interviewing techniques. Following training each individual practiced the technique and received feedback on their ability. Following the training, all the detectives were again asked to record their interviews, using the same original criteria as the pre-training interviews. These interviews were transcribed by research assistants at the University of California, Los Angeles (UCLA). The transcribers were not aware if the interviewer had been trained in CI or not, they transcribed only the relevant, factual statements made by the interviewees (Fisher et al., 1989). Following the transcription, a second group of research assistants counted the amount of relevant statements made by the interviewees. Relevant statements included physical descriptions and actions of the assailants (Fisher et al., 1989).

The effectiveness of the CI was examined in two different ways: the assistants compared the number of facts obtained before and after the training occurred; and the assistants compared the number of facts obtained by trained and untrained detectives. The CI was shown to be more effective in both groups. The trained detectives obtained 47% more information following the training than they had prior to the training (Fisher et al., 1989). Furthermore, results also showed while the trained and untrained detectives accumulated approximately the same amount of correct facts prior to the training, following the training, the trained detectives obtained 63% more correct information (Fisher et al., 1989). These results provided support for the use of the CI to obtain correct information.

Aschermann et al. (1991), recreated the original experiment conducted by Geiselman et al. in 1984. For this experiment, Aschermann et al. (1991) utilized 29

subjects versus the original 16, and the stimulus was only a film, there were no live actors. The subjects were told they would be asked to remember the histories of several patients, in an attempt to determine how nonmedical personnel remembered certain information. After the subjects were given the patient information to memorize, they watched a short film as a “reward” for their time. The CI group was given instructions prior to writing the free report of what they saw and then answering the 45 detailed questions. These instructions were the CI techniques and the group was advised to refer to the sheet and utilize the memory aids that were given. This experiment concluded that CI is an effective interviewing tool for enhancing memory retrieval without creating more mistakes (Aschermann et al., 1991). This experiment showed that free recall produced less information, but the information provided was more accurate, where asking specific questions produced more information, but the information was less accurate. The one difference from the Geiselman et al. study was that an interaction was found between the interview technique and the types of questions asked. This study proposes that additional studies be completed to determine if the CI is more appropriate for different types of individuals and to look at memory systems more closely (Aschermann et al., 1991).

Open-ended questions are a good indication of what information has been retained. Open-ended questions require individuals to process differently than when using multiple choice questions (Moreno & Mayer, 1999). One reason open-ended questions are rarely used in conjunction with interviews, is they tend to be more difficult to code for the researchers (Geer, 1991). Moreno and Mayer do note if open-ended questions are not well designed, they will not be effective in obtaining the information desired.

Summary

Memory, memory recall, misinformation, and suggestibility, all fall under the auspices of cognitive psychology. How individuals perceive information is correlated to how they will then recall it. While every individual is different in how they assimilate and process information, it is likely there are better ways to recall certain memories than others. Research has shown the CI consistently provides the most accurate reports from eyewitnesses (Memon, Zaragoza, Clifford, & Kidd, 2010). The CI is the closest research that correlates with free recall. Past studies have focused on the accuracy of memory based on true information, false information, and traumatic versus nontraumatic events, but only one study (Cady, 1924) focused on the ability of individuals to freely recall events. Given the lack of research in this area, free recall needs to be examined more thoroughly to determine if there is a better way to obtain information from individuals following any event, not necessarily a traumatic event.

Chapter 3: Research Method

Introduction

The purpose of this chapter is to describe the research method used and how data for this study were gathered. The purpose of this quantitative study was to determine if there was a statistically significant difference in amount of information participants recalled, based on how they were asked to recall information. The independent variable was response format, with three levels, free recall, cued recall, and recognition (using multiple choice) response forms. The dependent variable was the number of correct items on each response form.

The focus of this chapter provides the rationale for using a quantitative research design as opposed to a qualitative research design, who the participants were and how they were chosen, the materials utilized, the measures of the study, and how the analysis was completed.

Research Design and Approach

The study utilized a quantitative design to determine if there were statistically significant differences in the accuracy of participants' memory based on how they were asked to recall information. A quantitative, between-subjects design, investigating the difference in the amount of information recalled, between free recall, open-ended questions, and multiple-choice questioning was utilized. Quantitative research tests theories by examining relationships between variables (Creswell, 2009). The data gathered from this study were analyzed utilizing statistical procedures to establish if the hypotheses were valid. Quantitative methods are best used for studies that entail defining

the best predictors of outcomes and the usefulness of a specific intervention (Creswell, 2009).

Population

The population for this study consisted of individuals taking an introductory psychology class at an East Coast university in the United States. Most undergraduate students at the research site are required to take an Introduction to Psychology class to fulfill a general education requirement, so the population would be more diverse than if a higher level psychology class was utilized. The average class size is typically 50 to 90 students. The average age range for students in an introduction to psychology class is 18 to 25, although there could be older students in the classes. With 33 nations represented at the university, the results of this study were generalized to a mixed population, various ages, genders, ethnicities, and socioeconomic levels.

Sampling and Sampling Procedures

Convenience sampling was used to select participants for this study. This sampling strategy was appropriate because the participants were located in close proximity to me as the researcher and were easily accessible. However, participants were randomly assigned to group conditions (free recall, cued recall, or recognition).

Participants were asked to volunteer for the study and were advised that there would be no additional credit or grades given for participation. The participants were of various ages, ethnicities, and regional backgrounds. Participants were randomly assigned to different conditions: free recall, cued recall, or recognition. All participants must have been able to view a 9-minute video of a museum burglary and give consent via a signed

consent form in order to participate in this research. Participation in the study was voluntary, with no negative consequences if they opted out of the study.

A power analysis, using GPower3 software (Heinrich Heine University, 2012), was conducted to determine the appropriate sample size for the study. An a priori power analysis, assuming a medium effect size ($f = .25$), $\alpha = .05$, indicated a minimum sample size of 95 participants is required to achieve a power of .80. Increasing the sample size to 164 will increase power to .95. Therefore, I sought between 95 and 164 participants for the study (Figure 1).

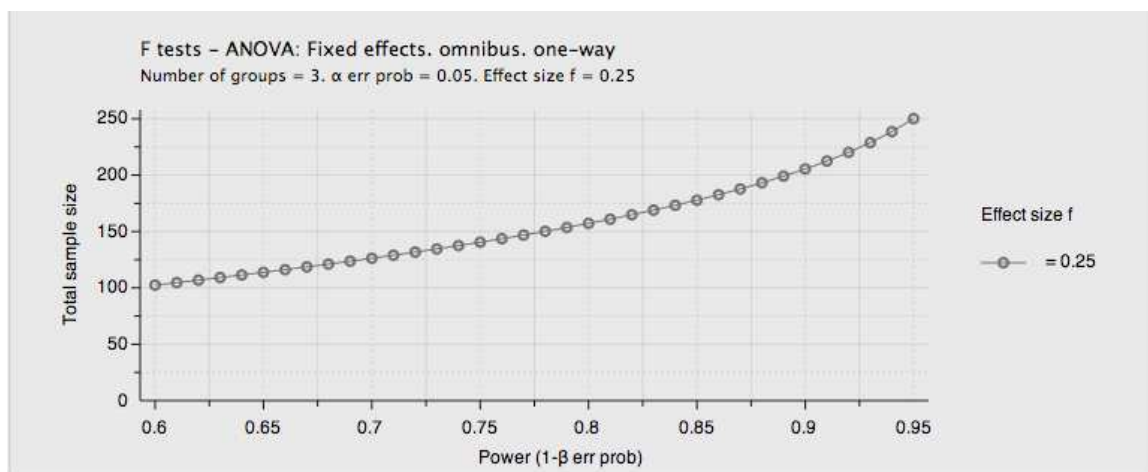


Figure 1. Power as a function of sample size.

Heiman (2004) noted the effect size is the amount of impact that changing the independent variable will have on the dependent scores. After a review of literature utilizing free recall procedures, open-ended questions, and multiple-choice questions, the use of a medium effect size ($f = .25$) was appropriate for this research study. Prior studies by Aschermann et al.(1991), Ihlebaek et al. (2003), and Roediger and Marsh (2005) showed results between the medium to large effect range.

The materials utilized for this study included three response forms. The first response form asked the participants to recall any details of the event they could remember, including settings, actions, participants, and so forth. The second response form consisted of 18 cued recall questions, such as, “the glove had the letter P embellished on it, what color was the letter?” The third response form consisted of 18 recognition questions. The questions were the same as those on the cued recall response form, but there were three choices to choose from.

Materials for the study included a video of a burglary and three response forms. The video was a 9-minute segment from the movie *The Return of the Pink Panther*, which portrayed a burglar breaking into a museum and stealing a diamond.

The cued recall and recognition response forms were adapted from response forms utilized by Wilford et al. (2013) in their research on retrieval-enhanced suggestibility. Additionally, the video clip I used was obtained from Wilford et al. (2013). Due to the utilization of these materials, which have been previously utilized and piloted, there was no pilot study during this research. Wilford et al. (2013) conducted a pilot study in which 20 individuals viewed the video of the museum burglary. After viewing the video, the participants were given 20 minutes to type what they viewed into a blank document, in as much detail as they could remember. These accounts were coded into units for scoring purposes. Units were deemed to be the smallest element of words or phrases that communicated a significant idea. For example, an early note of the burglar “zip-lining” or “sliding down a rope” was counted as a unit as to how the burglar got to

the museum roof. The 18 items identified dealt with different details from the video and were consistent among the participants (Wilford et al., 2013).

Procedures

For this study, participants viewed a 9-minute video segment from the movie *The Return of the Pink Panther*. As a group, the participants were told to pay attention to the video, as they would be asked their opinion and attitudes about it but were not told there would be a memory test. The participants then watched the video and were asked to complete one of the three response forms. The video was shown in the lecture hall where students had their Introduction to Psychology class. The lecture hall was large enough to accommodate the number of students and had technology to show the video, where it was visible and audible to the entire class. Following the video, the response forms were distributed randomly among the participants. The participants with the free recall paper (See Appendix B) were instructed to write down everything they remembered about the video. The participants with the cued recall questions (See Appendix C) were told to answer the questions as thoroughly as possible. The participants with the recognition multiple-choice questions (See Appendix D) were told to choose the correct answer.

Data Collection

As a group, all participants viewed the same video of an event. Immediately following the video presentation, the response forms were distributed randomly to the participants.

One response form consisted of asking the participants to recall any and all information about the event that they could, visual and auditory. The other two

questionnaires consisted of 18 questions. The closed-ended (multiple-choice) questions incorporated correct and false information.

Each response form was scored with 1 point for any critical part of the event remembered. There were 18 critical parts to be found, for a total of 18 points for the response form.

Data Analysis

Hypotheses

Null Hypothesis: There will be no statistically significant group difference in accuracy of total recall score based on free recall, cued recall, or recognition.

Research Hypothesis: There will be a statistically significant group difference in accuracy of total recall score based on free recall, cued recall, or recognition. Analysis

A one-way between subjects analysis of variance (ANOVA) was used to determine if there was a statistically significant difference between the levels of response format (memory response type: the three different questionnaires in response to video primer), and the dependent variable (the number of total items correct in each response questionnaire).

An ANOVA was most appropriate for the current analysis in order to simultaneously examine group differences between the three groups. A post-hoc Tukey HSD (Honestly Significant Difference) was performed to determine which groups were significantly different from one another. The Tukey HSD has relatively low error rates and is utilized when the number of scores in all levels are equal (Heiman, 2004).

Validity

Logically, there were differences in memory capacity and processing in the subjects. Individuals all differ in their memory capacity and processing; this study did not address these differences, so it was not possible to adjust for this. However, as random assignment was used, such differences should not have been an issue in the current study.

Internal validity examines the relationship between the independent and dependent variables. If the independent variable causes the dependent variable to change, then there is internal validity (McBurney & White, 2004). Threats to internal validity for this research could have included participants not taking the study seriously or not understanding what the response form is asking for. To address this concern, detailed instructions were given to the participants.

External validity is defined as how well the results of a study can be generalized to the rest of the population (McBurney & White, 2004). The biggest threat to external validity in this study was that when this is utilized in real-life, the setting is not identical to the classroom where the study took place. In a real life situation, exposure to a crime would put stress on an individual and they may function with a higher level of arousal (Sharps, Hess, Casner, Ranes, & Jones, 2007). Additionally, in a real life situation, there could be components of a crime scene that are blocked from the witness that could be important (Sharps et al., 2007). Construct validity questions whether the theory behind the research is supported (McBurney & White, 2004). In an effort to determine face validity, after the pilot study, there was a face validity check of the response forms by other individuals. These individuals were asked to critique the response forms prior to the

research taking place. Once face validity was established, there should not be any threats to construct validity as the response forms were designed to measure memory recall, which is what the information process theory is related to.

Statistical validity measures whether the observed relationship between variables is a cause-effect relationship or if the result was due to chance (McBurney & White, 2004). The biggest threat to the statistical validity of this research was possibly the small amount of subjects or that too few observations were made, so it was possible that even though there is a significant difference, it may be difficult to notice. The assumptions of the ANOVA are that (a) the individuals are randomly selected in the population, (b) the scores in the population are normally distributed, and (c) the scores have equal variance (Jaccard & Becker, 2002). The first assumption was addressed by the random assignment of the forms to individuals. The other assumptions were addressed by utilizing histograms, normality tests, and a test of homogeneity of variance.

Protection of Human Participants

When conducting research with human participants, especially when introducing any type of stress into the research, care must be taken to ensure their safety. While the level of stress this research caused should be extremely minimal, the participants were offered the opportunity to not participate in the study. If they participated and felt stress following the study, they were advised that they could contact the primary investigator for assistance. All participants signed a consent form. All participants remained anonymous both during and after the study; the data will be maintained on a password protected flash drive, and will be kept for 7 years, as required by the APA. Additionally,

approval from Walden's Institutional Review Board (IRB 03-17-15-0105654) was obtained prior to the study.

Summary

The purpose of this study was to determine if individuals who are allowed to freely recall events recall them more accurately than those who use cued recall. The response forms were designed to measure the accuracy of these recollections and therefore determined if there is a more accurate way to recall events. An ANOVA was selected as it evaluated the mean difference simultaneously between the three groups, while reducing the possibility of a Type I error. Chapter 4 will present and analyze the data collected.

Chapter 4: Results

The purpose of this study was to determine if there are statistically significant differences in information recall between varying levels of response format. The following chapter will present the descriptive statistics of the sample prior to conducting inferential analyses to answer the research questions. Utilizing a one-way between-subjects ANOVA, I determined whether there were significant differences in the number of items recalled as a function of recall format (recognition, cued recall, free call conditions).

Data Screening

The study was conducted at a university on the East Coast of the United States and involved participants enrolled in an Introduction to Psychology course. While a typical Introduction to Psychology class has approximately 100 students, this was a spring semester course and the class size was only 65. Of those 65 students, 54 participants responded to the survey. The participants watched an excerpt from the movie *The Return of the Pink Panther* and were then given one of three different response forms to complete. For analysis, data were input into SPSS version 22.0 for Windows. The data were screened for univariate outliers by creating standardized residuals, or z -scores, for the responses and removed participants with standardized values greater than 3.29 or less than -3.29 (Tabachnick & Fidell, 2012). None of the responses met the criteria to be designated as an outlier, so the final data analysis included all 54 participants.

Descriptive Statistics

Within the 54 responses, 17 were administered a free recall response form, 15 were administered a cued recall form, and 22 were administered a recognition form. Within the free recall group, there were 10 male (59%) and seven female (41%) participants. Ages for the free recall group ranged from 18 to 21, with $M = 19.18$ and $SD = 0.95$. Within the cued recall group, there were eight male (53%) and seven female (47%) participants. Ages for the cued recall group ranged from 18 to 22, with $M = 19.33$ and $SD = 1.23$. Within the recognition group, there were 14 male (64%) and eight female (36%) participants. Ages for the recognition group ranged from 18 to 23, with $M = 19.73$ and $SD = 1.42$. The frequencies and percentages for participant demographics are presented in Table 1. Descriptive statistics of age by recall format are presented in Table 2.

Table 1

Frequencies and Percentages of Gender by Recall Format

	Free Recall ($n = 17$)		Cued Recall ($n = 15$)		Recognition ($n = 22$)	
	n	%	n	%	n	%
Gender						
Male	10	59	8	53	14	64
Female	7	41	7	47	8	36

Note. Percentages may not total 100 due to rounding error.

Table 2

Descriptive Statistics of Age by Recall Format

Groups	<i>Min.</i>	<i>Max.</i>	<i>M</i>	<i>SD</i>
Free Recall	18.00	21.00	19.18	0.95
Cued Recall	18.00	22.00	19.33	1.23
Recognition	18.00	23.00	19.73	1.42

The three groups of survey response forms each had a possible score of 18 correct items recalled. The free recall group correctly recalled an average of 3.59 items ($SD = 2.27$). The cued recall group correctly recalled an average of 7.33 items ($SD = 3.20$). The recognition group correctly recalled an average of 10.00 items ($SD = 2.71$). There were three choices for the recognition portion of this study, so there was the probability of getting 33%, or 6 answers correct, just by guessing. Even though it can be presumed there may have been guessing in each condition, no correction for guessing was utilized during the analysis. This could explain the higher recall average for the recognition group. Mean and standard deviations of correct responses by recall format are presented in Table 3.

Table 3

Descriptive Statistics of Correct Responses by Recall Format

Groups	<i>Min.</i>	<i>Max.</i>	<i>M</i>	<i>SD</i>
Free Recall	1.00	9.00	3.59	2.27
Cued Recall	2.00	12.00	7.33	3.20
Recognition	4.00	15.00	10.00	2.71

Research Question: Is there a significant difference in the number of items recalled as a function of recall format (free recall, cued recall, recognition)?

H_0 : There is not a statistically significant group difference in total recall for adults between the ages of 18 and 25 years.

H_a : There is a statistically significant group difference in total recall for adults between the ages of 18 and 25 years.

One-Way ANOVA

To address the research question, a one-way between-subjects ANOVA was used to determine if there is a statistically significant difference in accuracy of total recall between the groups of free recall, cued recall, and recognition. The independent variable corresponds to recall type: free recall, cued recall, and recognition. The dependent variable corresponds to the number of correct items on each response form.

Before conducting the ANOVA analysis, the assumptions of normally distributed (bell-shaped) scores (normality) and equal variance (homogeneity) were tested by the Kolmogorov Smirnov (KS) test and Levene's test, respectively. The KS test yielded insignificant results such that the assumption of normality was met ($p = .064$) for the number of correct items on each response form. The Levene's test for equal variance on the three recall types was also not significant ($p = .333$), so the assumption of homogeneity was met.

The one-way ANOVA indicated significant effect of recall condition $F(2,54) = 26.51$, $p < .001$, partial $\eta^2 = .51$. A post hoc Tukey test was performed to determine which groups were statistically significantly different from one another. The post hoc analyses indicated significant mean differences between free recall ($M = 3.59$), cued recall ($M = 7.33$), and recognition ($M = 10.00$). The mean difference was greatest

between recognition and free recall and the mean difference was least between cued recall and recognition. The mean difference between free recall and cued recall was also found to be significant.

Kruskal-Wallis One-Way ANOVA

A Kruskal-Wallis one-way ANOVA was used to determine whether significant differences existed in total recall between the different groups (free recall, cued recall, and recognition). The Kruskal-Wallis is the nonparametric equivalent of the ANOVA that is implemented to assess for differences in a scale or ordinal dependent variable by a single nominal independent variable (Morgan, Leech, Gloekner, & Barrett, 2007).

Summary

This chapter explained how the data were collected and the analysis of the data. The research question addressed whether there would be a statistically significant difference between different types of recall. Based on the findings, it was determined there was a statistically significant difference, with individuals utilizing recognition performing better than the other two conditions. Chapter 5 will address the interpretation of the findings as well as limitations to the study, recommendations for future study, and the implications for social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to evaluate free recall, cued recall, and recognition, in order to examine the accuracy of eyewitness memory through a quantitative study to assess the accuracy of eyewitness memory as measured by results on free recall, cued recall, and recognition tests. Primarily, the study was conducted due to the critical role of eyewitness testimony in various types of courts and the need for further understanding regarding types of recall's effect on the accuracy of information and the reliability of eyewitness testimony (Christianson & Loftus, 1987; Cutler & Penrod, 1995; Levi & Levi, 2013; Loftus & Hoffman, 1989). As presented in the previous chapter, results suggested that participants were more accurate with the utilization of recognition techniques for recall, as opposed to the free or cued recall.

This chapter contains interpretations of the findings represented in Chapter 4. Comparisons between this study and previous research are discussed and key findings from the study are reviewed. Subsequently, the limitations of the study will be discussed, along with recommendations for future research. Finally, the chapter contains implications for positive social change.

Interpretation of the Findings

The research question investigated was as follows: Is there a statistically significant group (free recall, open-ended questions, and multiple-choice questions) difference in total recall for adults between the ages of 18 and 25 years of age? As discussed in the results chapter, descriptive statistics determined the relationships between the number of correct items on a recall test (dependent variable) and the recall

type used among a specific group (free, open-ended, or recognition; independent variables). Among the 54 undergraduate students that comprised the sample, the free recall group had the lowest scores on the recall test with a maximum score of 7 to 9 out of a possible 18 correct answers, and the most common score of 1 to 3 correct. The cued recall group followed, with a maximum score of 10 to 12 with the most common scores being 10 to 12 correct and 7 to 9 correct. The recognition group, who took a multiple-choice test, performed the best, with half of participants scoring 10 to 12 correct and the highest possible score being 11 to 15 correct. Thus, significant differences were present in total recall by group.

Since 1924 when Cady conducted a study to determine if free recall was more accurate than cued recall, there have been multiple studies with regard to free recall, cued recall, and recognition. The current study did what other studies have not—investigated all three of these possibilities within the same study. Based on the findings of this study, it appears that individuals who were part of the cued recall and recognition groups had more correct responses than those who were asked to freely recall the information, with those in the recognition groups performing the best. These findings support the hypothesis put forth in this study and limitations to this study will be addressed later in the chapter.

The results' support for the previous literature is mixed. Regarding the literature published on memory and recall, the findings seemed to suggest that unlike the positing of Kintsch (1970) and Moscovitch (1989), recall and recognition are not two separate processes; rather, recognition can function to prompt recall of events that are witnessed,

as was demonstrated in the sample under study. Alternatively, findings supported the idea that memory processes can be potentially riddled with errors even without interference from outside sources (Hunt & Ellis, 2004; Wise et al., 2009). This concept was demonstrated by the fact that individuals who used free recall to remember events performed the worst on the multiple-choice test when compared to individuals who used cued recall and recognition items as memory prompts. The results suggested that recognition was the most successful solicitor of correct responses in this sample.

Loftus (1979) noted acquiring information is one of the more difficult tasks for individuals, as they have to decide which of the information they will keep stored. Additionally, individuals tend to focus on different details of what is witnessed and that could affect the outcome of questioning (Loftus, 1979). Taking into consideration the video, participants may have been more likely to acquire information regarding the action and focus on larger details of the film, and not necessarily on the smaller details. After viewing the video, the current study required one group of students to freely recall what they watched. While they reported on the overall concept of what was occurring in the movie, they did not necessarily acquire the more minor details. This lack of attention may also have been true on the cued recall and recognition responses; however, because there was more guidance with those formats, the details remembered were more enhanced. Moreover, because the smaller details were not necessarily subject to the primacy, recency, or von Restorff effects, those completing the free recall portion may not have been prompted to recall those details (Corsini, 2002).

Another factor of memory theory that may have affected the results is that the 54 participants in the study had little to no stake in remembering the noted items. Unlike in an eyewitness situation, where a person has emotional and physical investments in the narrative memory-making process (Christianson & Loftus, 1987; Yuille & Cutshall, 1986), the participants in this study were physically, and perhaps emotionally, removed from the events. This distance may have interfered with the free recall process by disallowing meaning-making memory processes, such as assigning personal weight to the importance of details (Wise et al., 2009). In this vein, Loftus (1979) noted that event perception, including exposure time, frequency, detail salience, type of fact, and violence, could have a significant effect on an individual's ability to recall that information subsequently.

The results were also mixed regarding the previous empirical studies conducted regarding free recall, cued recall, and recognition, although no study had previously examined all of these types of memory in conjunction. For example, the findings of the present study were consistent with Cady's (1924) regarding free and cued recall. As demonstrated in the present study, Cady's examination of students in an eyewitness scenario suggested that free recall was not as effective as cued recall in eliciting correct information.

The findings of the present study were inconsistent with other studies conducted regarding the use of free recall in eyewitness testimony. One example of a study disconfirmed by these findings was Yuille and Cutshall's (1986). Yuille and Cutshall examined eyewitnesses to a bank robbery and their recall of correct details, and

determined that free recall elicited a median percentage of 82.93% accuracy in details from the scene, compared with median percentage of correct details from the original police interview, which was 81.82%. This accuracy was achieved in spite of the introduction of misleading and peripheral details. Thus, Yuille and Cutshall's research suggested that free recall was slightly better in eliciting accurate information than the initial cued recall type of questioning conducted by police, a finding that was not supported by the present study. Another example of a study that was disconfirmed by the present findings were those of Ozuru et al. (2013), who found there was no difference in performance between open-ended and multiple choice questions in prompting recall.

Additionally, the present study disconfirmed findings regarding the use of CI techniques, which follow the free recall system (Aschermann et al., 1991; Fisher et al., 1989; Geiselman et al., 1984). Geiselman et al. (1984) found that interviews wherein CI techniques were used elicited more accurate responses about people and events, but not objects. CIs utilize "cognitively based retrieval-enhancement techniques" (Geiselman et al., 1984, p. 74). The instructions for the CI are for the individual to restate the context in which he or she saw the event, report everything, adopt a different perspective of the event, and to change the order of events; these practices are attempts to obtain a more accurate description of what occurred (Geiselman et al., 1984). Conversely, incorrect answers were found to be higher when pointed questions were asked, as opposed to free response (Geiselman et al., 1984). Similarly, Fisher et al. (1989) determined that CI techniques retrieved 63% more correct information from eyewitnesses than cued recall through leading questions. However, in the controlled university setting utilized for the

current study, cued recall and recognition groups both were more successful in correctly recalling events in a testing situation than was the group that recalled using free recall.

The inconsistency of the results with previous, similarly conducted research regarding free recall may be due to the lack of misinformation being provided within this testing setting. As noted by Loftus and Hoffman (1989), there are four reasons why false information may be given by an eyewitness: (a) an individual's memory was tainted by hearing another's recall of a detail, which was subsequently repeated; (b) an individual believed someone else's memory over their own recollection; (c) an individual guessed about a detail; and (d) an individual forgot a specific detail due to new information that was deemed more essential. Because these factors were not included within the study, participants were allowed to complete the test portion without interference, and thereby were not subject to the increased effects of misinformation that have been demonstrated in cued recall scenarios (Wilford et al., 2013). In addition, including misleading questions on the multiple-choice test may have affected the participants' recall abilities, as demonstrated by Schooler et al. (1996). In addition, no previous researchers included recognition items as a primary recall technique. According to the present findings, recognition was the most effective method of prompting recall, though this method may not be effective in eliciting eyewitness testimony due to the increased likelihood of misinformation and misremembering being introduced in this style of questioning (Goodman & Schaaf, 1997).

Limitations of the Study

The first and most significant limitation of this study was the movie clip that was utilized. While this clip has been utilized in other studies (Wilford et al., 2013), those studies only utilized cued recall and free recall formats, not recognition. Had a more real-life scenario been utilized, it may have produced a more accurate response on the free-recall response forms, as was consistent with other research conducted among actual eyewitnesses (Aschermann et al., 1991; Fisher et al., 1989; Geiselman et al., 1984; Yuille & Cutshall, 1986). Another limitation was the length of clip, 9 minutes; in a real life situation where eyewitnesses would be useful, the length of the event would probably be less than 10 minutes. An additional limitation is that unlike in CI, which has previously shown to increase the reliability of free recall, the present study did not follow the entire CI process, although its utilization may have improved the free recall portion of the response forms.

Moreover, this study did not account for the correction of guessing on the multiple-choice response form. On any multiple-choice test, there is the chance that scores will increase due to students randomly guessing the correct answer (Betts, Elder, Hartley, & Trueman, 2009). Typically, to discourage guessing, students would be advised that a certain percentage or a whole mark (negative marking) would be deducted for any incorrect answer, but that if the question is not answered, there would be no negative consequence (Betts et al., 2009). This study differs from a classroom situation, in that there is no penalty if an incorrect answer was a guess or not. Harper (2003) noted there is no way to correct for guessing when multiple conditions are utilized. It is not possible to

apply negative markings to conditions other than multiple-choice responses (Harper, 2003), so while guessing may have occurred in either of the three conditions, it was not possible to account for those in this study; therefore, correction for guessing was not utilized. Because there was no correction for guessing in this study, it was not possible to assess if the higher scores on the multiple choice response forms could be attributed to the participants guessing the correct answer.

Recommendations

This study was unique in that it utilized three different forms of recall, which would still prove useful in further studies, once the limitations are addressed. The most important recommendation for future researchers would be that they find or recreate an event that would be more realistic and more likely to occur in the real world where it would be witnessed. Thus, the full effects of stress, event perception, and emotional connections could be better perceived in conditions that were similar to actual eyewitness scenarios (Christianson & Loftus, 1987; Loftus, 1979; Loftus & Hoffman, 1989). Additionally, future researchers may consider utilizing CI techniques within such a study in an effort to confirm or disconfirm dated findings regarding the utility of CI in eyewitness situations (Aschermann et al., 1991; Geiselman et al., 1984).

The findings may also have significance for practice. Those who work in law enforcement have long noted that the use of leading questions may be necessary in order to prompt recall (Goodman & Schaaf, 1998; White et al., 1997; Wright, Loftus, & Hall, 2001). The present findings suggested that, in fact, the more prompting that a witness received in relation to events, the better he or she performed on a recall test, with those

receiving recognition items performing better than those who used cued recall, and those who used cued recall performing better than free recall groups. One pitfall to avoid in the use of leading questions, however, is the introduction of false memories or misinformation, which may be more highly represented with heavy prompting from an interviewer (Schooler et al., 1986; White et al., 1997). Thus, people conducting interviews that use leading questions should be cautious to avoid altering memories unduly through their lines of questioning. Stakeholders should draft policies that allow for the use of leading questions without the introduction of false or misleading evidence that may influence the outcomes of a case.

Implications

Social Benefits

Eyewitness testimony is considered to be unreliable in most cases and has led to many instances of false convictions (Gould & Leo, 2010). If eyewitness testimony can become a more reliable tool, this development could lead to fewer false convictions and hopefully to an increase in proper convictions. While this study did not successfully support the hypothesis presented, if the limitations are addressed, it could assist law enforcement with obtaining reliable eyewitness, which would lead to the correct outcome of incidents, regardless of the case. Reliable eyewitness testimony will assist in a multitude of different cases ranging from a simple car accident to a more heinous crime such as a bank robbery.

Individual Benefits

In any case of inaccurate eyewitness testimony, there will always be at least one individual who loses; whether it is an improperly witnessed motor vehicle accident, which results in an increase of car insurance rates or a witness to a murder that implicates and convicts an individual. In any case involving eyewitness testimony, obtaining the most accurate account is imperative. Thus, the implications of this study may lead to developing the foundation of retrieving accurate details from eyewitnesses, thereby improving the individual consequences of inaccurate information provided by eyewitnesses.

Conclusions

There is no method that will ever be 100% accurate when it comes to obtaining eyewitness testimony. Past statistics show that over 200 people who were initially convicted due to eyewitness testimony were exonerated later based on DNA evidence (Gould & Leo, 2010). Had there been a more reliable method to obtain eyewitness testimony, it is possible that some of those convictions may not have occurred. This study set out to determine if allowing individuals to freely recall a series of events would ensure a more accurate testimony than through asking them questions, whether through cued recall or through recognition items. The results of the study demonstrated that those who participated in the recognition group performed significantly better than did those who participated in the cued recall group, and those who performed in the free recall group did significantly worse than those in the cued recall group. Thus, the findings from the present study did not confirm the utility of free recall in eyewitness situations.

Although there were limitations to this study, based on past research with the CI, if those limitations were addressed, it is still possible that allowing individuals to freely recall an event prior to being questioned, could elicit a more accurate recollection of the events that occurred, possibly ensuring fewer incorrect convictions based on that testimony. Continued research in this field is warranted, not only to ensure those incorrect convictions, but also to address poor eyewitness testimony when it comes to civil matters as well.

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Appendix A: Free Recall Paper

Please describe, in as much detail as possible, the event you just witnessed. Include all actions, props, surrounding area, etc.

Appendix B: Cued Recall Questions

1. The video began with the burglar on the roof of a building. How did the burglar get from the roof of the building he started on to the roof of the museum?

2. In the video, how did the burglar get under the alarm beams undetected when advancing to the room with the diamond?

3. After getting to the room with the diamond in the video, how did the burglar remove the dome-shaped glass case covering the diamond?

4. When the burglar worked to retrieve the diamond in the video, what apparatus, if any, is used to retrieve the diamond?

5. Once the burglar had stolen the diamond, a glove was put in its place; what was the color of the glove that the burglar put in place of the diamond?

6. In the video, how did one of the guards finally discover that there was something going wrong in the museum?

7. As the burglar entered the roof of the museum in the video, the entrance was of a particular shape. What shape was it?

8. In the video, upon entering the museum, the burglar found himself in a dimly lit hallway area; what color were the walls painted?

9. Describe the pedestal, which was used to hold the large baseball-shaped diamond in the big room in the video.

10. In the video, a piece of artwork was present on the ceiling of the big room (where the burglar stole the diamond). Describe what the artwork looked like and be as specific as possible (e.g., what patterns were present in the artwork, etc.)

11. In the video, the glove had the letter P embellished on it; what color was the letter embellished on the glove?

12. In the video, all the museum guards wore hats as part of their uniform; what color were the hats the guards wore?

13. In the video, when the two museum guards were shown talking, they were standing in front of what appeared to be a stained glass window. Please describe the design of this window as specifically as possible (e.g., colors, patterns, etc.).

14. In addition to the stained glass window, what large objects were shown in the video shot of the two guards talking?

15. In the video, the dome-shaped glass case that covered the diamond had a handle on it; what shape was the handle of this case?

16. In the video, a carpet was placed underneath the diamond stand in the large room and surrounded by velvet ropes. Describe the carpet (size, color, pattern, etc.).

17. In the video, the alarm is eventually set off; please describe who set the alarm off and how.

18. As the burglar escaped from the museum in the video, the guards began to shoot at him; how many guards were shooting at the burglar as he got away?

Appendix C: Recognition Multiple-Choice Questions

1. The video began with the burglar on the roof of a building. How did the burglar get from the roof of the building he started on to the roof of the museum? A: Slid down a cable with use of crossbow. B: Swung on a rope. C: Jumped
 2. In the video, how did the burglar get under the alarm beams undetected when advancing to the room with the diamond? A: Used his legs to slowly propel himself on his back. B: Used the crossbow to shoot a rope and pull himself. C: Used his arms to crawl forward on his belly.
 3. After getting to the room with the diamond in the video, how did the burglar remove the dome-shaped glass case covering the diamond? A: Picked it up carefully with his hands. B: Used the mechanical arms to remove it. C: Used the crossbow to shoot a rope and make a pulley.
 4. After getting to the room with the diamond in the video, how did the burglar remove the dome-shaped glass case covering the diamond? A: Used the mechanical arms to remove it. B: Picked it up carefully with his hands. C: Used the crossbow to shoot a rope and make a pulley.
 5. Once the burglar had stolen the diamond, a glove was put in its place; what was the color of the glove that the burglar put in place of the diamond? A: White. B: Black. C: Silver.
 6. In the video, how did one of the guards finally discover that there was something going wrong in the museum? A: Sees the burglar. B: Hears the burglar. C: Sees the glove in place of the diamond.
 7. As the burglar entered the roof of the museum in the video, the entrance was of a particular shape. What shape was it? A: Square. B: Circular. C: Octagonal.
 8. In the video, upon entering the museum, the burglar found himself in a dimly lit hallway area; what color were the walls painted? A: White/off-white. B: Beige. C: Gray.
 9. Describe the pedestal, which was used to hold the large baseball-shaped diamond in the big room in the video. A: Marble cupids. B: Marble dolphins. C: Glass, hourglass-shaped.
 10. In the video, a piece of artwork was present on the ceiling of the big room (where the burglar stole the diamond). The artwork was? A: Wooden, brown circular patterns. B: Knights charging. C: David and Goliath.]
 11. In the video, the glove had the letter P embellished on it; what color was the letter embellished on the glove? A: Gold. B: Silver. C: White.

12. In the video, all the museum guards wore hats as part of their uniform; what color were the hats the guards wore? A: Dark Brown. B: Tan. C: Dark Green.
13. In the video, when the two museum guards were shown talking, they were standing in front of what appeared to be a stained glass window. A: Holy Figure. B: Simple, Colored Shapes. C: Flowers.
14. In addition to the stained glass window, what large objects were shown in the video shot of the two guards talking? A: Two Bronze statues. B: Two Pillars. C: Two marble statues.
15. In the video, the dome-shaped glass case that covered the diamond had a handle on it; what shape was the handle of this case? A: Moon-shaped, crescent. B: Rectangular. C: Round.
16. In the video, a carpet was placed underneath the diamond stand in the large room and surrounded by velvet ropes. What did the carpet look like? A: Orange, Round. B: Blue, Rectangular. C: Red, Octagonal.]
17. In the video, the alarm is eventually set off; please describe who set the alarm off and how. A: The guard accidentally set it off upon seeing the glove. B: The burglar hits an alarm button. C: The guard purposely sets it off.
18. As the burglar escaped from the museum in the video, the guards began to shoot at him; how many guards were shooting at the burglar as he got away? A: 1. B: 2. C: 3