ABSTRACT

Comparing the Efficacy of Expert Testimony and Detailed Jury Instructions
Under High and Low Cognitive Load

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I investigated juror's ability to update knowledge following clarifying information about eyewitness memory. In Experiment 1, mock jurors read a trial summary describing the armed robbery of a convenience store and included eyewitness testimony, and rendered a verdict. Jurors then read the New Jersey "Henderson" juror instructions, watched or read the testimony of a memory expert, or read about an unrelated topic, and rendered a verdict. Jurors who received information regarding eyewitness memory (juror instructions or expert testimony) were more confident in a not guilty verdict at Time 2, indicating mock jurors were able to process initial information and make changes when new information becomes available. Need for cognition played a unique role in the decision making process. In Experiment 2, jurors performed the same task under conditions of high or low cognitive load. Jurors who did not receive clarifying eyewitness memory information did not change verdict confidence over time. Jurors under low load were more confident in a not guilty verdict following clarifying memory information. However, mock jurors under high load did not change verdict confidence at Time 2,

indicating jurors' ability to process clarifying memory-related information was impaired under conditions of high cognitive load. Implications of juror decision making under cognitive load are discussed.

Comparing the Efficacy of Expert Testimony and Detailed Juror Instructions Under High and Low Cognitive Load

by

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To Matthew

For his encouragement, support, laughter and love

CHAPTER ONE

Background and Significance

In our legal system, jurors determine guilt or innocence based on the evidence provided during the trial. Eyewitness testimony is often presented as evidence in a trial (Penrod & Cutler, 1995); however, eyewitness misidentification is the leading cause of wrongful convictions later overturned by DNA evidence (Innocence Project, 2014). These convictions occur in part because of the inability of jurors to recognize the unreliability of eyewitness memory. Memory experts have been called to testify on the fallibility of memory in order to clarify some of these issues for jurors. However, not all courts universally accept expert testimony. Some judges fear overvaluation of expert testimony or enhanced skepticism by jurors (Schauer & Spellman, 2013). As an alternative, some state legislatures have developed juror instructions regarding the unreliability of memory, highlighting factors that influence eyewitness memory. The effectiveness of juror instructions regarding memory is unknown, nor have instructions been compared to memory expert testimony. In the present mock trial experiments, I examined the effect of both memory expert testimony and juror instructions on juror decision making after exposure to eyewitness testimony in two studies varying cognitive load.

Factors Affecting Eyewitness Memory

The fallibility of memory is especially important to consider in a forensic setting. Often, eyewitness testimony is used as evidence in a legal setting (Penrod & Cutler,

1995). However, eyewitness misidentification, that is, identification of an innocent person as the perpetrator of a crime, is the leading cause of wrongful convictions overturned by DNA evidence (Innocence Project, 2014). The Innocence Project (2014) reports 75% of wrongful convictions were due to eyewitness misidentifications. Of these misidentifications, 25% had two eyewitnesses identifying innocent individual as the perpetrator, while 13% had three or more eyewitnesses misidentifying the same innocent defendant.

Many factors influence the accuracy of memory. Researchers classify these factors into system or estimator variables (Wells, 1978). System variables can be controlled by the legal system. Examples include instructions given to the witness before a line-up or photo-array identification, whether a sequential or simultaneous line-up is used, the selection of foils used during the line-up, and communication after an identification is made. Also, attorneys and judges can control what type of question is asked to the witness during a trial. For example, leading questions can distort a memory (Loftus & Palmer, 1974). Estimator variables include those things that cannot be controlled by the legal system, such as the contextual circumstances surrounding the crime. This includes presence of a weapon (weapon focus), whether the race of the perpetrator is different than the race of the eyewitness (own race bias), the stress felt during the crime (arousal), and other factors such as distance from perpetrator, interaction with perpetrator, and the lighting where the crime occurred. Memory is particularly vulnerable to errors that intrude during encoding (Pollio & Foote, 1971). Because eyewitness testimony is a key component of the case in these experiments, a review of the factors affecting eyewitness memory is warranted.

Estimator Variables

Weapon focus. The presence of a weapon during the crime may impair facial recognitions. Weapon focus occurs when a witness of a weapon-present crime has a decreased ability to identify the perpetrator due to focused attention on the weapon instead of the perpetrator's face. Loftus, Loftus and Messo (1987) clarified the effect of weapon focus using an experiment where witnesses viewed a slideshow of an event in a fast food restaurant. Half of the participants witnessed a customer handing a check to the cashier while the other half viewed a customer pointing a gun to the cashier while all other details remained identical. Those in the weapon present condition made more frequent and longer fixations on the gun than those in the weapon absent condition made on the check. In Experiment 2, Loftus, Loftus and Messo (1987) presented the same slideshows with memory questions asked 15 minutes later. Victims of violent crimes provided less complete descriptions of the perpetrator and spent more time fixating on the weapon than on other stimuli. One explanation for the phenomena is that attention is tunneled to relevant features in a stressful situation while peripheral features are ignored (Easterbrook, 1959).

A crime is a novel and stressful situation for most eyewitnesses. The witness tends to focus on the features of the weapon, a salient stimulus, and not the features of the perpetrator, which may be thought of as peripheral. Kramer, Buckhout, and Eugenio (1990) simulated a real-world demonstration of weapon focus (two conditions: WHV, weapon high visibility; WLV, weapon low visibility) and arousal using a slideshow of a staged assault. Those in the WLV condition had more accurate descriptions of the perpetrator. In fact, not a single person in the WHV condition correctly identified the

perpetrator. All participants in WHV group correctly identified the weapon as a bottle while less than half of the WLV group identified the weapon, indicating the weapon focus effect occurred. Also, self-reported high arousal impaired facial recognition in both conditions, but especially in the WHV condition.

Arousal. Yerkes-Dodson (1908) law states stressor intensity affects performance with an inverted-*U* function. Performance improves with increasing arousal up to an optimal point and declines when arousal further increases. At moderate levels of stress, performance is optimal, indicating some arousal during task performance is good. At low or high levels of stress, performance is increasingly impaired. In a meta-analysis of 27 experiments regarding the effects of heightened stress during eyewitness identifications, Deffenbacher, Bornstein, Penrod, and McGorty (2004) report clear support that increased stress has a detrimental effect on eyewitness identification accuracy. Additionally, heightened stress had an even more unfavorable effect on eyewitness identifications in ecologically valid eyewitness identification paradigms (i.e., exposure to few faces before recognition by simultaneous or serial line-up) versus face recognition paradigms (i.e., exposure to many target faces followed by a recognition test with many new faces included).

Varying levels of attention and arousal may impact recognition in own-race and other-race faces. These two factors are especially relevant in weapon-present witnessed crimes, especially if the crimes included highly visible weapons (see Kramer, Buckhout & Eugenio, 1990). Tooley, Brigham, Maass, and Brothwell (1987) found arousal differentially affected own-race facial recognition, with recognition increasing as a function of increased arousal via threat of electric shock.

Own race bias. The own-race bias is a robust phenomenon in which people more accurately identify features of people of their own race. When the perpetrator is of a different race than the witness, facial encoding may be impaired. In a meta-analysis of own-race versus other-race facial recognition literature, 79% of participants in 14 experimental samples exhibited the own-race bias for Black and White participants (Bothwell, Bringham, & Malpass, 1989). Lindsay, Jack, and Christian (1991) demonstrated the own race bias in White subjects identifying African American faces using a delayed match-to-sample task with pictures of faces. White subjects more accurately recognized faces of their own race than African American faces. Walker and Hewstone (2008) validated the own-race bias in White and South Asian participants in the United Kingdom. In this experiment, White and South Asian subjects responded to a computer-based discrimination task of White, South Asian, and Black faces of both genders. As expected, White participants more accurately identified White faces than other race faces while South Asian participants more accurately identified South Asian faces than other race faces.

Estimator variables usually do not occur in isolation; in a crime, multiple estimator variables may be present. MacLin, MacLin, and Malpass (2001) examined the effects of four factors: arousal (high, low), delay (none, minutes), presentation (simultaneous, sequential) and race of face (Hispanic, Black), on subsequent facial recognition by Hispanic participants. Participants engaged in a facial recognition task after exposure to 40 pictures of Black and Hispanic faces. Participants recognized own-race faces more accurately, especially with sequential presentation, confirming the own-race bias using a Hispanic population. In addition, participants in the high-arousal

condition had low recognition scores for own-race and other-race conditions. With high arousal, simultaneous presentation negatively affected facial recognition for own-race faces. That is, own-race faces were more negatively affected by competition for attention during high arousal states. Increased delay negatively affected facial recognition for participants in the high arousal and simultaneous conditions. Delay between initial facial view and subsequent recognition test decreases own-race identifications (Shepard, Gibling, & Ellis, 1991) and increases misidentifications (Barkowitz & Brigham, 1982).

Confidence

Weapon focus, own-race bias, and arousal all impair the accuracy of eyewitness memory. In addition, confidence of a memory poorly reflects the accuracy of that memory (Wells, Olson, & Charman, 1995, Deffenbacher, 1980; Holmes & Weaver, 2010; Krug & Weaver, 2005). An examination of the cases later overturned by DNA evidence reveals high confidence in the identification by the eyewitness causes particularly persuasive testimony for jurors. In meta-analyses or eyewitness studies examining the confidence and accuracy relationship, Penrod (1980) reported an average correlation of .23 while Wells and Murray (1984) found an average correlation of .07.

Wells, Lindsay, and Ferguson (1979) staged a calculator theft in order to assess accuracy of eyewitness identifications. Twenty-four participants had accurate identifications while 18 participants were inaccurate. Mock jurors observed follow-up questioning regarding confidence in the identification, though these jurors did not know if the eyewitnesses were accurate or inaccurate. Jurors were unable to distinguish between accurate or inaccurate eyewitnesses. Additionally, jurors' attributions of confidence to the eyewitness accounted for 50% of the variance in witness believability.

In addition, testimony with increased confidence, even with inaccuracies in testimony, expressed by an eyewitness appear more believable over less confident testimony with less inconsistencies (Brewer & Burke, 2002). Brewer and Burke (2002) had mock jurors listen to a tape of an armed robbery trial, which included eyewitness testimony. The eyewitness provided a testimony that was either confident or not as confident, and either consistent or inconsistent. Despite inconsistencies, witness confidence had a strong effect on verdict judgments. Therefore, confidence of eyewitnesses plays a unique role in overshadowing memory inaccuracies of eyewitnesses.

Juror Acceptance of Eyewitness Memory

The ease with which jurors accept the accuracy of the eyewitness' memory and the apparent weight attributed to eyewitness testimony is as disturbing as the memory errors that occur in eyewitnesses. Jurors are likely to overvalue eyewitness testimony in their decisions due to their lack of knowledge regarding memory in general and eyewitness memory, specifically. Without knowledge of factors such as weapon-focus, own-race bias, stress effects, and confidence malleability, jurors tend to weigh eyewitness testimony as hard evidence, which may ultimately affect jurors' decisions (Benton, Ross, Bradshaw, Thomas, & Bradshaw, 2006; Kassin, Tubb, Hosch, & Memon, 2001; Schmechel, O'Toole, Easterly, & Loftus, 2006).

As a result of this basic misunderstanding, a number of false beliefs are commonly accepted by typical jurors. Simons and Chabris (2011) collected data from 1,838 members of the general population and weighted the responses to represent a 1,500 person, nationally representative sample, to which they compared responses from memory experts at the national Psychonomic Society meeting in 2010. Memory experts

met the criteria of working in a memory-related field for over ten years. Astonishingly, 63% of the nationally representative sample agreed with the statement, “Human memory works like a video camera, accurately recording the events we see and hear so that we can review and inspect them later.” Of course, none of the memory researchers agreed with the statement. Also, 55% of the sample agreed with the statement, “Once you have experienced an event and formed a memory of it, that memory does not change.” Again, 0% of the experts agreed with this statement. These data confirm the lack of knowledge regarding memory by the general public. Simons and Chabris (2012) replicated these results using a nationally representative Mechanical Turk sample.

Kassin and colleagues (2001) surveyed 64 eyewitness experts for their opinions on reliability of eyewitness memory phenomena (“Do you think this phenomena is reliable enough for psychologists to present in courtroom testimony?”), research basis (Is your opinion “based on published, peer reviewed, scientific research?”), and if they believed the phenomena to be a common sense notion among jurors (“Most jurors believe this statement to be true as a matter of common sense.”). The survey included 30 eyewitness topics. On the topic of weapon focus, 87% of experts deemed it reliable, 97% said it had a research basis, and 64% said it was not common sense for jurors. On the topic of own-race bias, 90% of experts deemed it reliable, 97% said it had a research basis, and 35% said it was not common sense for jurors.

Benton and colleagues (2006) surveyed jurors, judges, and law enforcement officials on the same 30 eyewitness topics as Kassin et al (2001). Of particular interest, they asked potential jurors in Tennessee to read and evaluate 30 statements about eyewitness memory and reliability. A panel of eyewitness memory experts also evaluated

these statements. The responses of jurors diverged from those of the experts nearly 90% of the time, again demonstrating the lack of knoweledge on the part of jurors regarding factors affecting eyewitness memory.

In another study, Schmechel and colleagues (2006) surveyed more than a thousand potential jurors, and identified more than 10 different areas in which jurors' "common sense" beliefs regarding memory were flawed. The survey showed the majority of jurors come to trial with misconceptions of memory at the most basic level and especially eyewitness memory topics (Schmechel et al., 2006). Jurors disagreed with eyewitness experts on 87% of eyewitness topics and statements. Judges and law enforcement disagreed with experts on 60% of the issues. Specifically, only 39% jurors agreed with experts on the topic of weapon focus (i.e., 61% of jurors did not believe a weapon's presence impairs eyewitness identification) and only 47% agreed with experts on the topic of own-race bias (i.e., 53% of jurors did not believe eyewitnesses are more accurate at identifying members of their own race). These misperceptions likely influence how jurors evaluate memory fallibility.

Kassam and colleagues (Kassam, Gilbert, Swencionis, & Wilson, 2009) investigated whether the average person is sensitive to a memory phenomenon called "motivation to remember (MTR)," that may affect the accuracy of memories later recalled. Previous research found MTR was more effective at encoding and considerably less effective at a later time. For example, when a student is told the lecture material covered today will be used as an essay question on the exam, the student is highly motivated to pay attention and remember the lecture. If the professor instead tells the student about the essay question a week later, the student may not recall all the

information he could have. Jurors may not sufficiently understand how MTR works in memory recollection and accuracy. In the trial of Scooter Libby (United States v. I. Lewis Libby, 2006), jurors could not believe Scooter Libby could forget a very important conversation so they found him guilty of five counts of perjury, obstruction, and making false statements to the FBI. To study this effect, Kassam and colleagues (2009) asked individuals to judge memory errors committed by others who had MTR at encoding, at retrieval, or at no time. Participants consistently expected people to recall more than they did, failing to recognize MTR plays a role in accuracy of memory. Thus, juror insensitivity to factors influencing eyewitness memory plays a role in how they accept testimony from eyewitnesses. If jurors believe "memory is like a video camera," they may accept the eyewitness' testimony without question. The data summarized above demonstrate jurors do not fully understand the mechanism of memory and as such, memory is beyond the ken of the majority of jurors. For cases involving eyewitness testimony, jury members would likely benefit from expert testimony or juror instructions regarding the fallibility of eyewitness memory.

Addressing Eyewitness Memory in the Courtroom

Hastie (as cited in Hastie, Penrod & Pennington, 1983) states that there are four basic weaknesses regarding jurors' reaction to eyewitness memory:

> 1. Jurors are insensitive to bias that may be introduced during a crime investigation,
> 2. Jurors possess insufficient awareness of factors that interfere with accurate retention,
> 3. Jurors lack sophistication regarding tests of facial recognition, and
> 4. Jurors place excessive emphasis on a witness's statements about the confidence of his/ her identification.

The lack of knowledge concerning memory and factors that influence eyewitness memory lends credence to the notion expert testimony on the topic of memory will assist jurors with the challenge of rendering a verdict based on the accuracy of an eyewitness. An analysis of memory- related factors in a case could assist members of a jury in their decision-making process.

Expert Testimony

To address the memory misconceptions of jurors, the courts frequently allow expert testimony to explain phenomena considered "beyond the ken" of the average person. There are several types of expert testimony but the testimony of interest in cases with eyewitness testimony is from psychologists or scientists with memory expertise. These experts are commonly retained by the defense (and occasionally by prosecutors) to evaluate eyewitness reliability. During this type of testimony, the expert is only expected to explain eyewitness memory-related phenomena to jurors and not expected to offer ultimate opinions on the accuracy of an eyewitness' memory.

Admissibility of expert testimony is usually determined using Frye standard (novel information presented in testimony is generally accepted by the scientific community; Frye v. United States, 1923) or the more stringent Daubert criteria (information presented in testimony is relevant, reliable, and valid, as deemed by the judge; Daubert v. Merrell Dow Pharmaceuticals, Inc., 1993). If a judge allows an expert to testify, the expert is to address scientific research related to the case in order to raise awareness of, or clarify, specific information for jurors. The expert cannot opine regarding the credibility of an eyewitness and should merely identify factors that may influence eyewitness memory and testimony. Jurors remain the sole determinants of the

credibility of an eyewitness. While expert testimony is commonly permitted in courts, some prosecutors argue expert testimony regarding eyewitness memory contains nothing more than common sense knowledge, or that memory expert testimony makes it impossible to convict due to increased skepticism (McClosky & Egeth, 1983a).

Memory researchers have examined the use of expert testimony on juror decision making with mixed results. Loftus (1980) discovered merit in expert testimony in criminal court cases with an eyewitness' testimony: jurors were somewhat, though not significantly, less likely to convict when expert testimony was included in a mock trial, especially in violent crimes. Loftus hypothesized jurors were more thoughtful regarding eyewitness memory after expert tesimony. Expert testimony did not lower conviction rates such that jurors would completely disregard not guilty verdicts; instead, jurors had additional information about the memory process and were more able to think critically about the eyewitness testimony. In a second experiment in Loftus (1980) reported that jurors who listened to expert testimony during a case spent significantly more time examining the eyewitness testimony during deliberation than those without such exposure.

Hosch, Beck, and McIntyre (1980) also found jurors in cases with expert testimony were more likely to discuss relevant, non-eyewitness related information during deliberation, in addition to the eyewitness' testimony itself. Mock jurors listened to a burglary trial that included an eyewitness to the crime. Half of the jurors also heard expert testimony. Jurors were more likely to scrutilize the case evidence when expert testimony was involved, although expert testimony did not affect verdicts: All juries acquitted the defendant.

Cutler, Penrod, and Dexter (1989) also found jurors provided expert testimony paid more attention to conditions of the crime (which are known to influence eyewitness identifications and memory) and conditions surrounding the identification than those who did not hear expert testimony. Unlike Loftus (1980) however, jurors who listened to expert testimony did not have increased skepticism of eyewitness evidence (Cutler, et al, 1989).

The timing of expert testimony may affect juror decision making differentially. Leippe, Eisenstadt, Rauch, and Seib (2004) compared expert testimony provided before evidence to that which followed evidence in a murder trial. The evidence included testimony from an eyewitness. Eyewitness believability and jurors' perception of defendant guilt both decreased if jurors read the expert testimony after evidence presentation. Jurors were more likely to find the defendant not guilty if the expert testimony followed the evidence than if the expert testimony preceded it.

The type of expert testimony may also play a role in its effectiveness. Kovera, Gresham, Borgida, Gray, and Regan (1997) reported a beneficial effect of expert testimony that explicitly linked scientific research evidence to the crime (called "concrete" testimony) than expert testimony that lacked these links. This effect occurred without detrimentally influencing juror verdicts. Expert testimony grounded in science provides maximum effectiveness.

Jurors, when given a choice, may prefer expert testimony during a trial to help with criminal justice or memory issues they are not confident in their own knowledge about. When expert psychologists, jurors, and jury-eligible students were asked to estimate the effects of witness suggestibility methods, non-psychologists largely

underestimated the effects of witness suggestibility (McAuliff & Kovera, 2006). McAuliff and Kovera (2006) discovered jurors were likely to believe expert testimony was beneficial, due to their lack of knowledge of witness suggestibility.

Expert testimony may be beneficial in aiding jurors, but it also may make convictions more difficult by increasing skepticicm of the accuracy of memory (Wells, 1986). Wells, Lindsay, and Tousignant (1980) presented half of the mock jurors with expert estimony and the other half with no expert testimony before both groups viewed eyewitness testimony (accurate or inaccurate). They found mock jurors were unable to distinguish between accurate and inaccurate eyewitness testimony, even with the aid of expert testimony. However, those who listened to expert testimony were more likely to discount the testimony of the eyewitness.

Some jurors believe experts to be "hired guns," and as such, will say anything for money. Cooper and Neuhaus (2000) investigated the "hired gun" effect, if it exists, on juror decision making. Jurors listened to a mock trial to determine whether a chemical the plaintiff was exposed to at work primarily caused his colon cancer. The mock trial included expert witnesses hired by the defense and prosecution. The pay (high or reasonable) and credientials (high or modest) of the expert for the defendant was manipulated. Interestingly, credentials only affected juror decisions for highly paid experts: Experts with high pay but modest credentials sided with the plaintiff while experts with high pay and high credentials did not side with his client. Jurors did not like or believe these "hired guns" and may actually discredit their testimony (Cooper & Neuhaus, 2000).

McCloskey and Egeth (1983b) further stated that a good defense attorney covers factors influencing eyewitness memory, such as duration of crime, dark lighting, stress, weapon focus, and own-race bias; and therefore expert testimony is unnecessary. The beneficial effects of expert testimony can be inconsistent. Jurors may have a hard time processing the scientific information given in expert testimony, may discredit highly paid experts, or may not even need expert testimony in the courtroom.

Benton and colleagues (2006) reported that 32% of states do not admit expert testimony in their courts, 42% allow for the possibility of expert testimony in their courts, and only about 25% generally accept expert testimony, though only usually if the case against the defendant is weak (i.e., without corroborating evidence). Recently, fear of overvaluation of expert testimony by jurors in relation to tangible evidence presented in trial has lead to many jurisdictions to restrict expert testimony (Schauer & Spellman, 2013). In those jurisdictions where the admissability of expert testimony is limited, another way to educate jurors on the unrelability of eyewitness memory is through clear, consise, research-based juror instructions.

Juror Instructions

Judicial instructions regarding eyewitness memory were established in United States v. Telfaire (1972). However, these instructions relayed negligible information to the jury, such as factors that influence identification accuracy, without explaining the impact those factors may have on memory accuracy (Penrod, Cutler, & Dexter, 1988; Penrod & Cutler, 1989). Penrod and Cutler (1989) found the Telfaire instructions to have little to no impact on evaluation of eyewitness memory by jurors, and these instructions provided no scrutiny of eyewitness testimony.

In the landmark case New Jersey v. Larry R. Henderson (2012), New Jersey established research-based jury instructions for all future cases in which an eyewitness is involved. New Jersey composed instructions that describe memory errors that may occur with eyewitnesses and also specifically stated that memory is not perfect and must be scrutinized. The new juror instructions are a brief but thorough review of system and estimator variables and their possible effects on eyewitness misidentifications. Interestingly, the first call to make these types of research-based juror instructions was made by Kassin, Ellsworth, and Smith (1989) following the first survey of memory experts regarding the general acceptance of factors affecting eyewitness memory.

These research-based instructions may have benefits beyond those of expert witnesses, including cost and standardization. Also, instructions may be less likely to confuse jurors, as conflicting expert testimony may do to jurors. Though instructions may be more beneficial than expert testimony, the court noted there might be times when expert witnesses should be allowed.

The effectiveness of the Henderson juror instructions have not been fully established. Moreover, a comparison of expert testimony and the new juror instructions has yet to be conducted. Thus, the current study examines whether juror instructions may be as effective as eyewitness memory experts in some situations.

Cognitive Load and its Effects on Decision Making

Decision Making

Hastie and colleagues (1983) found jurors often adopt a story early in the trial and then use evidence to modify the existing narrative. For example, approximately 80% of

jurors favor one verdict before deliberation (Hastie, Penrod, & Pennington, 1983). Pennington and Hastie (1986) offered the three-stage explanation-based Story Model to explain the way a juror reaches a verdict: story construction, verdict representation, and story classification. First, jurors use the evidence presented to form a narrative. Then, the juror uses possible verdict alternatives as end-result decision categories. Finally, jurors try to find the best fit between the narrative story formed and the verdict category. The verdict with the best fit to the story is proposed to be the verdict chosen by the juror. Thus, new information or evidence given throughout the trial serves to enhance the prevailing narrative story.

Rational decision-making also has been characterized by dual processing models. Chaiken (1980) proposed the Heuristic-systematic model (HSM) of a social information processing. Petty and Cacioppo (1986) described the Elaboration-likelihood model (ELM) to describe how persuasion affects decision-making in observers. Both of these models distinguish between two modes: the central or "effortful processing" mode, characterized by rapid, effortless, instinctual, and largely unconscious processes, and the peripheral or "heuristic-based processing" mode, characterized by effortful, slow, logical, and more deliberate processes. In behavioral economics, Kahneman (2011) characterizes two similar systems: "System 1 [is described as] effortlessly originating [the] impressions and feelings that are the main sources of the explicit beliefs and deliberate choices of System 2" (Kahneman, 2011, pg. 11). System 1 is peripheral and heuristic-based while System 2 is central and effort-based. A high level of cognitive effort characterizes System 2 processing, while System 1 processing relies on decision-rules and biases.

Decision makers, jurors included, often assume they are relying on System 2 processes. In reality, System 1 processes drive most attributions and decisions. Although jurors may deny that decisions might be influenced by unconscious factors like racial bias, for example, they undoubtedly are. Adams, Bryden, and Griffin (2011) investigated these processes in mock jury deliberations involving White and Middle Eastern witnesses, victims, and defendants. During deliberations, where Kahneman's System 2 processes might be expected, racial biases were mediated by juror discussions. When the authors invoked implicit stereotypes of Middle Eastern terrorists (a System 1 process), biases in jurors were not positively mediated by deliberation, and they were more likely to recommend higher sentences. These subtle forms of racial biases occur outside the realm of consciousness. When resources are limited, or perhaps when case complexity or cognitive demands are high, System 1 processes may play a much larger role in juror decision-making than jurors realize or expect.

Cognitive Load

Cognitive demands are relevant in the courtroom as jurors seldom have ideal circumstances under which to gather information and make decisions. Rather, jurors must selectively identify critical evidence from an abundance of information presented to them in court. Jurors must keep track of facts, evidence, testimony, and attorney statements. As such, jurors are thought to be operating under conditions of "high cognitive load." One key role of working memory in selective attention is distinguishing between relevant and irrelevant material (Lavie, Hirst, de Fockert, & Viding, 2004). The load theory of selective attention and cognitive control (Lavie, Hirst, De Fockert, & Viding, 2004) assumes perception is limited in capacity and is an automatic process. Lavie (2010) states

the ability to focus attention worsens under higher working memory load (i.e., cognitive load). The level of load on cognitive-control functioning plays an important role on the effectiveness of working memory. Cognitive load, or cognitive busyness, is described as information held in mind while performing other tasks (Gilbert, Pelham, & Krull, 1988). Examples of cognitive load functions used in the laboratory are making participants switch back and forth between different tasks or having them hold some task-unrelated material (e.g., memorizing a sequence of digits) in their working memory (Shiv & Fedorikhin, 1999). High cognitive load overloads working memory into impairing selective attention of relevant information.

Increased cognitive load can cause errors in decision-making. According to Gilbert, Pelham, and Krull (1988), busy perceivers (i.e., those with high cognitive load) do not fail to notice or recall information, but rather are too busy cognitively to use information from situational contexts to correct their initial impressions. Importantly, initial characterization of a person requires fewer cognitive resources than later correction of misperceptions indicating increased reliance on a System 1 process in the initial stage. These issues may be especially important in juror decision-making. Juror might recognize evidence presented to them but may be too cognitively loaded to use the information in their verdict decision-making process, again presenting evidence that when System 2 processes are overloaded, System 1 processes come into play.

Cognitive load can have a direct effect on decision-making by basing decisions on factors other than reason. Shiv and Fedorikhin (1999) investigated the relationship between affect and cognition on decision-making. The first experiment examined cognitive load (low, high) and presentation mode (symbolic, real) on decision-making.

The researchers conducted the experiment in two rooms. In the first room, respondents were asked to memorize a number (7-digits for high load or 2 digits for low load) when exiting and asked them to recall the number in the second room. The experimenter displayed the number to be memorized and asked participants to walk over to a cart that held either pictures of a slice of chocolate cake and a bowl of fruit (i.e., symbolic presentation mode) or an actual chocolate cake and a bowl of fruit (i.e., real presentation mode). Respondents chose which snack they would like to have and moved on to the second room to recall their number. In the second room, participants also described what went through their minds when choosing between the two snacks. Load had an effect only in the real presentation mode. Participants in the high cognitive load chose chocolate cake more frequently and based their decisions on affect, while participants in the low cognitive load chose a healthy snack and based their decisions on cognitions. This has several implications in the legal decision-making literature. Jurors, overloaded with information of the case, may be less likely to base their decisions on cognition (a System 2 process) and instead utilize a System 1 process to make decisions. Higher cognitive load may affect the amount of resources available to acknowledge new information during a trial.

Kleider, Knuycky, and Cavrak (2012) recently studied the effects of available cognitive resources in the decision-making of racially prejudiced mock jurors in ambiguous, weak, or strong cases. Jurors under increased cognitive load, especially those with high racial prejudice and low working memory capacity, were more likely to convict Black defendants in ambiguous cases. Kleider and colleagues suggested ignoring implicit stereotypes in racially biased jurors is cognitively demanding. Thus, the reduced

cognitive resources of these jurors allowed for implicit racial biases (a System 1 process) to play a key role in their juror decision-making.

Need for Cognition

Individual differences in critical thinking enjoyment and exertion (i.e., need for cognition) may affect juror decision-making, especially in situations where more cognitive effort is required. Cacioppo and Petty (1982) developed a 34-item questionnaire called the Need for Cognition Scale (NCS) to measure the tendency to engage in and enjoy thinking. Sample items include "I prefer complex to simple problems" and "I only think as hard as I have to" (reverse-scored). This scale is highly reliable, with Cronbach alphas exceeding .84, and test-rest and split-half reliabilities averaging .87 and .83, respectively. A more efficient measure, the Need for Cognition- Revised (NFC-R) was developed by Cacioppo, Petty and Kao (1984). The NFC-R is 18-items long and has a Cronbach's alpha of 0.90 and correlates highly with the original NCS ($r = + 0.95$, $p < .001$). Need for cognition in decision-making circumstances is related to how systematic and carefully an individual will consider information or evidence.

Need for cognition may affect juror receptiveness of information in expert testimony. McAuliff and Kovera (2008) presented jurors with a civil litigation case that included eyewitness testimony and expert testimony, which was internally valid or invalid in nature. Jurors high in need for cognition were more likely to side with the plaintiff and were more sensitive to validity of the expert's evidence. This experiment suggested a strong relationship between need for cognition and verdict judgments, that is, high need for cognition individuals will side for the plaintiff.

Leippe, Eisenstadt, Rauch, and Seib (2004) presented evidence that need for cognition may be curvilinearly related to guilty verdict decisions. Mock jurors read a murder trial transcript that included eyewitness testimony. The transcript depicted a weak case, moderate case, or strong case against the defendant, and either did include or did not include expert testimony. Jurors who were either low or high in need for cognition were less likely to convict than jurors with moderate need for cognition in strong cases but they were more likely to convict in weak cases. This study did not find an interaction of need for cognition and expert testimony, implying inclusion of expert testimony did not affect jurors at different levels of need for cognition. One can make competing predictions regarding need for cognition's relationship with verdict judgments. Need for cognition may be a good covariate for research in juror decision-making that utilizes cognitive load. Jurors high in need for cognition should utilize System 2 processes while jurors low in need for cognition will utilize System 1 processes.

Manipulating Cognitive Load in Our Laboratory

In more general studies, Malavanti and Weaver (2013) investigated the effects of cognitive load in rendering verdicts. In Experiment 1, we manipulated cognitive load by having the jurors memorize a series of numbers during summary reading and videotape viewing. Mock jurors read a trial summary describing the armed robbery of a convenience store in which the suspect appears guilty and an eyewitness plays a central role, and then rendered a verdict. All jurors then viewed a videotape of the robbery in which the perpetrator did not match the description provided in the trial summary. All jurors then voted again. Those who read under conditions of cognitive load were less likely to vote guilty initially. Those who watched the video under cognitive load were

less likely to modify their verdict after viewing exculpatory evidence. Therefore, cognitive load impaired initial processing of information as well as knowledge updating.

Actual jurors do not operate under conditions of high load via a laboratory task of memorizing numbers; therefore, in the next experiment, we used an ecologically valid measure of cognitive load: information overload. In Experiment 2, we added extraneous defense details to the case summary and limited the time available to read the summary for half of the jurors. All jurors rendered a verdict, watched the video, and rendered a verdict again. The results mirrored those of Experiment 1: jurors under high defense load were less likely to vote guilty initially and unlikely to modify their verdict after the video.

While the results replicated Experiment 1's findings, the impairment seen in initial processing may be a function of biased defense information presented in the defense load case summary. To investigate, we added prosecution load as another treatment level in Experiment 3. The procedure remained the same as Experiment 2 with a third of the jurors receiving prosecution extraneous details in their case summary instead of defense load or no load. The results confirmed those of Experiment 2: jurors under no load processed exculpatory evidence over time and were less likely to convict at Time 2 than at Time 1. Both types of load did function to bias initial processing towards the prosecution or defense, depending on the type of load received. Importantly, jurors under high defense load or high prosecution load were less likely to modify their verdict after the video than no load jurors, indicating the processing of true exculpatory evidence is impaired by cognitive load. One explanation of impaired processing of true exculpatory evidence is mock jurors are making verdict decisions based on System 1 processes when under conditions of high load.

The Present Experiments

I investigated how jurors form and then update courtroom "stories" as a function of additional evidence (i.e., from eyewitness testimony and subsequent memory rebuttals by jury instructions or expert testimony) and differing cognitive load in ambiguous cases. Kleider, Knuycky, and Cavrak (2012) noted ambiguous cases are most likely to be similar to actual court cases.

The present experiments established a juror decision-making paradigm focusing on the effect of eyewitness testimony, and jurors' understanding of key factors in eyewitness memory. In both experiments, I measured verdict changes over time. In Experiment 1, I measured the effect of an eyewitness' testimony and a rebuttal of the eyewitness' testimony on juror decision-making. The goal of Experiment 1 was to measure the effect of the memory rebuttal in juror decision-making. In Experiment 2, I followed similar procedures to Experiment 1 but included a typical cognitive load task (i.e., memorizing an 8-digit list of numbers) during the reading of the case summary. In Experiment 2, the goal was to investigate cognitive load effects on the use of expert testimony and juror memory instructions in a mock trial.

In both experiments, eyewitness testimony was contradicted by a memory rebuttal (expert testimony or juror instructions or control, a filler reading). I hypothesized expert testimony and juror instructions would reduce conviction rates at Time 2 by diminishing the effect of eyewitness' testimony only when jurors are under conditions of no or low load. To date, experimental studies have not examined the effect of juror instructions regarding memory in mock trial experiments, nor compared the effect of juror instructions to the effect of memory expert testimony. As such, both studies were unique.

Kahneman's (2011) dual processing theory can be applied to juror decision-making decisions, especially when jurors are under conditions of high cognitive load. Relatively few studies had investigated the performance of jurors under high cognitive load demands; thus, Experiment 2 was distinctive. According to the dual processing models, jurors under conditions of high load will depend on System 1 processes to make decisions. Jurors will be overloaded with information and unable to update their story like the knowledge updating model suggests. I expected jurors under load to be more likely to vote guilty at time 1 and less likely to change verdicts over time. I hypothesized increased cognitive load would affect jurors' ability to process information initially and over time, and thus, the dual processing model will be supported in Experiment 2.

Additionally, need for cognition was measured in both experiments. Need for cognition is hypothesized to play a role in juror decision making, though there are competing predictions on how this individual difference variable affects decisions in forensic situations. I hypothesized jurors high in need for cognition would utilize System 2 processes. I expected need for cognition to be a significant covariate in both studies.

CHAPTER TWO

Experiment One

Overview

In Experiment 1, I investigated decision making in jurors in a mock trial. Participants first read a case summary, which described an armed robbery of a convenience store. Then, participants read the official statement from the eyewitness and victim of the armed robbery, the clerk of the convenience store, and rendered an initial verdict. Lastly, participants read a memory rebuttal (testimony from a memory expert, juror instructions, or an unrelated article) before rendering a second verdict. Using this paradigm allows for the assessment of verdict changes occurring after presentation of new evidence.

Hypotheses

I had two hypotheses for Experiment 1:

1. No main effect of memory rebuttal condition will be present for verdict one, as all participants will have been exposed to the same information.

2. Memory rebuttal condition will affect decisions for verdict two. Specifically, I expected the mean verdicts of jurors exposed to juror instructions or expert testimony to be significantly lower (indicating these jurors are more confident in a not guilty verdict) from the control memory rebuttal group.

Method

Participants

One hundred and fifty participants (Males = 47, Females = 103, mean age = 19.34 years [SD = 1.40 years]) were recruited from Baylor's introductory psychology classes through the online recruitment tool, Sona Systems. Sample size determination procedures are given in Appendix A. Participants received one research-participation credit that was applied to a course research participation requirement or extra credit. All participants completed the experiment in two 30 minute sessions, one online and one in a laboratory. Only students over the age of 18 could be a part the study, as citizens must be over the age of 18 to participate in a jury. All participants signed an informed consent for research participation and received a copy of the form for their records. The study was approved by Baylor's Institutional Review Board (IRB) and met the American Psychological Association's (2002) standards for minimal risk to the well being of subjects.

Materials

Demographic questionnaire. This questionnaire assessed basic demographic characteristics: sex and age.

Need For Cognition. All participants completed the 18-item NFC-R questionnaire (Cacioppo, Petty, & Kao, 1984) to assess how much they thinking and exerting cognitive effort to evaluating complex information. Higher scores indicate higher need for cognition (NFC). The NFC-R was introduced to participants as part of the

demographic questionnaire as a *voir dire* survey and was completed prior to coming to the lab.

Case summary. The summary included both prosecutorial and defense presentations of evidence for an African American male accused of committing an armed robbery of a convenience store. A copy of the full case summary is given in Appendix B. The prosecutorial statement included a gun registered to the defendant's name that used the same caliber of bullet used in the robbery, and money found in the defendant's home that was close to the amount taken from the crime scene. The defense statement included an alibi from the defendant's girlfriend, an explanation of the money found in a closet in the defendant's home, and an explanation of the gun registered to his name. The case summary was purposefully ambiguous in nature, as the main goal of Experiment 1 is to measure verdict changes after being exposed to memory rebuttals.

Eyewitness testimony. The testimony from the eyewitness was a brief statement of his armed robbery experience and a positive identification of the defendant. A copy of the eyewitness testimony is given in Appendix C. The eyewitness was highly confident that he had identified the correct person as the robber (i.e., confidence/ accuracy effect), was of a different race than the defendant (i.e., own race bias), admitted to paying very close attention to the gun used in the robbery (i.e., weapon focus effect), and was very scared during the crime (stress). All of these factors are generally accepted (by memory experts) estimator variables influencing eyewitness memory accuracy (Kassin, Tubb, Hosch, & Memon, 2001; Wells, 1978).

Memory rebuttal. Three types of memory rebuttals were used in this experiment: testimony from a memory expert, juror instructions, or an unrelated article. A copy of all three memory rebuttals are given in Appendix E, F, and G, respectively. Participants in the Expert Testimony condition either read or watched a memory expert's statement describing estimator variables that were directly related to the present case (a concrete testimony, described in Kovera, et al., 1997). Studies directly comparing presentation media, such as reading a script or watching a video or a case, have failed to offer consistent findings on which type of presentation is more beneficial in mock juror trials. Ross, Dunning, Toglia, and Ceci (1990) reported no differences between watching or reading case information on juror decisions. Half of the participants in the Expert Testimony condition watched a testimony while half read about it. Participants in the Juror Instructions condition read the actual Henderson instructions document from the New Jersey court, elucidating the fallibility of eyewitness memory. Participants in the Control condition read a brief three-page article about the water cycle (a filler task).

Dependent Measures

For both verdicts, participants rendered a verdict judgment (-1 = Not guilty, 1 = Guilty) and indicated the degree of confidence in their verdict, measured on a scale using 10% increments with anchors of 0%= No confidence to 100%= Complete confidence. This type of verdict decision measures guilty/not guilty verdict decisions and the implicit confidence in the chosen verdict (Kassin & Sommers, 1997; Kleider, Knuycky, & Cavrak, 2012). The dependent variable, *verdict confidence*, is the product of the verdict and confidence percentage. A copy of the verdict assessment is given in Appendix D.

Procedure

All participants completed the informed consent form, demographic survey, and the NFC-R scale online prior to coming into the laboratory. All participants were tested individually. Participants were randomly assigned to one of three treatment levels before the experimental session. Upon entering the laboratory, a research assistant (RA) asked the participant to be seated in a study room. At this time, participants were assigned an ID number, which was used for all analyses, thus preserving participants' privacy and anonymity.

To begin the experiment, the RA told the participant, "Throughout this experiment, you will be simulating the role of a juror in an armed robbery trial." Subsequently, they were asked to read a case summary at their own pace. The case summary included background information of the crime, prosecution statements, and defense statements. Next, participants read an eyewitness' testimony from the same crime. After reading the eyewitness testimony, the RA gave all participants a verdict sheet and asked them to render a "Not Guilty" or "Guilty" judgment based on the information provided (i.e., verdict at Time 1) as well as indicate the degree of confidence in their verdict.

Next, participants read one of three memory rebuttal documents or watched a video of the memory expert. After completion of the memory rebuttal, the RA asked the participants to render judgment on the defendant using the two same scales as before (i.e., verdict at Time 2). The RA then asked several questions (see Appendix H) to assess awareness of details throughout the study and then fully debriefed the participant.

Design and Data Analysis

The study consisted of two predictor variables. The first variable is the memory rebuttal condition: Control (n = 50); Juror Instructions (n = 50); and Expert Testimony (n = 50). The second is time (i.e., verdict at Time 1 and verdict at Time 2.

The data were analyzed using a 3 (experimental condition, 3 levels between-subjects) by 2 (verdict time, 2 levels within-subjects) ANOVA, also known as a split plot factorial 3·2 ANOVA design. We measured verdict changes over time. The dependent variable is verdict confidence, which is the verdict multiplied by the juror's chosen confidence percentage, resulting in a continuous dependent variable.

Results

Medium for Expert Witness Testimony

Independent sample t-tests were conducted to assess differences in media for expert testimony on verdicts at each time. There was no difference in verdicts from those exposed to expert testimony by reading testimony or video watching at Time 1 (t (48) = 0.023, p = .982). There was no difference in verdicts from those exposed to expert testimony by reading testimony or video watching at Time 2 (t (48) = 0.638, p = .527, See Table 1.1, See Figure 2.1). Therefore, the scores were collapsed across the two media to form one expert testimony condition.

Table 2.1

Mean Verdict Confidence Score and SEM across Time and Expert Testimony Medium

	Time 1		Time 2	
Expert Testimony Media	*M*	*SEM*	*M*	*SEM*
Statement	-15.80	11.54	-41.00	10.22
Video	-16.20	13.36	-50.00	9.73

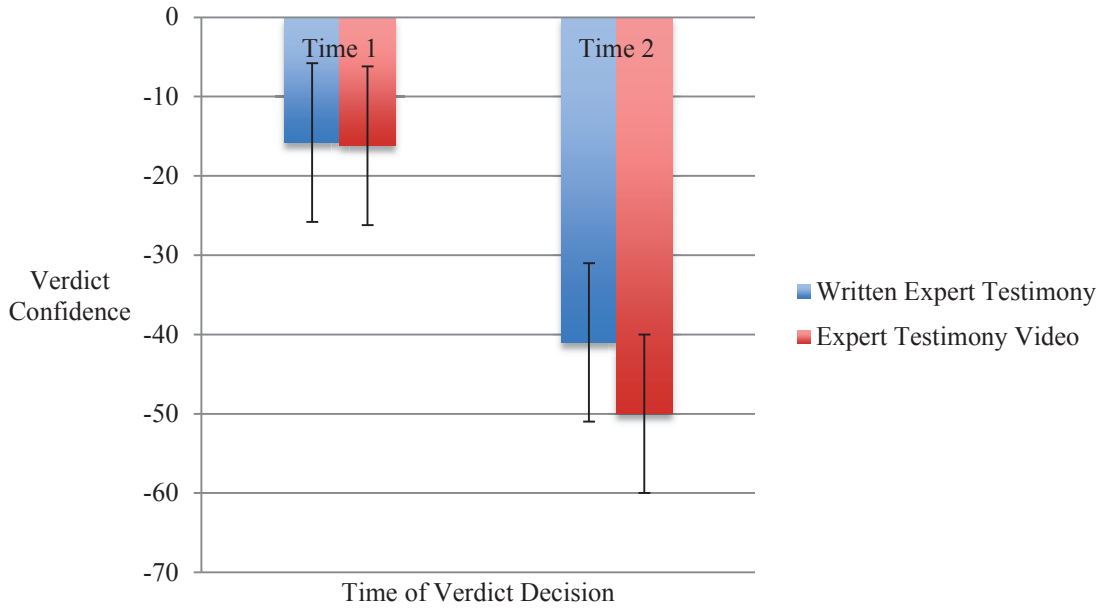

Figure 2.1. Verdict confidence score across time and expert testimony medium.

Experimental Manipulation

Means and standard errors for the experimental groups are in Table 2.2.

Table 2.2

Mean Verdict Confidence Score and SEM at Time 1 and Time 2 for Each Memory Rebuttal Condition

	Time 1		Time 2	
Memory Rebuttal Condition	*M*	*SEM*	*M*	*SEM*
Control	-19.00	8.89	-21.60	7.76
Expert Testimony	-16.00	8.89	-45.50	7.76
Juror Instructions	-23.00	8.89	-55.10	7.76

Overall, verdict confidence scores changed over time, F (*1,147*) = 51.45, $p < .001$ $\eta_p^2 = .259$. This represented a large effect. There was a small but non-significant main effect of memory rebuttal condition, F (*2,147*) = 1.38, $p = .254$, $\eta_p^2 = .018$. However, there was a time by memory rebuttal condition interaction. As predicted, those in the control group showed no change from Time 1 to Time 2. Those who received memory rebuttal information were more confident in a not guilty verdict at Time 2, reflected in the Time by Condition interaction, F *(2, 147)* = 9.99, $p < .001$, $\eta_p^2 = .120$ (See Figure 2.2). This represented a medium effect.

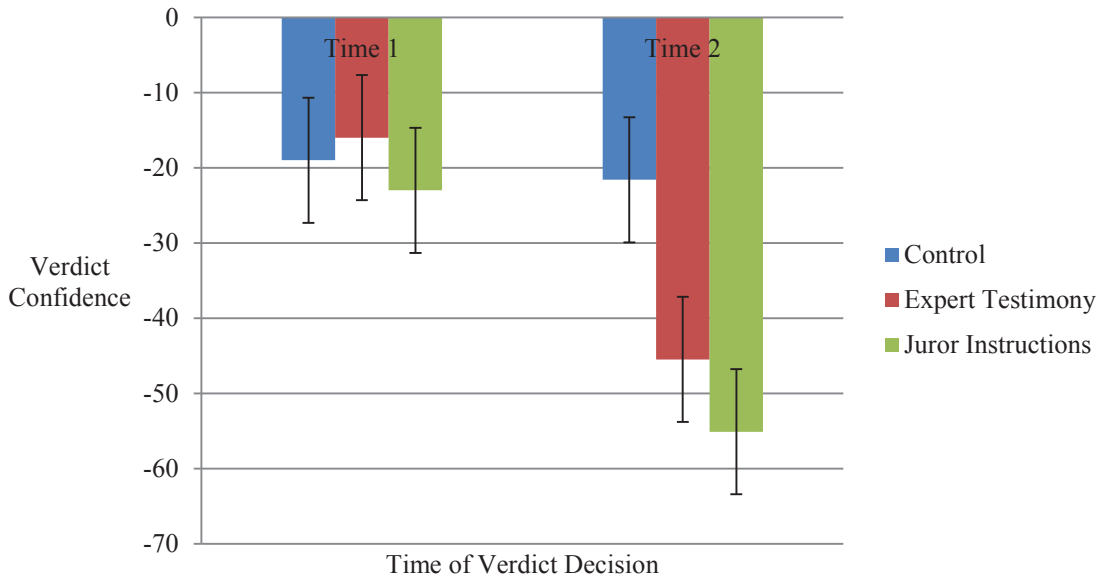

Figure 2.2. Verdict confidence score as a function of time of verdict decision and memory rebuttal condition.

Because there was an interaction, I conducted a one-way ANOVA to assess differences in verdicts across conditions at Time 2. This confirmed a simple main effect of condition at Time 2, $F\ (2, 147) = 4.94$, $p = .008$, $\eta_p^2 = .063$ (See Figure 2.3). This represented a medium effect. Tukey's HSD *post hoc* test confirmed verdicts of jurors who received instructions or expert testimony were not different ($p = .657$; $d = .17$). Additionally, verdicts of jurors who received instructions were more likely to vote guilty than control jurors at Time 2 ($p = .008$; $d = .61$). This represented a medium effect. However, verdicts of jurors who received expert testimony were not significantly different than control jurors at Time 2 ($p = .079$; $d = .44$). This represented a small effect.

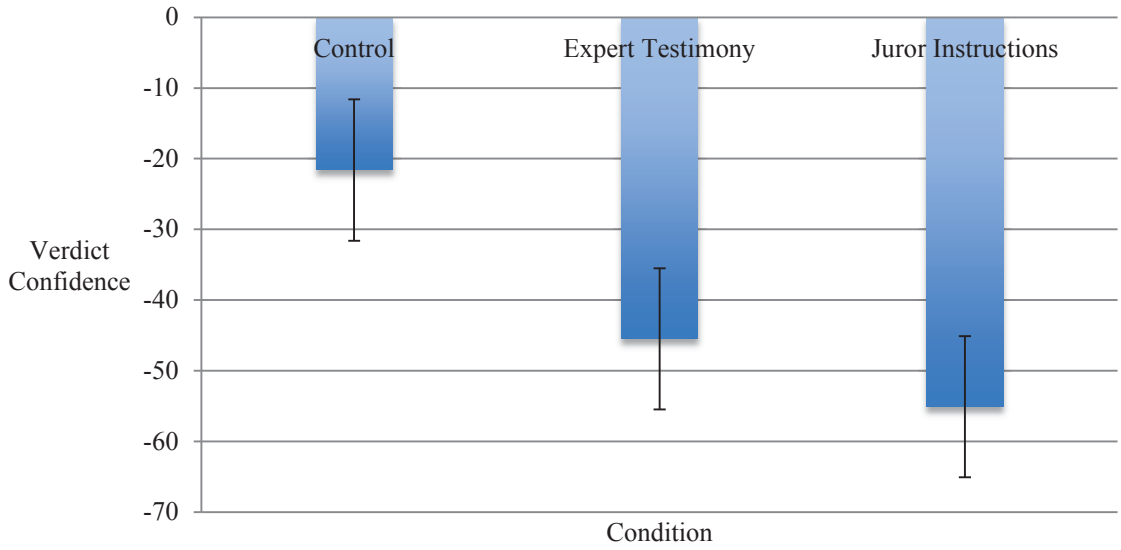

Figure 2.3. Verdict confidence score as a function of memory rebuttal condition at Time 2.

Need For Cognition

I found a negligible relationship between NFC and verdict at Time 1 (r = - .049) or verdict at Time 2 (r = - .033). When NFC was entered as a covariate, the overall model did not change (See Table 2.3).

Verdicts did not change over time, F (*1,138*) = 0.38, p = .539, η_p^2 = .003. In addition, condition had a small but non-significant effect, F (*2, 138*) = 1.99, p = .140, η_p^2 = .028. NFC had no effect, F (*1,138*) = 0.35, p = .555, η_p^2 = .003. However, the Time and Condition variables interacted. As predicted, those in the control group showed no change from Time 1 to Time 2. Those who received memory rebuttal information were significantly more confidence in a not guilty verdict at Time 2, reflected in the Time by Condition interaction, F (*2,138*) = 9.87, p < .001, η_p^2 = .125 (See Figure 2.4). This represented a medium effect size.

Table 2.3

Means and SEM at Time 1 and Time 2 for Each Memory Rebuttal Condition with NFC Entered as a Covariate

	Time 1		Time 2	
Memory Rebuttal Condition	*M*	*SEM*	*M*	*SEM*
Control	-18.19	9.11	-20.43	7.83
Expert Testimony	-15.39	9.23	-45.30	7.93
Juror Instructions	-27.00	9.48	-58.21	8.15

Because there was an interaction, a one-way ANCOVA was conducted to assess differences in verdicts across conditions at Time 2. This confirmed a simple main effect of condition at Time 2, $F\ (2, 138) = 5.83$, $p = .004$, $\eta_p^2 = .078$ (See Figure 2.5). This represented a medium effect size.

Tukey's HSD *post hoc* test confirmed verdicts of jurors who received instructions or expert testimony were not different ($p = .258$; $d = .23$), though a small effect existed. Verdicts of jurors who received instructions were significantly more confident in a not guilty verdict than control jurors at Time 2 ($p = .001$; $d = .67$). This represented a large effect. After controlling for NFC, verdicts of jurors who received expert testimony were significantly more confident in a not guilty verdict than control jurors at Time 2 ($p = .028$; $d = .45$). This represented a small effect.

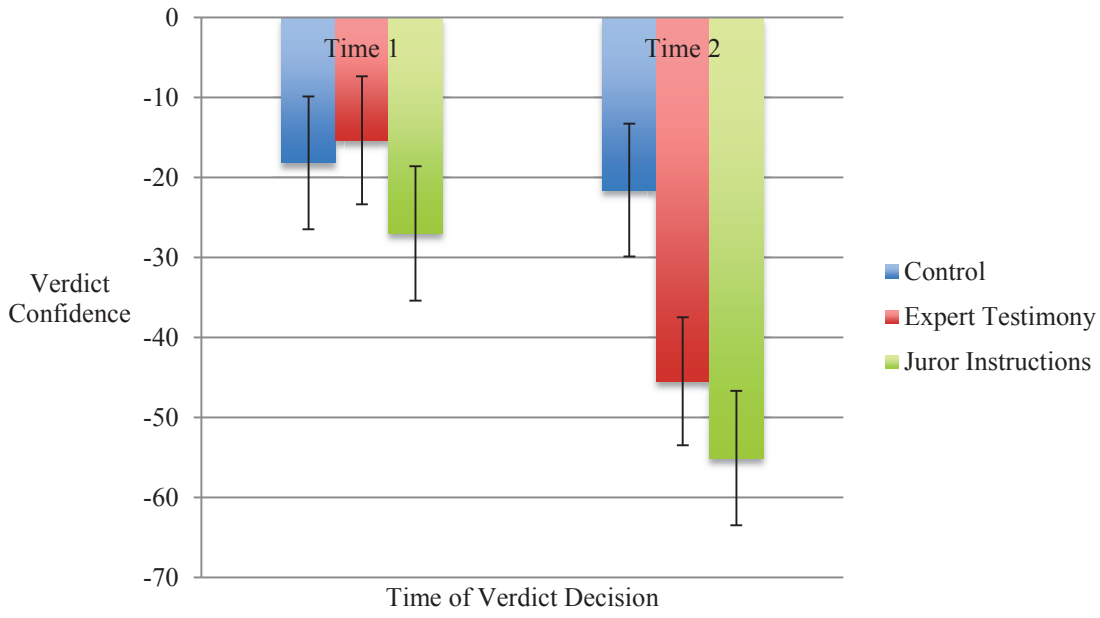

Figure 2.4. Verdict confidence score as a function of time of verdict decision and memory rebuttal condition (NFC = 56.58).

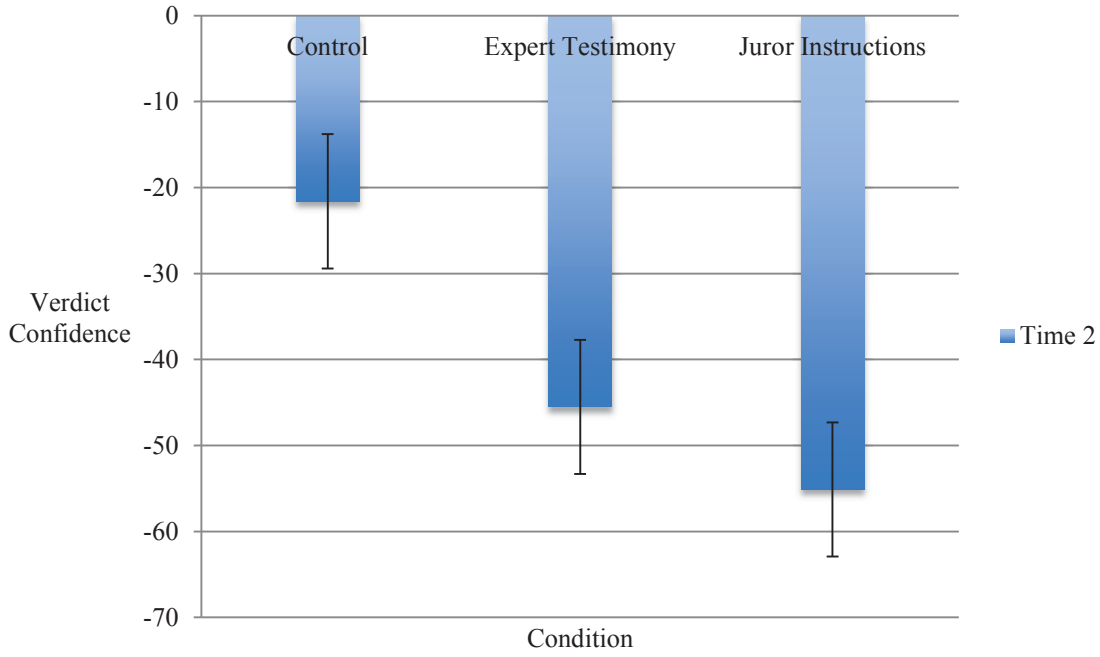

Figure 2.5. Verdict confidence score as a function of memory rebuttal condition at Time 2 (NFC = 56.58).

Discussion

Memory Rebuttals

The design of the present experiment allowed us to assess the effects of different memory rebuttals on verdict confidence scores. Those who received eyewitness memory information were more confident than Controls in a not guilty verdict at Time 2. In particular, the Henderson juror instructions were more effective than expert testimony at explaining clarifying eyewitness memory-related information, evidenced by the significant increase in confidence in a not guilty verdict at Time 2. Those who received instructions increased confidence in a not guilty verdict than Control group jurors.

While those who received expert testimony were also more confident in a not guilty verdict following the new information at Time 2, this effect was not significantly different than controls (though it was trending in the right direction). Experts may not have been as effective as instructions due to the "hired gun effect" or as a function of the expert testimony being viewed as unnecessary or unhelpful (Cooper & Neuhaus, 2000; Wells, Lindsey & Tousignant, 1980). However, the overall ability of jurors to update knowledge with clarifying information suggests they utilized rational thinking and System 2 processes as hypothesized.

The two groups who received expert testimony via reading a script or watching a video did not differ in verdicts at Time 1 or Time 2, indicating neither form of transmission proved superior. This result extends findings from Ross, Dunning, Toglia, and Ceci (1990), who found no differences in type of presentation for case summary information on juror decision making, to expert testimony literature.

The three groups received the same information in the initial case summary and their verdicts reflect this because they did not differ at Time 1. Those in the Control group did not receive additional case-related information; the verdicts did not change at Time 2 as hypothesized. These results replicate findings from Malavanti and Weaver (2013).

Need for Cognition

Before need for cognition was added as a covariate, juror instructions, and not expert testimony, explained a significant increase in confidence in a not guilty verdict than those who received unrelated (control) information. When need for cognition was controlled as a covariate, expert testimony now also explained a significant increase in confidence in a not guilty verdict than those who received unrelated information, suggesting both instructions and expert testimony are useful tools to introduce clarifying memory information at trial. This effect occurred even though NFC was not a significant covariate in the model. Overall, though, the pattern of clarifying information increased confidence in a not guilty verdict was the same as it was before NFC was added into the model.

Conclusion

All jurors updated their schema with new information when it became available. One advantage of measuring verdict confidence before and after memory rebuttals is the ability to control for the effect of transience, time-related changes in memory, between the two groups. In these experiments, jurors with clarifying eyewitness memory information successfully updated their story. However, these jurors were operating under

ideal conditions- there was no competition for working memory resources in this experiment. Malavanti (2012) found differences in verdicts when cognitive load was manipulated. Will the results of Experiment 1 hold when jurors are operating under conditions of high load?

CHAPTER THREE

Experiment Two

Overview

The first experiment served to establish a new paradigm in which to measure juror verdict changes, specifically targeted at evaluating the effect of eyewitness memory rebuttals. The same experimental methodology as in Experiment 1 was used in this experiment with the addition of a cognitive load manipulation during the experimental session.

A limitation of Experiment 2 in Malavanti and Weaver (2013) was that the members of the control group were not under any type of load. In the current experiment, I utilized a low load condition (two digit set) to compare with a high load condition (eight digit set) to determine if an interaction between load and memory rebuttal condition occurred. The value of using a cognitive load manipulation that is not ecologically relevant to the actual situation (i.e., memorizing numbers in a juror decision making paradigm) is that the resulting load component is a truly unbiased.

In Experiment 2, I investigated whether initial schema formations and later knowledge updating would be affected by cognitive load in a mock trial procedure similar to that in Experiment 1. Cognitive load was manipulated using a working memory task of memorizing a series of numbers.

Hypotheses

Experiment 2 had three main hypotheses:

1. Experiment 1 results will be replicated under conditions of low load. Under low load, no main effect of memory rebuttal condition will be present at Time 1, as all participants will have been exposed to the same information. Memory rebuttal condition and Time will interact. Specifically, I expected the mean verdict confidence of jurors exposed to juror instructions or expert testimony to be lower (indicating these jurors are more confident in a not guilty verdict) than the mean of the control group at Time 2.

2. A simple main effect of load will be present at Time 1. Specifically, I expected high load jurors to be more likely to convict than low load jurors at Time 1.

3. At Time 2, I expected an interaction effect of load condition and memory rebuttal condition. Specifically, jurors under conditions of low load who also read juror instructions or expert testimony are expected to be more confident in a not guilty verdict at Time 2 than jurors in the control level of memory rebuttal condition. I expected no differences in verdicts by any of the memory rebuttal jurors under conditions of high load at Time 2. An interaction effect will lend credence to the dual processing model.

Method

Participants

One hundred and thirty-eight participants (Males = 31, Females = 107, Mean age 19.91 years [SD = 1.55 years]) were recruited from Baylor's introductory psychology classes through the Sona scheduling system and received one research-participation credit that could be applied to a course research participation requirement or extra credit. All

participants completed the experiment in two thiry minute sessions, one online session and one in a laboratory. Only students over the age of 18 could be a part of study, as citizens must be over the age of 18 to participate in a jury. Students who participated in Experiment 1 were excluded from signing up for this study. All participants signed an informed consent for research participation and received a copy of the form for their records. The study was approved by Baylor's IRB and met the American Psychological Association's (2012) standards for minimal risk to the well-being of subjects.

Materials

In addition to the materials used in Experiment 1, participants in Experiment 2 had the added experimental manipulation of cognitive load.

Cognitive Load. Participants in the low load were asked to memorize a two digit numerical sequence while participants in the high load condition were asked to memorize an eight digit numerical sequence. I used four two digit sets (e.g., 3 7) and four eight digit sets (e.g., 3 9 5 2 6 1 4 7). These sets were randomly assigned to each participant, with the restriction that a participant could not receive the same numerical sequence twice.

Procedure

All participants completed the informed consent form, a demographic survey, and the NFC-R online prior to coming into the laboratory. Participants were randomly assigned to one of six independent groups (i.e., low load or high load, and memory rebuttal condition- control, expert testimony, or juror instructions). Upon entering the laboratory, an RA asked the participant to be seated in a study room. At this time,

participants were assigned an ID number, which was used for all analyses, thus preserving participants' privacy and anonymity.

To begin the experiment, the RA told the participant, "Throughout this experiment, you will be simulating the role of a juror in an armed robbery trial." Participants were told to memorize an assigned numerical sequence, depending on their level of cognitive load condition in order to simulate the cognitive business of jurors. Subsequently, they were asked to read a case summary at their own pace. The case summary included background information of the crime, prosecution statements, and defense statements. Next, participants read an eyewitness' testimony from the same crime. After reading the eyewitness testimony, the RA asked for their numerical sequence. Then, the RA gave all participants a verdict sheet and asked them to render a "Not Guilty" or "Guilty" judgment based on the information provided (i.e., verdict at Time 1) as well as indicate the degree of confidence in their verdict.

Afterwards, participants were told to memorize a second assigned numerical sequence, depending on their level of cognitive load condition, in order to simulate the continuing cognitive business of jurors throughout the duration of the trial. Next, participants read one of three memory rebuttal documents. After completion of the memory rebuttal, participants were asked to verbally recall their numerical sequence. Then, the RA asked the participants to render judgment on the defendant using the two same scales as before (i.e., verdict at Time 2). The RA then asked several questions (as an end-of-study survey) to assess awareness of details throughout the study and then fully debriefed the participant.

Results

The study consisted of six independent treatment combinations, with the restriction of 23 participants in each combination for equal cell sizes: Low Load/Control, Low Load/Juror Instructions, Low Load/ Expert Testimony, High Load/Control, High Load/Juror Instructions, High Load/ Expert Testimony. Unless stated otherwise, the data were analyzed using a 3 (experimental condition, 3 levels between-subjects) by 2 (load condition, 2 levels between-subjects) by 2 (decision time, 2 levels within-subjects) ANOVA, also known as an SPF-32·2 ANOVA design. A verdict of not guilty or guilty was recoded as -1 and +1, respectively. This variable was multiplied by the juror's chosen confidence percentage, resulting in a continuous dependent variable, Verdict Confidence, for time 1 (VC1) and time 2 (VC2) for the statistical analyses.

Manipulation Check

After each cognitive load manipulation, participants were asked to recall the numerical sequence. If the participant correctly recalled the numbers, the participant was included in the subsequent analyses under the assumption that he or she correctly followed the instructions of holding the information in working memory. Therefore, 6 low load and 51 high load participant data were excluded from further analyses: Low Load/Control (n = 22), Low Load/Juror Instructions (n = 21), Low Load/ Expert Testimony (n = 20), High Load/Control (n = 6), High Load/Juror Instructions (n = 5), High Load/ Expert Testimony (n = 7).

Dichotomous Verdicts. As an added manipulation check, proportions of guilty verdicts was assessed for the excluded participants across all groups at Time 1 and Time

2. Jurors voted not guilty at both Time 1 (*M* = .36, *SEM* = .07) and Time 2 (*M* = .23, *SEM* = .06). Proportion of guilty verdicts was assessed for all remaining participants across all groups at Time 1 and Time 2. Jurors voted not guilty at both Time 1 (*M* = .19, *SEM* = .04) and Time 2 (*M* = .13, *SEM* = .04). These proportions indicate the excluded participants were more likely overall to vote guilty initially.

Memory Rebuttals

Means and standard errors for verdict confidence scores are in Table 3.1.

Table 3.1

Mean Verdict Confidence Score and SEM at Time 1 and Time 2 for Each Memory Rebuttal Condition Collapsed across Load Conditions

	Time 1		Time 2	
Memory Rebuttal Condition	*M*	*SEM*	*M*	*SEM*
Control	-35.40	12.40	-33.70	11.50
Expert Testimony	-42.45	11.67	-60.96	10.83
Juror Instructions	-47.42	10.63	-61.84	9.86

Overall, verdict confidence scores changed over time, $F\,(1,78) = 9.13$, $p = .009$, $\eta_p^2 = .077$. This represented a medium effect size. There was a small but non-significant main effect of memory rebuttal condition, $F\,(2,78) = 0.99$, $p = .377$, $\eta_p^2 = .021$. In addition, there was a small but non-significant Time by Condition interaction, $F\,(2, 78) = 2.31$, $p = .106$, $\eta_p^2 = .051$ (See Figure 3.1). Those in the control group showed no change

from Time 1 to Time 2. Those who received memory rebuttal information were also unlikely to change verdicts over time.

Although the Time by Condition interaction was not significant, a one-way ANOVA was conducted to assess differences in verdicts across memory rebuttal condition at Time 2. This confirmed a simple main effect of condition at Time 2, $F\ (2, 78) = 3.20$, $p = .046$, $\eta_p^2 = .068$ (See Figure 3.2). This represented a medium effect size.

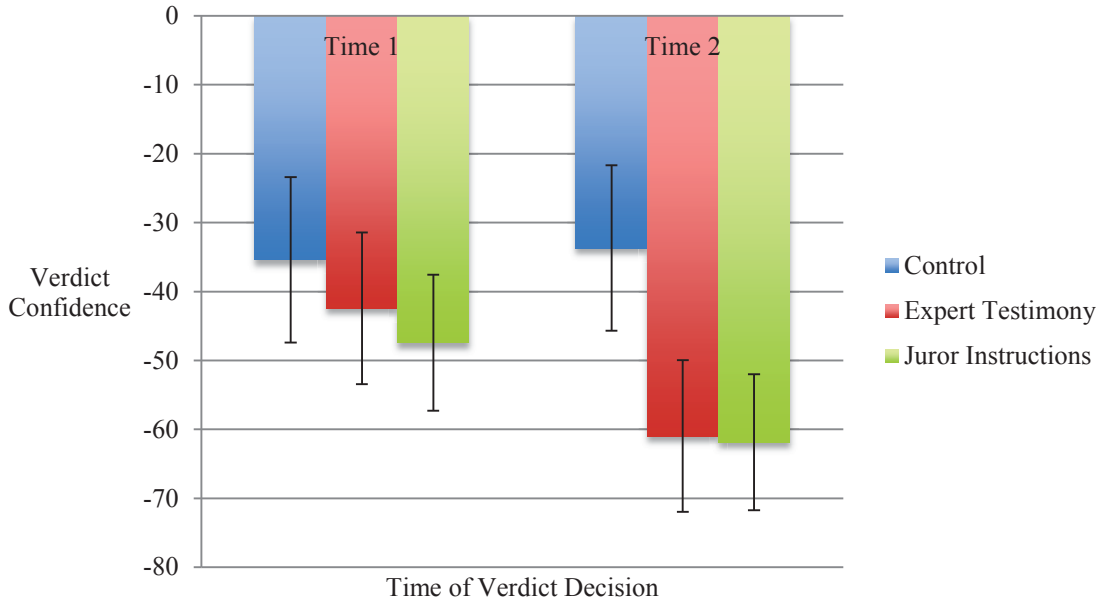

Figure 3.1. Verdict confidence score as a function of time of verdict decision and memory rebuttal condition.

Cognitive Load

Means and standard errors for verdicts under low load or high load are in Tables 3.2 and 3.3, respectively. There was a small but non-significant main effect of cognitive load condition, $F\ (1,78) = 1.85$, $p = .183$, $\eta_p^2 = .021$. There was no interaction effect of cognitive load with time, $F\ (1,78) = 0.81$, $p = .371$, $\eta_p^2 = .009$; with memory rebuttal

condition, $F\,(2,78) = .05$, $p = .948$, $\eta_p^2 = .001$; or with both time and memory rebuttal condition, $F\,(1,78) = .36$, $p = .702$, $\eta_p^2 = .008$ (See Figures 3.3 and 3.4).

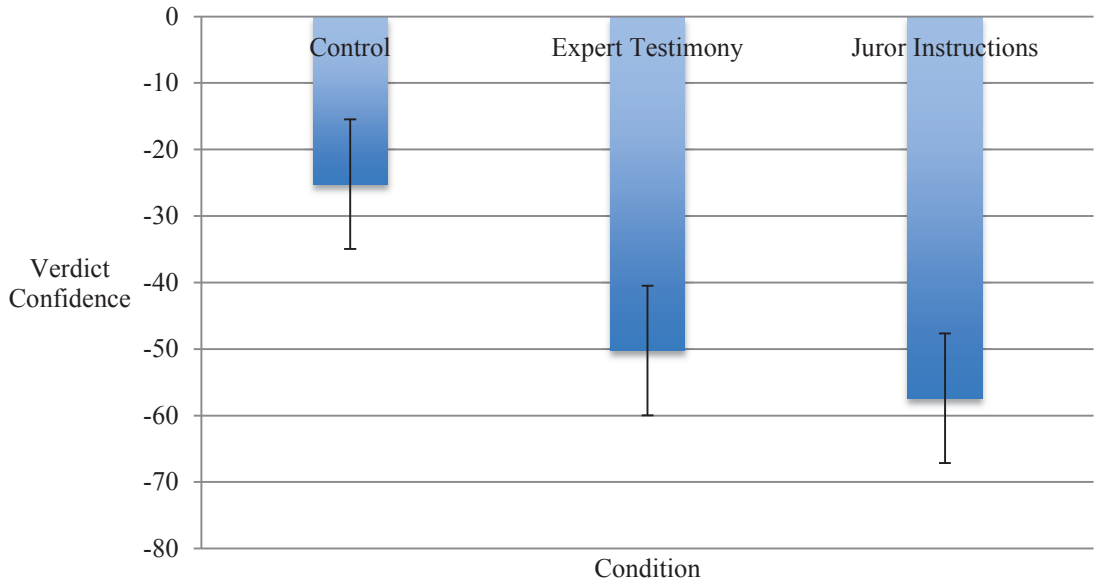

Figure 3.2. Verdict confidence score as a function memory rebuttal condition at Time 2.

Effect size analyses were utilized to determine magnitude of differences in verdict confidence scores by load. Under conditions of low load, Cohen's *d* indicated a small effect of juror instructions on verdict confidence over time ($d = .22$). Also, there was a large effect of instructions on verdict confidence when compared to control jurors at Time 2 ($d = .57$). There was a small effect of expert testimony on verdict confidence over time ($d = .22$). There was a large effect of expert testimony on verdict confidence when compared to control jurors at Time 2 ($d = .57$).

Under conditions of high load, Cohen's *d* indicated a small effect of juror instructions on verdict confidence over time ($d = .28$). Also, there was a large effect of instructions on verdict confidence when compared to control jurors at Time 2 ($d = .98$). There was a large effect of expert testimony on verdict confidence over time ($d = .50$).

There was a large effect of expert testimony on verdict confidence when compared to control jurors at Time 2 (d = .80).

Table 3.2

Means and SEM at Time 1 and Time 2 for Each Memory Rebuttal Condition under Low Load

	Time 1		Time 2	
Memory Rebuttal Condition	*M*	*SEM*	*M*	*SEM*
Control	-29.13	11.28	-27.39	10.46
Expert Testimony	-33.48	11.28	-54.78	10.46
Juror Instructions	-32.61	11.28	-54.78	10.46

Table 3.3

Means and SEM at Time 1 and Time 2 for Each Memory Rebuttal Condition under High Load

	Time 1		Time 2	
Memory Rebuttal Condition	*M*	*SEM*	*M*	*SEM*
Control	-41.67	11.82	-40.00	13.78
Expert Testimony	-51.43	10.94	-67.14	12.75
Juror Instructions	-62.22	9.65	-68.89	11.25

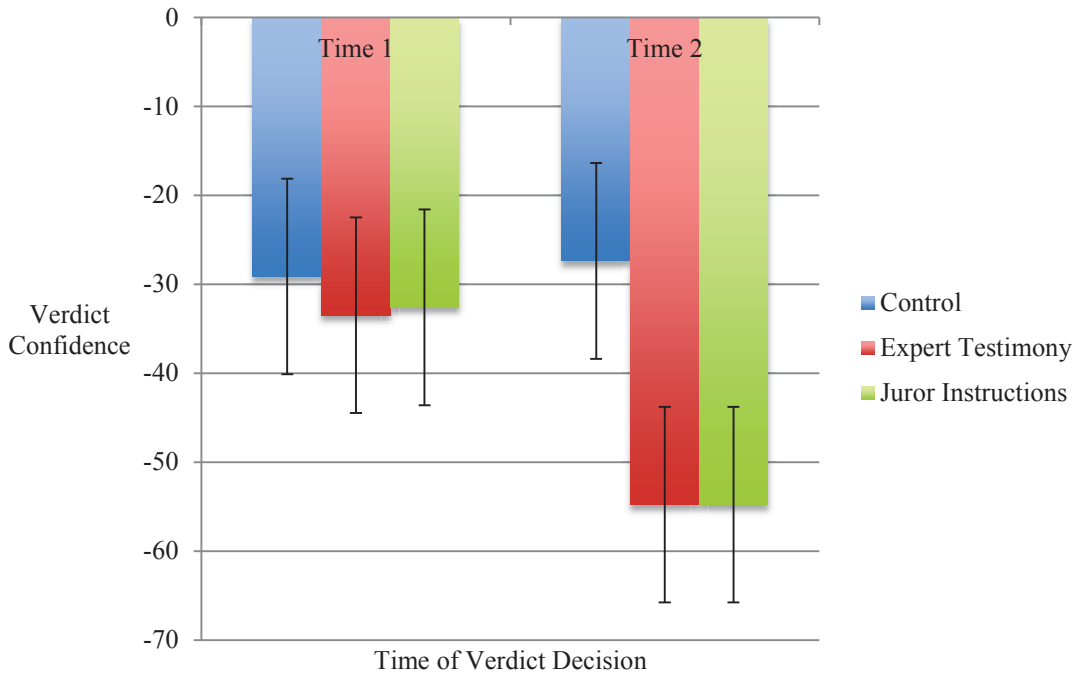

Figure 3.3. Verdict confidence score as a function of time of verdict decision and memory rebuttal condition under low load.

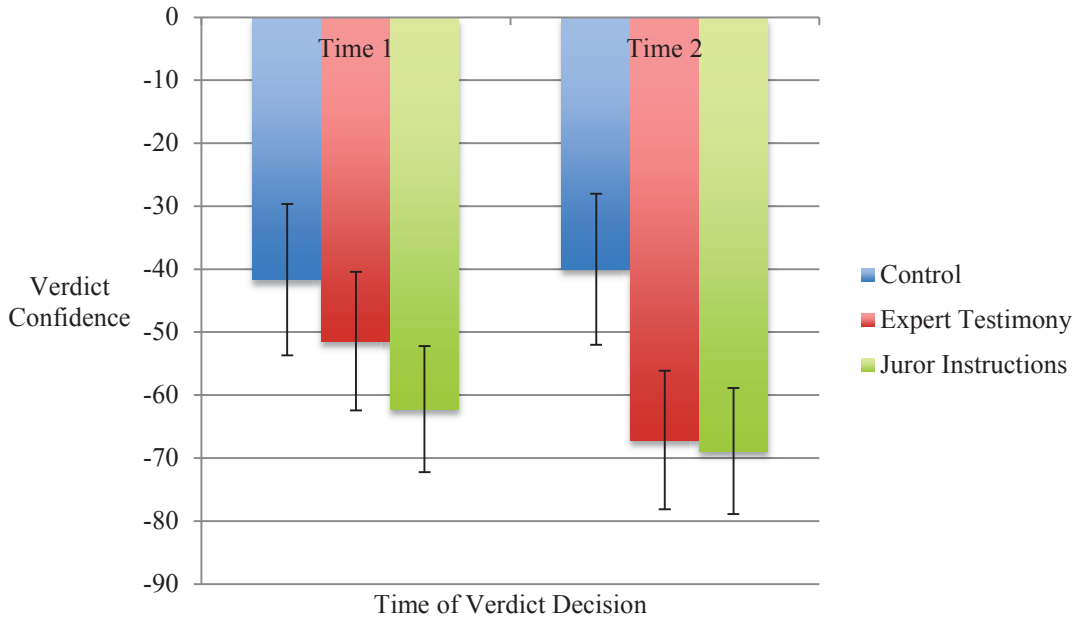

Figure 3.4. Verdict confidence score as a function of time of verdict decision and memory rebuttal condition under high load.

Need for Cognition

Correlation analysis revealed a positive relationship between NFC and verdict at Time 1 ($r = .117$) and a positive relationship with verdict at Time 2 ($r = .145$). When NFC was entered as a covariate, the overall pattern of results did not change (See Table 3.4).

Verdicts did not change over time, $F\ (1,74) = 0.02$, $p = .881$, $\eta_p^2 = .000$, and the Memory Rebuttal condition had a small but non-significant main effect on verdicts, $F\ (2, 74) = 1.0$, $p = .368$, $\eta_p^2 = .027$. NFC had no effect on verdicts, $F\ (1,74) = 0.45$, $p = .506$, $\eta_p^2 = .006$. Cognitive Load had a small but non-significant effect on verdicts, $F\ (1,74) = 1.34$, $p = .250$, $\eta_p^2 = .018$. There was a small but non-significant Time and Memory Rebuttal condition variables interaction, $F\ (2,74) = 2.22$, $p = .116$, $\eta_p^2 = .057$ (See Figure 3.6). As predicted, those in the control group showed no change from Time 1 to Time 2. Those who received memory rebuttal information did not change verdicts over time.

Table 3.4

Means and SEM at Time 1 and Time 2 for Each Memory Rebuttal Condition with NFC Entered as a Covariate

	Time 1		Time 2	
Memory Rebuttal Condition	*M*	*SEM*	*M*	*SEM*
Control	-34.32	12.72	-32.79	11.63
Expert Testimony	-43.93	12.12	-64.12	11.09
Juror Instructions	-46.70	13.73	-60.68	12.56

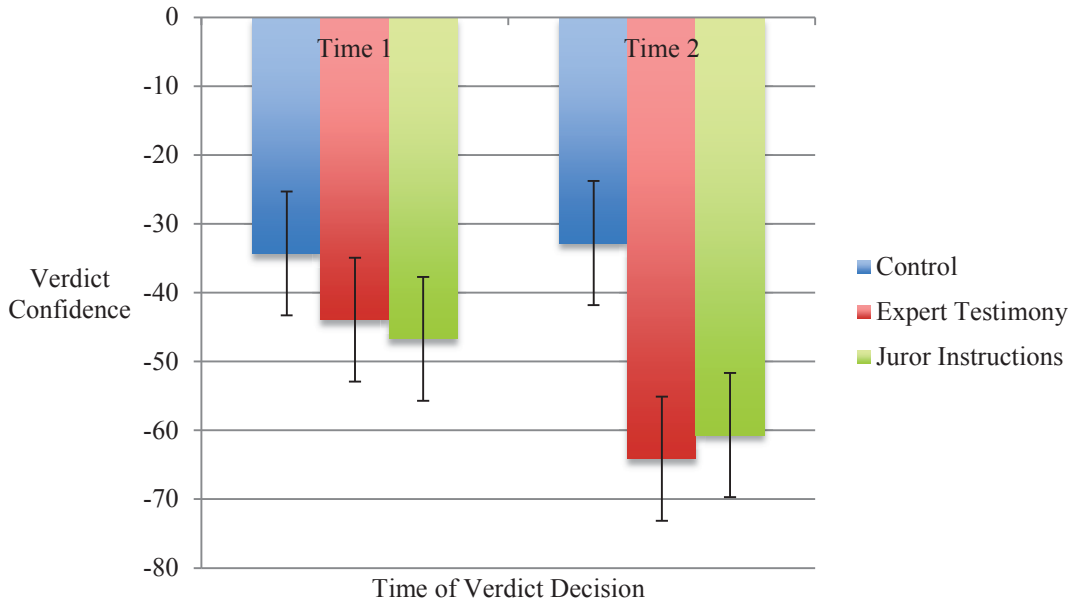

Figure 3.5. Verdict confidence score as a function of time of verdict decision and memory rebuttal condition (NFC = 55.95).

Discussion

Memory Rebuttal

Experiment 2 replicated the main effects observed in Experiment 1. Verdict confidence scores changed over time, indicating jurors were likely to utilize the new information in their second verdict. Additionally, a simple main effect of condition at Time 2 revealed those who received clarifying memory information were more confident in a not guilty verdict than those who received unrelated information. As expected, those who received additional unrelated information did not change their verdict confidence over time. In this experiment, expert testimony and detailed instructions were equally beneficial ways of getting eyewitness memory-related information to jurors.

Cognitive Load

High load jurors on the whole were more likely to vote not guilty than low load jurors. At Time 1, the initial verdict confidence score for high load jurors was centered at about -50 whereas the initial verdict confidence score was centered at approximately -30 for low load jurors. This pattern persisted at Time 2. The fact that jurors operating under conditions of high load were more confident in a not guilty verdict than the low load jurors lends credence to a dual process decision-making model. Jurors operating under conditions of high load were more affected by the initial case summary and were more likely to vote not guilty, demonstrating a reliance on System 1 or heuristic processing. Additionally, verdicts were unlikely to change over time, relying on System 1 processes again. This pattern replicates Experiment 1 in Malavanti and Weaver (2013).

Looking at the patterns that occurred in the data, a replication of Experiment 1 is seen in jurors under both low and high load, although those with low load more closely replicated the pattern seen in Experiment 1. High load jurors were more confident than low load jurors in a not guilty verdict at Time 1. I hypothesized that jurors under high load would focus on the eyewitness statement and therefore be more likely to vote guilty at Time 1. The data suggest the eyewitness statement at Time 1 had less of an impact on these jurors due to the cognitive busyness caused by the working memory task. Unable to rationally process the eyewitness statement, these jurors demonstrated a reliance on System 1 processes because System 2 was overloaded with memorizing numbers.

Additionally, an examination of verdict confidence score changes for jurors who received clarifying memory information revealed that jurors under low load were more likely to change verdicts over time (21.3% change for jurors who received expert

testimony and 22.17% change for jurors who received juror instructions), which closely follows the pattern of change in verdicts in Experiment 1 (approximately 30.5% change for each memory rebuttal condition). Jurors operating under conditions of high load, however, were much less likely to change verdicts over time (15.71% change for jurors who received expert testimony and 6.67% change for jurors who received juror instructions). This decision-making pattern under load replicates Experiment 1 in Malavanti and Weaver (2013). Verdicts were unlikely to change over time for all jurors under high load, again demonstrating a reliance on System 1 processes.

Although the effects on decision-making under high load were in the predicted direction (highly confident in not guilty verdict initially and over time when compared to low load jurors), they did not reach levels of statistical reliability. The dual-process working memory manipulation used in the experiment has been well established in the literature. This manipulation has been successfully utilized in studies of juror decision making over time, such as Malavanti and Weaver (2013). One explanation for the lack of differences between low load and high load jurors is that the initial case summary and eyewitness testimony in this experiment was a more taxing read than the case summary previously used. Indeed, while the information was largely the same, the case summary and eyewitness statement was more detail-rich than the one used in Malavanti and Weaver (2013). Additionally, the low sample size in the high load condition is a serious limitation (n = 18, total N = 81). Indeed, post hoc power analyses revealed actual power = .48.

A comparison of proportion of guilty verdicts for the excluded participants versus the included participants revealed the remaining participants were more likely to vote not

guilty overall. The tendency for the excluded participants to vote guilty may be explained by the lack of load on their working memory. These excluded participants could not correctly recall the numerical sequence and as such, were hypothesized to have not been rehearsing the information correctly throughout the decision-making process. An increased sample size would help reduce the error variance and increase degrees of freedom.

Need for Cognition

When need for cognition was added to the model as a covariate, the same overall pattern was observed as in Experiment 1. Need for cognition did seem to help explain verdict changes at Time 2 for those who received expert testimony, but reduced power limits definitive statements.

This experiment was the first to compare the effectiveness of instructions and expert testimony under conditions of load. Future research should utilize a large enough sample size to accommodate the manipulation check on load.

CHAPTER FOUR

General Discussion

Pennington and Hastie's (1983) story model of juror decision-making has profoundly influenced the past 25 years of research in this area. Above all else, jurors must evaluate evidence and adjust their decision accordingly. According to Hastie, Penrod, and Pennington (1983), all jurors form "stories" early in the decision-making process. Then, they modify those views as new evidence is brought forth. The original paradigm introduced in these studies involved making verdict decisions based on information provided which included reading a case summary, eyewitness testimony and a type of memory rebuttal. This was the first experiment to methodically measure the effectiveness of the new Henderson instructions and compare the effectiveness of these detailed juror instructions to that of expert testimony, adding to the juror decision-making literature.

Members of a jury are unlikely to have knowledge of eyewitness memory or memory in general (Benton et al, 2006; Kassin et al, 2001; Schmechel et al, 2006; Simons & Chabris, 2011). Our results suggest both Henderson instructions and expert testimony are helpful in providing eyewitness memory-related information to jurors who otherwise would not have access to this knowledge.

Mock jurors were able to process initial information, and made changes when new information becomes available: jurors modified their verdicts after receiving clarifying memory information (Experiment 1). This interaction suggests System 2

process were utilized as theorized. Jurors were able to process the clarifying information rationally and were therefore more confident in a not guilty verdict.

As expected, jurors who received clarifying information in any form chose verdict confidence scores similar to each other at Time 2. That is, verdicts of jurors who received detailed juror instructions did not differ from verdicts of jurors who received expert testimony at Time 2. Of note, jurors who received clarifying information in the form of instructions were found to be significantly different from control jurors, but jurors who received clarifying information in the form of expert testimony were not significantly different than controls at Time 2. This suggests detailed juror instructions are a more beneficial way of introducing clarifying eyewitness memory information than expert testimony.

The Henderson instructions explained the same memory-related information as the expert testimony in these experiments. As such, the instructions may increase scrutiny on an eyewitness testimony (Loftus, 1980, Hosch, Beck & McIntyre, 1980) and on conditions of the crime (Cutler, Penrod, & Dexter, 1989). Additionally, the Henderson instructions improved on the Telfair instructions by clearly explaining the impact estimator and system variables have on eyewitness memory. The Henderson juror instructions make it very clear that all statements are research-based and generally accepted by experts in the field. This important distinction may increase the effectiveness of juror instructions, in the same way expert testimony that is scientifically linked is more effective at trial over anecdotal evidence (Kovera, Gresham, Bogida, Gray, & Regan, 1997). This distinction may be a reason why the Henderson instructions significantly

affected verdicts in this experiment, while the Telfair instructions proved ineffective when utilized in a juror decision-making study (Penrod & Cutler, 1989).

In Experiment 2, all participants were randomly assigned to memory rebuttal groups with the added experimental manipulation of processing information under low or high cognitive load. Experiment 2 provided evidence that jurors operating under conditions of cognitive load do not change verdicts. Jurors may be unable to update knowledge due to reliance on heuristics or previous impressions (Gilbert, Pelham, & Krull, 1988) or decreased ability to filter out unnecessary or distractor information (Longstaffe, Hood, Gilchrist, 2014). Jurors must pay attention to all information in the duration of a trial. However, increased cognitive load may have jurors unable to pinpoint particularly important pieces of evidence, such as clarifying memory information. Because verdicts did not change for low load or high load jurors, the patterns seen in Experiment 2 and subsequent explanations are not definitive. Still, with a larger sample, the pattern shown for high load jurors may be clarified. This experiment should be replicated with an increased sample size to account for the manipulation check on load effectiveness and possible removal of participants.

Unexpectedly, jurors who received instructions were more affected by high load than those who received expert testimony. Jurors who received memory information in the form of expert testimony were more likely to increase confidence in their verdict, indicating reduced impairment by cognitive load. Expert testimony, and not instructions, seems to be a better way at getting clarifying eyewitness memory information to jurors when they are under conditions of high load. This may be due to increased persuasiveness of having information presented by a person who is deemed an expert by

the court (Cooper & Neuhaus, 2000). Despite the limitations of hiring experts, such as cost and standardization, the present research is supportive of expert testimony being utilized by defendants for their case, especially when case complexity is high. However, the reduced power, a function of high variability and low degrees of freedom, preclude strong conclusions. For the present experiments, jurors under high load do not change verdicts over time.

Need for cognition did not explain unique variance in juror decision-making, however, it may still be a useful tool for voir dire proceedings (Leippe, Eisenstadt, Rauch, & Seib, 2004; McAuliff & Kovera, 2008). Jurors high in need for cognition enjoy critical thinking; this case systematically included estimator variables as a method of getting jurors to pay attention to basic but critical facts of the case (i.e., race of the defendant, stress during the crime, and presence of the gun). Therefore, need for cognition may be an important individual difference variable that should be measured in juror decision-making studies.

Jurors must process information presented during the trial and update that knowledge when new information becomes available. Finally, they must retrieve and attend to this information during deliberation. Jurors in these experiments updated their knowledge with the presence of new information. Information that reduces available cognitive resources, though, may compromise both their ability to acquire knowledge initially and then update that new clarifying information when they are operating under conditions of high load. Expert testimony and juror instructions had a predictable effect on verdict confidence when jurors were not operating under conditions of high load. However, the inability to change verdict confidence when jurors are under conditions of

high load may lead to juries that are easily persuaded by other factors, such as the information that is first presented during a case, and not on the clarifying information that should help the defendant's case tremendously.

APPENDICES

APPENDIX A

Required Sample Size and Power Analysis

Experiment 1

A power analysis for an SPF-3·2 experimental design was conducted using G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) using the following assumptions: The Type II error rate was set at b = .20 (power = .80) and Type I error rate at a = .05. The required sample size for Experiment 1 is shown in Table 1.

Table 1

Required *n* Calculation Results for Experiment 1

Required *n*	Calculation Method
957	Cohen J., 1992 "small" effect size
102	Cohen J., 1992 "medium" effect size
33	Cohen J., 1992 "large" effect size

Using a medium effect size ($f^*_A = 0.353$) calculated using Kirk (2012) and Cohen (1992) procedures, approximately 102 participants result in an 80% chance of finding a true effect due to changes in the independent variable with a 5% chance of a false positive (rejecting our null hypothesis when the null hypothesis is actually true). Our estimates of effect sizes are based off Cohen's (1992) claim that medium effect size represents an effect likely to be visible to the naked eye of a careful observer. Due to this we plan to recruit for 120 participants for Experiment 1, allowing for 40 participants in each treatment combination. The total number will meet the participant requirement for a medium effect size and has been shown in prior studies (e.g., Malavanti & Weaver, 2013;

Kassin & Sommers, 2007) as an adequate sample size. We recruited 150 participants for this experiment. Actual power for this design and sample size = .97.

Experiment 2

A power analysis for an SPF-32·2 experimental design was conducted using G*Power using the following assumptions: The Type II error rate was set at b = .20 (power = .80) and Type I error rate at a = .05. The required sample size for Experiment 2 is shown in Table 2.

Table 2

Required *n* Calculation Results for Experiment 2

Required *n*	Calculation Method
636	Cohen J., 1992 "small" effect size
114	Cohen J., 1992 "medium" effect size
48	Cohen J., 1992 "large" effect size

Using a medium effect size ($f^*_A = 0.353$), approximately 114 participants result in an 80% chance of finding a true effect due to changes in the independent variable with a 5% chance of a false positive (rejecting our null hypothesis when the null hypothesis is actually true). Due to this we plan to recruit for 150 participants for Experiment 2, allowing for 25 participants in each treatment combination. The total number will meet the participant requirement for a medium effect size and has been shown in a prior study as an adequate sample size. For this design and sample size, power = .90. Due to time constraints and manipulation check, only 81 participants were included out of the 138 recruited. Actual power for this design and sample size =.43.

APPENDIX B

Court Case Summary

1. At 7:03 P.M. on September 26, 2007, a heavy-set dark-skinned black male matching the defendant's description entered the convenience store wearing a hooded jacket. He approached the counter, lifted his hood onto his head and proceeded to rob the manager of the store at gunpoint. The suspect, and his "look out," fled with an undisclosed amount of money in a gold Jeep Cherokee.
2. What follows is a summary of the trial proceedings in the case of Cefco v. Alan Crowtzer. The defendant was charged with one count of Armed Robbery.
3. In his opening statement, the prosecutor claimed the evidence will show that Alan Crowtzer robbed the Cefco at gunpoint during the evening of September 26, 2007. Crowtzer denies involvement in the robbery, but the evidence will prove that he had the means and opportunity.
4. The prosecutor outlined his theory of the case. On the night of the armed robbery, Crowtzer with the help of an unidentified friend decided to rob a local gas station. The evidence presented by the prosecution included a positive identification of the defendant by the store clerk. The police also found money in the defendant's closet that was very close to the amount reported stolen, and the defendant had a gun registered to his name. Crowtzer did not have substantial savings and desperately needed the money.
5. The defense attorney opened by claiming that all the evidence is purely circumstantial. After all, Crowtzer never confessed. The defense claimed that the defendant was in the convenience store as a customer earlier that day, and that the defendant's girlfriend provided an alibi indicating that he was not present at the store at the time of the robbery. The defense also claimed that the gun registered in the defendant's name was stolen several years earlier, though no police report was ever made. The defense also claimed that the money in the closet represented savings from the defendant's job. It is clear that the prosecution has failed to prove its case.
6. The prosecutor began his closing argument by reminding the jury that a gas station was robbed, and someone had to pay for the damages. He fit the physical profile of the robber. The weapon was never found, but Crowtzer did own a gun and had ample time to dispose of it. In light of all the evidence, the defendant should be found guilty of armed robbery.
7. The defense lawyer began closing argument by acknowledging Alan Crowtzer frequented the gas station on occasion. So what is the crime against Crowtzer?

There was no confession and no weapon, only weak circumstantial evidence. The defense attorney concluded by arguing the prosecution has failed to prove its case beyond a reasonable doubt and that Crowtzer should be found not guilty.

APPENDIX C

Eyewitness Statement

1. The witness for the prosecution was Omar Patel, an Indian man who served as the cashier on the night of the incident. He positively identified the defendant as the man who robbed the convenience store the night of September 26, 2007. He was very confident in his identification. He stated that he would never forget the defendant's face or the type of gun used during the robbery. He stated that he feared for his life during the short duration of the robbery and that is why he gave up the money.
2. Patel rebuked the defense attorney's notion that the defendant was in the store earlier on the same day, although he acknowledged that he didn't remember the face of every person who walked in the store that day. He was then shown a photograph of a man who was known to be in the store earlier that day, before the robbery was committed. The eyewitness stated that the man did resemble the defendant, but stood by his identification of Alan Crowtzer, the defendant, as the man who robbed the store.

APPENDIX D

Verdict Assessment

Please consider the all evidence presented to you. Then, make a judgment as you would if you were passing final judgment on this particular case.

1. On the case against Alan Crowtzer, do you find the defendant:

Guilty Not guilty

2. Indicate the degree of confidence you have in the above verdict decision:

0% 10 20 30 40 50 60 70 80 90 100%

No Confidence Moderate Confidence Complete Confidence

APPENDIX E

Memory Rebuttal: Expert Witness Statement

The fact that memory is reconstructive rather than reproductive is generally accepted in the scientific community. Human memory is not foolproof. Research has revealed that human memory is not like a video recording that a witness need only replay to remember what happened. In other words, our recall is often organized in ways that 'make sense' of the present. We interpret the past by correcting ourselves, adding bits and pieces, deleting certain recollections and interpreting reality in a very subjective manner. Thus, our representation of the past is not fixed, but rather is changed over time because of various factors. Eyewitness identification evidence must be scrutinized carefully. Human beings have the ability to recognize other people from past experiences and to identify them at a later time, but research has shown that there are risks of making mistaken identifications. That research has focused on the nature of memory and the factors that affect the reliability of eyewitness identifications.

Memory research indicates that there are a number of factors that affect the accuracy of memory.

Stress: Contrary to popular belief, high levels of stress do not improve a witness' ability to perceive and recall events. Studies have shown that the effects of stress are distributed along a curve (termed the "Yerkes-Dodson law"). At low levels of stress, witnesses tend to be inattentive, and as a result are likely to be inaccurate. At moderate levels of stress, memory improves because a person focuses better. However, at high levels of stress a person has difficulty concentrating, which adversely affects the ability to store details of an event. Thus, it is not the case that a victim who views an attacker during the stress of a criminal event will have a "flashbulb memory" of the event as a result of the stress. Stress can affect a witness' original perception of an event as well as his subsequent recall of the event. Stress and other forms of emotional provocation can improve perception to some extent, but when stress levels get too high, they can impair a witness' ability to assess the situation accurately. Violence is one major factor that causes stress for eyewitnesses of crime, particularly victims. Studies have shown that witnesses perceive details of violent events less accurately than non-violent events. This is likely a result of stress, which limits the witness' ability to focus on the details of the event. A witness to a violent event may be able to recall the general events, but is likely to be less accurate in describing the perpetrator. However, this effect is limited to the violent portions of an event. Thus, if a witness has an opportunity to view the perpetrator of an offence in a non-violent situation (for example, at the start of a crime before violence is

manifested), they are more likely to be accurate than if they do not have this opportunity.

Duration: In general, accuracy of facial identification improves the longer the original time in which the witness can view the face. A brief or fleeting contact is less likely to produce an accurate identification than a more prolonged exposure to the perpetrator. In addition, time estimates given by witnesses may not always be accurate because witnesses tend to think events lasted longer than they actually did.

Weapon Focus: Presence of a weapon is also an important factor. Witnesses whose identification evidence is based on an original viewing of the person at a time when the assailant was holding a weapon are less accurate in making facial identifications than witnesses who make the original observations when no weapon is present. Researchers refer to this phenomenon as 'weapon focus.' As a result of weapon focus, witnesses spend less time focusing on other details of the crime, including the appearance of the assailant. This may result in less accurate eyewitness identifications, especially in short duration crimes. However, the longer the event, the more time the witness may have to adapt to the presence of the weapon and focus on other details

Distance: A person is easier to identify when close by. The greater the distance between an eyewitness and a perpetrator, the higher the risk of a mistaken identification. In addition, a witness's estimate of how far he or she was from the perpetrator may not always be accurate because people tend to have difficulty estimating distances.

Lighting: The lighting conditions at the time and location of the given event can affect a witness' perception. As common sense indicates, humans have better vision in good lighting than in poor lighting. Good lighting allows a person to store more information about an event in his memory; consequently, he will have to remember more upon later recall.

Disguises/Changed Appearance: The perpetrator's use of a disguise can affect a witness' ability both to remember and identify the perpetrator. Disguises like hats, sunglasses, or masks can reduce the accuracy of an identification.

Confidence and Accuracy: Common sense may suggest that the more confident a witness is, the more likely it is that his memory is accurate. However, psychological research has shown little or no correlation between eyewitness confidence and accuracy. In some studies, researchers asked eyewitnesses how confident they were in their ability to make a positive identification before viewing a lineup. This pre-identification confidence proved to be a poor predictor of the witnesses' actual ability

to identify the correct suspect in the lineup. Other studies asked eyewitnesses about their confidence levels after they had viewed a lineup and made an identification. The correlation between post-identification confidence and accuracy was only slightly higher than that for pre-identification confidence. Some studies have shown no relationship at all between confidence and accuracy, and some even suggest a negative correlation—that witnesses can be more confident when they are inaccurate than when they are accurate. In addition, witness confidence is subject to outside influences. Witnesses who are questioned repeatedly become more confident in their accounts, regardless of accuracy. Those who are told they have identified the "correct" suspect also become more confident. Taken together, this research indicates that although juries often consider eyewitness confidence in weighing credibility, confidence is an unreliable indicator of accuracy, and can be influenced by factors bearing no relation to the accuracy of a witness's identification.

Time Elapsed: Another factor that can influence eyewitness accuracy is the simple passage of time. Memory does not diminish at a uniform rate. Rather, we forget at a rapid rate immediately following an event, and the rate of forgetting then diminishes over time. This is called the "forgetting curve." Thus, even if an eyewitness testifies shortly after an event, his memory may already be substantially diminished. In other words, the more time that passes, the greater the possibility that a witness' memory of a perpetrator will weaken.

Cross-Racial Effects: Research has shown that cross-racial identifications tend to be less accurate than identifications of a person of the same race as the witness. Studies have shown that this is true among different races. Studies have also shown that racial prejudices or lack of exposure to people of other races are not the cause of this phenomenon. People are generally better at recognizing the faces of people who are the same race as they are. Witnesses identify same-race faces correctly more often, and falsely identify them less often. There is substantial psychological research to support the existence of this phenomenon, but there is little indication of why this is the case. One theory is that people have more experience with their own race, and therefore are better able to recognize same-race faces than different-race faces. However, numerous studies have shown that witnesses with substantial exposure to another race were no better at recognizing different-race faces. Another theory is that racial prejudice may influence eyewitness identification of different-race faces, but psychological research has found that racial attitudes have no impact on accuracy. Regardless of the cause, reduced accuracy in cross-race identifications is highly relevant in any trial involving an eyewitness of a different race than the defendant.

APPENDIX F

Memory Rebuttal: Henderson Juror Instructions

Alan Crowtzer, as part of his general denial of guilt, contends that the State has not presented sufficient reliable evidence to establish beyond a reasonable doubt that he is the person who committed the alleged offense. The burden of proving the identity of the person who committed the crime is upon the State. For you to find Alan Crowtzer guilty, the State must prove beyond a reasonable doubt that this person is the person who committed the crime. Alan Crowtzer has neither the burden nor the duty to show that the crime, if committed, was committed by someone else, or to prove the identity of that other person. You must determine, therefore, not only whether the State has proved each and every element of the offense charged beyond a reasonable doubt, but also whether the State has proved beyond a reasonable doubt that Alan Crowtzer is the person who committed it.

The State has presented testimony that on a prior occasion before this trial, Omar Patel identified Alan Crowtzer as the person who committed Armed Robbery. According to the witness, his identification of the defendant was based upon the observations and perceptions that he made of the perpetrator at the time the offense was being committed. It is your function to determine whether the witness's identification of Alan Crowtzer is reliable and believable or whether it is based on a mistake or for any reason is not worthy of belief. You must decide whether it is sufficiently reliable evidence that Alan Crowtzer is the person who committed the offense charged.

Eyewitness identification evidence must be scrutinized carefully. Human beings have the ability to recognize other people from past experiences and to identify them at a later time, but research has shown that there are risks of making mistaken identifications. That research has focused on the nature of memory and the factors that affect the reliability of eyewitness identifications.

Human memory is not foolproof. Research has revealed that human memory is not like a video recording that a witness need only replay to remember what happened. Memory is far more complex. The process of remembering consists of three stages: acquisition -- the perception of the original event; retention -- the period of time that passes between the event and the eventual recollection of a piece of information; and retrieval -- the stage during which a person recalls stored information. At each of these stages, memory can be affected by a variety of factors.

Relying on some of the research that has been done, I will instruct you on specific factors you should consider in this case in determining whether the eyewitness identification evidence is reliable. In evaluating this identification, you should consider the observations and perceptions on which the identification was based, the witness's ability to make those observations and perceive events, and the circumstances under which the identification was made. Although nothing may appear more convincing than a witness's categorical identification of a perpetrator, you must critically analyze such

testimony. Such identifications, even if made by good faith, may be mistaken. Therefore, when analyzing such testimony, be advised that a witness's level of confidence, standing alone, may not be an indication of the reliability of the identification. In deciding what weight, if any, to give to identification testimony, you should consider the following factors that are related to the witness, the alleged perpetrator, and the criminal incident itself.

(1) The Witness's Opportunity to View and Degree of Attention: In evaluating the reliability of the identification, you should assess the witness's opportunity to view the person who committed the offense at the time of the offense and the witness's degree of attention to the perpetrator at the time of the offense. In making this assessment you should consider the following:

(a) Stress: Even under the best viewing conditions, high levels of stress can reduce an eyewitness's ability to recall and make an accurate identification. Therefore, you should consider a witness's level of stress and whether that stress, if any, distracted the witness or made it harder for him or her to identify the perpetrator.

(b) Duration: The amount of time an eyewitness has to observe an event may affect the reliability of an identification. Although there is no minimum time required to make an accurate identification, a brief or fleeting contact is less likely to produce an accurate identification than a more prolonged exposure to the perpetrator. In addition, time estimates given by witnesses may not always be accurate because witnesses tend to think events lasted longer than they actually did.

(c) Weapon Focus: You should consider whether the witness saw a weapon during the incident and the duration of the crime. The presence of a weapon can distract the witness and take the witness's attention away from the perpetrator's face. As a result, the presence of a visible weapon may reduce the reliability of a subsequent identification if the crime is of short duration. In considering this factor, you should take into account the duration of the crime because the longer the event, the more time the witness may have to adapt to the presence of the weapon and focus on other details.

(d) Distance: A person is easier to identify when close by. The greater the distance between an eyewitness and a perpetrator, the higher the risk of a mistaken identification. In addition, a witness's estimate of how far he or she was from the perpetrator may not always be accurate because people tend to have difficulty estimating distances.

(e) Lighting: Inadequate lighting can reduce the reliability of an identification. You should consider the lighting conditions present at the time of the alleged crime in this case.

(f) Intoxication: The influence of alcohol can affect the reliability of an identification. An identification made by a witness under the influence of a high level of alcohol at the time of the incident tends to be more unreliable than an identification by a witness who drank a small amount of alcohol.[12]

(g) **Disguises/Changed Appearance:** The perpetrator's use of a disguise can affect a witness's ability both to remember and identify the perpetrator. Disguises like hats, sunglasses, or masks can reduce the accuracy of an identification. Similarly, if facial features are altered between the time of the event and a later identification procedure, the accuracy of the identification may decrease.

(2) Prior Description of Perpetrator: Another factor for your consideration is the accuracy of any description the witness gave after observing the incident and before identifying the perpetrator. Facts that may be relevant to this factor include whether the prior description matched the photo or person picked out later, whether the prior description provided details or was just general in nature, and whether the witness's testimony at trial was consistent with, or different from, his prior description of the perpetrator.

(3) **Confidence and Accuracy:** You heard testimony that Omar Patel made a statement at the time he identified the defendant from a photo array/line-up concerning his level of certainty that the person/photograph he selected is in fact the person who committed the crime. As I explained earlier, a witness's level of confidence, standing alone, may not be an indication of the reliability of the identification. Although some research has found that highly confident witnesses are more likely to make accurate identifications, eyewitness confidence is generally an unreliable indicator of accuracy.

(4) Time Elapsed: Memories fade with time. As a result, delays between the commission of a crime and the time an identification is made can affect the reliability of the identification. In other words, the more time that passes, the greater the possibility that a witness's memory of a perpetrator will weaken.

(5) Cross-Racial Effects: Research has shown that people may have greater difficulty in accurately identifying members of a different race. You should

consider whether the fact that the witness and the defendant are not of the same race may have influenced the accuracy of the witness's identification.

APPENDIX G

Memory Rebuttal: Filler Reading for Control Condition (Water Cycle)

What is the water cycle?

What is the water cycle? The water cycle describes the existence and movement of water on, in, and above the Earth. Earth's water is always in movement and is always changing states, from liquid to vapor to ice and back again. The water cycle has been working for billions of years and all life on Earth depends on it continuing to work; the Earth would be a pretty stale place without it.

Where does all the Earth's water come from? Primordial Earth was an incandescent globe made of magma, but all magmas contain water. Water set free by magma began to cool down the Earth's atmosphere, and eventually the environment became cool enough so water could stay on the surface as a liquid. Volcanic activity kept and still keeps introducing water into the atmosphere, thus increasing the surface- and groundwater volume of the Earth.

A quick summary of the water cycle

The water cycle has no starting point, but we'll begin in the oceans, since that is where most of Earth's water exists. The sun, which drives the water cycle, heats water in the oceans. Some of it evaporates as vapor into the air; a relatively smaller amount of moisture is added as ice and snow sublimate directly from the solid state into vapor. Rising air currents take the vapor up into the atmosphere, along with water from evapotranspiration, which is water transpired from plants and evaporated from the soil. The vapor rises into the air where cooler temperatures cause it to condense into clouds.

Air currents move clouds around the globe, and cloud particles collide, grow, and fall out of the sky as precipitation. Some precipitation falls as snow and can accumulate as ice caps and glaciers, which can store frozen water for thousands of years. Snowpacks in warmer climates often thaw and melt when spring arrives, and the melted water flows overland as snowmelt. Most precipitation falls back into the oceans or onto land, where, due to gravity, the precipitation flows over the ground as surface runoff. A portion of runoff enters rivers in valleys in the landscape, with streamflow moving water towards the oceans. Runoff, and groundwater seepage, accumulate and are stored as freshwater in lakes.

Not all runoff flows into rivers, though. Much of it soaks into the ground as infiltration. Some of the water infiltrates into the ground and replenishes aquifers (saturated subsurface rock), which store huge amounts of freshwater for long periods of time. Some infiltration stays close to the land surface and can seep back into surface-water bodies (and the ocean) as groundwater discharge, and some groundwater finds openings in the land surface and emerges as freshwater springs. Yet more groundwater is absorbed by plant roots to end up as evapotranspiration from the leaves. Over time, though, all of this water keeps moving, some to reenter the ocean, where the water cycle "ends."

Water storage in oceans: Saline water existing in oceans and inland seas

The ocean as a storehouse of water

The water cycle sounds like it is describing how water moves above, on, and through the Earth ... and it does. But, in fact, much more water is "in storage" for long periods of time than is actually moving through the cycle. The storehouses for the vast majority of all water on Earth are the oceans. It is estimated that of the 332,600,000 cubic miles (mi^3) (1,386,000,000 cubic kilometers (km^3)) of the world's water supply, about 321,000,000 mi^3 (1,338,000,000 km^3) is stored in oceans. That is about 96.5 percent. It is also estimated that the oceans supply about 90 percent of the evaporated water that goes into the water cycle.

During colder climatic periods more ice caps and glaciers form, and enough of the global water supply accumulates as ice to lessen the amounts in other parts of the water cycle. The reverse is true during warm periods. During the last ice age glaciers covered almost one-third of Earth's land mass, with the result being that the oceans were about 400 feet (122 meters) lower than today. During the last global "warm spell," about 125,000 years ago, the seas were about 18 feet (5.5. meters) higher than they are now. About three million years ago the oceans could have been up to 165 feet (50 meters) higher.

Oceans in movement

If you have ever been seasick (we hope not), then you know how the ocean is never still. You might think that the water in the oceans moves around because of waves, which are driven by winds. But, actually, there are currents and "rivers" in the oceans that move massive amounts of water around the world. These movements have a great deal of influence on the water cycle. The Kuroshio Current, off the shores of Japan, is the largest current. It can travel between 25 and 75 miles (40 and 121 kilometers) a day, 1-3 miles (1.4-4.8 kilometers) per hour, and extends some 3,300 feet (1,000 meters) deep. The Gulf

Stream is a well known stream of warm water in the Atlantic Ocean, moving water from the Gulf of Mexico across the Atlantic Ocean towards Great Britain. At a speed of 60 miles (97 kilometers) per day, the Gulf stream moves 100 times as much water as all the rivers on Earth. Coming from warm climates, the Gulf Stream moves warmer water to the North Atlantic.

Evaporation: The process by which water is changed from liquid to a gas or vapor

Evaporation and why it occurs

Evaporation is the process by which water changes from a liquid to a gas or vapor. Evaporation is the primary pathway that water moves from the liquid state back into the water cycle as atmospheric water vapor. Studies have shown that the oceans, seas, lakes, and rivers provide nearly 90 percent of the moisture in our atmosphere via evaporation, with the remaining 10 percent being contributed by plant transpiration.

Heat (energy) is necessary for evaporation to occur. Energy is used to break the bonds that hold water molecules together, which is why water easily evaporates at the boiling point (212° F, 100° C) but evaporates much more slowly at the freezing point. Net evaporation occurs when the rate of evaporation exceeds the rate of condensation. A state of saturation exists when these two process rates are equal, at which point, the relative humidity of the air is 100 percent. Condensation, the opposite of evaporation, occurs when saturated air is cooled below the dew point (the temperature to which air must be cooled at a constant pressure for it to become fully saturated with water), such as on the outside of a glass of ice water. In fact, the process of evaporation removes heat from the environment, which is why water evaporating from your skin cools you.

Evaporation drives the water cycle

Evaporation from the oceans is the primary mechanism supporting the surface-to-atmosphere portion of the water cycle. After all, the large surface area of the oceans (over 70 percent of the Earth's surface is covered by the oceans) provides the opportunity for such large-scale evaporation to occur. On a global scale, the amount of water evaporating is about the same as the amount of water delivered to the Earth as precipitation. This does vary geographically, though. Evaporation is more prevalent over the oceans than precipitation, while over the land, precipitation routinely exceeds evaporation. Most of the water that evaporates from the oceans falls back into the oceans as precipitation. Only about 10 percent of the water evaporated from the oceans is transported over land and falls as precipitation. Once evaporated, a water molecule spends about 10 days in the air.

Sublimation: The changing of snow or ice to water vapor without melting

Sublimation describes the process of snow and ice changing into water vapor without first melting into water. Sublimation is a common way for snow to disappear in certain climates.

Read more: http://ga.water.usgs.gov/edu/watercyclesummary.html

APPENDIX H

End of Study Survey

During the first part of the study:

1. What crime did the defendant allegedly commit?

2. What evidence did the prosecution present?

3. What evidence did the defense present?

During the second part of the study:

1. What did the eyewitness say in his testimony?

2. Were there aspects of the crime that may have affected his memory?

During the third part of the study:

1. Did the new information affect your decision? In what way?

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