2012

Cognitive Maps and the Confidence-Accuracy Relation in Eyewitness Identification

Hannah Mazoe Paul
University of Northern Iowa

COGNITIVE MAPS AND THE CONFIDENCE-ACCURACY RELATION IN EYEWITNESS IDENTIFICATION

A Thesis Submitted

in Partial Fulfillment

of the Requirements for the Designation

University Honors

Hannah Mazoe Paul

University of Northern Iowa

May 2012

This Study by: Hannah Paul

Entitled: Cognitive Maps and the Confidence-Accuracy Relation in Eyewitness Identification

has been approved as meeting the thesis or project requirement for the Designation

University Honors

4/30/12
Date

Dr. Otto MacLin, Honors Thesis/Project Advisor

5/7/12
Date

Jessica Moon, Director, University Honors Program

Abstract

Cognitive maps are map-like representations of a spatial environment. Eyewitnesses are often asked to create a cognitive map of a crime scene so that it can be submitted as evidence in a criminal trial. Another key piece of evidence provided by an eyewitness is a description of the perpetrator which is used to acquire eyewitness identification. To the best of our knowledge, the correlation between cognitive maps and eyewitness identification has never been empirically investigated. The present study asserts the hypothesis that complex cognitive maps are positively correlated with correct eyewitness identifications. This hypothesis has been formulated off previous research done by McClure and Shaw (2002) on facial sketches and eyewitness identification. Results of the present study however, show that there is no correlation, neither positive or negative, between cognitive map complexity and eyewitness identification. The results of this study have created possibilities for further research on these pieces of evidence and what it means for the future of cognitive maps in a courtroom.

Introduction

Eyewitnesses play a crucial role in the prosecution of a defendant. Many have been lead to believe that attainment of an eyewitness identification guarantees an accurate verdict. There is a good chance that people who believe in the reliability of eyewitness identification will be selected as juror members in a case; furthermore strengthening the impact an eyewitness identification has in deciding a guilty verdict. As Supreme Court Justice Brennan put it in his dissent to Watkins v. Sowders (19), " All the evidence points rather strikingly to the conclusion that there is almost nothing more convincing than a live human being who takes the stand, points a finger at the defendant, and says 'that's the one!'" (Watkins v. Sowders, 19). Misconceptions on the accuracy of eyewitness identification can lead to a faulty verdict, which could ultimately create irreparable consequences.

Eyewitness testimony can include a number of things. Figure 1 is an example of evidence that is regularly submitted in court. Sketches such as these originate from an eyewitness, and are meant to represent a witness's memory for an event that they have experienced. In Figure 1, the eyewitness was asked to recreate the scene of a crime using only their memory of the event. Despite, the common presence of sketches such as these, we are unaware of any research that has been done to determine whether these sketches are good indicators of an eyewitness's accuracy.

Cognitive Maps

What has been studied is cognitive maps. The concept of a cognitive map was first developed by Edward C. Tolman in 1930. A common definition for the term cognitive maps is: a map-like cognitive representation of an environment. Tolman used this term to refer to the general spatial knowledge exhibited by rats in a maze. Obviously rats cannot draw a sketch of an

environment they are placed into, however Tolman measured the rat's spatial memory by observing their behaviors. Tolman would place rats in a radial maze, a maze that has a central area from which arms extend in all directions, and watch them as they navigated the maze in search of food. He would repeat this task a number of times, each time adding a new obstacle in the rat's way such as a barricade. By observing their behavior, Tolman could measure just how well a rat can remember spatial orientations.

Spatial Memory in Humans

This concept of cognitive maps has been examined in humans as well. A study, done by Taylor and Tversky (1992), showed that humans remember spatial knowledge using conceptual strategies. One such strategy that seemed to occur most predominantly was the use of hierarchical structures. Hierarchical structures of spatial memory refer to the tendency of subjects to subdivide their environment and to draw or describe one set of features prior to another (Taylor & Tversky 1992). To clarify the concept of a hierarchical structure of memory, imagine that someone was asked to draw a picture of their home. This individual could draw a number of things that represent their home. They could draw their house, or their city, state or country. An individual could even draw a picture of the Milky-Way Galaxy and still be said to draw an accurate picture of their home. This is an example of somebody dividing his or her environment into clusters. One could divide their environment into cities, states, countries, and continents; each one of these representing a cluster of their environment. Why do people use hierarchical structures for remembering spatial information? That is because it is easier to remember a large quantity of detailed information when you divide it into distinguishable categories; this is a way for humans to keep all of their spatial information in order.

The data collected in Taylor and Tversky's study (1992) supported the idea of hierarchical structures of spatial memory. In their study, participants were asked to study one of three different maps; the maps depicted a town, an amusement park, or a convention center. Despite the difference in the map type, each map seemed to have demonstrated the same conclusion that humans use hierarchical structures to remember spatial information. After viewing a map for five minutes, participants were asked to generate either a picture or a written description of the map from memory. The researchers observed the order of recall for specific landmarks on the map. After analyzing their results, they found that the organization of recall was similar across descriptions and depictions (drawings) of the same map. The most predominant way in which participants clustered the landmarks of the map was from smallest to biggest in size. For example, participants who viewed the map of the town were more likely to recall the mountains before they recalled the much smaller stables, or restaurant. Moreover, participants would describe all of the large landmarks before moving on to the other cluster of the smaller landmarks. In summary, this study suggests that when eyewitnesses are asked to draw a cognitive map of a crime scene, they too may remember the details of the crime scene through the use of conceptual strategies such as the hierarchical structure of memory.

Distortions in Spatial Memory

The problem with hierarchical thinking is that it can cause distortions in the distance and orientation of geographical locations. Stevens and Coupe (1978) conducted a study showing how predefined boundaries, such as state borders, create natural divisions or clusters in our environment. These predefined boundaries are universal and easily recognizable by a vast population making them useful when remembering spatial information. However, Stevens and Coupe's (1978) research also demonstrated how these predefined boundaries are a large cause of

spatial distortion. Participants in their study were asked to a draw a sketch that showed the orientation of three well-known cities: San Francisco, Reno, and Los Angeles. What the participants produced was an inaccurate orientation of these three cities in relation to one another (Stevens & Coupe, 1978). Stevens and Coupe (1978) attributed these inaccuracies to the use of hierarchical strategies; in specific to the participant's tendency to divide these cities into groups determined by their state's boundaries. For example, Lose Angeles and San Francisco are both in California. It is general knowledge that California is West of Nevada, the state that the city of Reno is located. Based on this information, participants generalized that Reno must therefore be east of both San Francisco and Los Angeles. In reality, Reno is east of San Francisco, but is orientated to the west of Los Angles. Figure 2 demonstrates the difference between a map produced by a participant of Stevens and Coupe's (1978) study and an accurate map depicting the relationship of the three cities.

The distortion of spatial information is not solely attributed to hierarchical structures. Humans also distort spatial information by their tendency to view the world in a subjective manner. A study done by Saarinen (1988) wanted to prove this point. This study was an international study of worldviews. A total of 4,000 maps were produced from participants all around the world. Some of the basic finding of this study where that the majority of participants showed a Eurocentric worldview. Similarly, Americans showed to have a tendency to draw an Americentric map. Simply by looking at a map you could tell where the participants originate. These results show that people are going to draw what they know best, and what is their immediate environment.

Just as the rat's behavior in the Tolman study demonstrated spatial information in rat's memories, cognitive maps represent the spatial information in human memories. Unfortunately,

as both Stevens and Coupe (1978) and Saarinen's (1988) study found, these cognitive representation of the human memory are not always accurate given the mistakes and distortions found in the before mentioned studies. Saarinen's (1988) study further demonstrates that humans are more likely to be accurate when asked to draw a sketch of an area they know well. Conceptual strategies are utilized mainly in instances where we are unfamiliar with the environment, meaning we need to divide unfamiliar environments into clusters to make it easier to recall from memory. Alternatively, familiar environments are more engraved in our memory because we spend more time in these areas. When eyewitnesses are unfamiliar with the environment in which a crime takes place, previous research suggests that distortions may occur when trying to recall the scene of a crime.

Police Lineups

Earlier it was mentioned that cognitive maps are a form of evidence provided by an eyewitness in a trial. Another form of evidence that an eyewitness may provide during an investigation is a description of the perpetrator(s). These descriptions are very valuable to the police and are used to create police lineups. These lineups are an important tool used to acquire eyewitness identification. Once the police have acquired an identification from the eyewitness, this information is used in court as evidence. Unfortunately there is a considerable amount of research demonstrating that eyewitness identifications may not be as reliable as once thought (Wells et al., 1998). The Innocence Project (1992), an organization that has made it their duty to discover the trends in wrongful convictions, has found that eyewitness misidentifications are the leading cause of wrongful convictions, playing a role in 75% of convictions overruled by DNA evidence. These defendants were actually innocent, sent to jail for upwards to 7 years and later

deemed innocent of the crime because the DNA evidence left behind belonged to another person. In 75% of these cases eyewitnesses evidently identified the wrong person.

Research on police lineups and eyewitness identifications has attributed many factors to the cause of eyewitness misidentification. The majority of these factors are forms of systematic variables; which are variables that are under the direct control of the criminal justice system (Wells, 1978). For example, the following have shown to affect the accuracy of identifications: the time elapsed between the crime and the identification (Lipton, 1977), authority figure feedback (Wells et al., 2003), and lineup instructions (Malpass & Devine, 1981).

Many studies on eyewitness identification have questioned the use of relative judgment and how this process affects the performance of eyewitnesses. The theory of relative judgment states that "eyewitnesses tend to identify the person from the lineup who, in the opinion of the eyewitness, looks most like the culprit relative to the other members of the lineup" (Wells et al., 1998, 613). A way in which researchers can tell if eyewitnesses are using relative judgment and those who do not is by the use of dual lineups. Dual lineups include a blank lineup, where every member is known to be innocent, followed by an actual lineup in which the suspect is present. The eyewitness is specifically told that the perpetrator might not be present in an effort to make eyewitnesses resist the temptation to pick someone based on relative judgment. Instructing eyewitnesses in this way, saying "might or might not be present", is an important component of the dual lineup procedure (Malpass & Devine, 1981). In Malpass and Devine's study (1981), one hundred eyewitnesses were asked to watch a staged vandalism. Following the staged crime, the eyewitnesses were asked to view target-absent lineups after being given either biased or unbiased instructions. Biased instruction implied that the witnesses had to choose someone whereas unbiased instructions alluded to the idea that the suspect may not be present in the lineup. The

unbiased instructions decreased the amount of choosing and false identifications without reducing the amount of correct identifications. Because of this study done by Malpass and Devine (1981) and studies like it, the criminal justice system has revised the procedures used to conduct police lineups. Revising these procedures are key to eliminating as many biases as possible.

In order to test the theory of relative-judgment, Wells (1984), conducted a study that directly tested the effects of a blank lineup. Using 192 eyewitnesses, Wells (1984) showed the eyewitnesses a blank lineup prior to showing them the actual lineup. The results of this study *showed that those who made no identification in the blank lineup were more likely to make a* correct identification in the actual lineup compared to those who identified somebody in the blank lineup or those who were not shown a blank lineup at all. These results point to a conclusion that blank lineups do not lead to a decline in accurate identifications, but help weed out those who use a relative judgment process.

Confidence-Accuracy Relation

Beyond the use of dual lineups is the important use of confidence ratings. In their report on recommended eyewitness identification procedures, Wells et al. (1998), put "Obtaining Confidence Statements" as rule four stating that "A clear statement should be taken from the eyewitness at the time of the identification and prior to any feedback as to his or her confidence that the identified person is the actual culprit" (Wells et al., 1998, p. 27). The purpose of this precaution is to rule out the influence of any post identification factors on the confidence judgment such as authority figure feedback (Wells et al., 2003). Having an unbiased confidence rating is important when comparing the confidence that an eyewitness expresses at trial to the

confidence recorded at the time of identification. Vast changes in the confidence of an eyewitness between these two times could be a reason to question an eyewitness's memory.

Does the confidence of an eyewitness influence their performance on cognitive maps when they are asked to draw one? An eyewitness who feels very confidence in their identification may carry that confidence over to their testimony during the trial. When the eyewitness is asked to draw a sketch of the crime scene, a cognitive map, does this confidence carry over into their sketches? There may be a relationship between identification confidence and cognitive map complexity making confidence assessments a necessary step in a lineup procedure.

Attorneys and Mock Jurors

Much eyewitness research has been designated to questioning the relation between the accuracy of an eyewitness's identification and the confidence expressed by the eyewitness at the time of identification. Given the strong connection people place between confidence and accuracy, the statistical relation between the two warrants close inspection. A study done by Brigham and Wolfskiel (1983) demonstrated that the majority of public defenders, state prosecutors, and private defense attorneys, believe in a strong relation between eyewitness identification confidence and accuracy. This trend extends to those outside of the criminal justice system as well. Mock- jury studies have produced findings that show how heavily jurors tend to rely on the expressed confidence of an eyewitness at the time of the trial. Wells et al. (1979) conducted a study in which 80% of the accurate eyewitnesses and 20% of the inaccurate eyewitnesses were correctly classified as accurate or inaccurate by the mock jurors. In short, these results show that mock jurors made a lot of mistakes in identifying the accuracy of an

eyewitness. These mistakes are believed to be made because of the mock jurors' reliance on the *eyewitness's confidence to show* accuracy.

Expert witnesses are often used in court to testify on the reliability of the confidence-accuracy relationship. Most expert witnesses agree with research findings that result in a weak confidence-accuracy relation (Kassin et al., 1989). Kassin, Ellsworth, and Smith (1989) did a study measuring how reliable expert psychologists view twenty-one specific topics of eyewitness research. Among these was the topic of the confidence-accuracy relation. They surveyed a total of sixty-three experts who were asked to respond to the following statement: "An eyewitness's confidence is not a good predictor of his or her identification accuracy" (p. 1091). Twenty-eight of sixty-three experts found the research supporting this statement to be "very reliable", while on 6 found the research to be inconclusive, and few challenged the statement at all.

Cognitive maps may prove to be a significant moderator variable in the confidence-accuracy relationship. Studies done on cognitive maps may show that jurors place heavy weight on their ability to predict eyewitness accuracy. Confidence has already been shown to be a poor indicator of accuracy, resulting in many wrongful convictions. Cognitive maps may prove to be another variable that eyewitness place to much reliance on making empirical research on cognitive maps even more important. The present study looks at both forms of evidence provided by an eyewitness. Although research has been done individually on both cognitive maps, from a non-forensic standpoint, and police lineups, there is a lack of evidence showing how cognitive maps used as evidence and eyewitness identifications correlate. Therefore, there is a need to answer the question "Do people who draw complex cognitive maps make correct identification?", or "By looking at a witness' map, can we predict the accuracy of an eyewitness's identification?"

Facial Sketches and Eyewitness Identification

Although we were unable to find any study examining the forensic use of cognitive maps, the study that has come closest to answering the above-mentioned questions was conducted by McClure and Shaw (2002). McClure and Shaw (2002) hoped to determine how well facial sketches correlate with eyewitness identification accuracy. Facial sketches differ from cognitive maps in that they are a representation of the perpetrator rather than of a crime scene. However both contain features and spatial information related to an image stored in the witness' memory. In their study, participants were shown a number of target faces, which were presented three seconds each. Following this, they were given a filler task and a three minute practice interval. During the practice interval participants were instructed to generate a drawing, generate a written description, or do another filler task. After completing the practice interval participants then completed the test phase which consisted of them looking at photos of faces and indicating "Yes" or "No" as to whether or not they were one of the target faces shown in the first phase of the study. After identifying the target face, participants were asked to assess their confidence. The results of the study showed that participants who generated the drawing during the practice phase were more likely to make correct identifications in the test phase. Furthermore, McClure and Shaw (2002) found that artistic quality does not lead to higher accuracy. Instead, the complexity of the drawings predicted the accuracy of eyewitness identification.

Using cognitive maps as a variable in research requires the formulation of guidelines in evaluating free-hand drawings. McClure and Shaw (2002) used three criteria in evaluating free-hand drawings of faces: 1) complexity; 2) similarity; and 3) representativeness. In their specific study (2002) complexity was the only criteria that correlated with target recognition accuracy. Complexity was assessed by calculating the number of characteristics that were included in the

participant's drawings, and dividing that by the total number of characteristics depicted in the original photograph of the face. The characteristics included in this assessment were predetermined by the researchers based on how essential the characteristics are in subsequent recognition of that face.

The present study aims to describe the relationship between cognitive map complexity and eyewitness identification accuracy. Specifically, we hope to find whether complex maps indicate accurate eyewitness identification. Based on the finding of McClure and Shaw (2002), we hypothesize that complex cognitive maps positively correlate with correct identifications, and can thus be used to predict the accuracy of an eyewitness' identification.

Methods

The present study is looking at both the complexity of cognitive maps, and the accuracy of eyewitness identification. Participants were asked to generate both forms of evidence so that way we could assess their impact on one another. Participants were asked to perform a number of tasks, which include watching a video of a staged crime, making an identification on two separate lineups, answering a series of questions over the details of the staged crime, producing a cognitive map of the crime scene, and lastly completing a volunteer survey. Participants of the same session completed each of these tasks at the same time. For the purposes of the study, participants were randomly assigned to one of eight conditions. The main difference between these conditions was the order in which the participants were asked to perform each of the tasks. For a complete list of each condition and its order of events, refer to Figure 2. It should also be mentioned that the volunteer survey completed by each participant was not assessed as a part of this study because it was part of a separate study.

Subjects

This study was approved by the University of Northern Iowa IRB review board allowing us to collect data from human participants. A total of 67 participants were recruited for this study. All participants were undergraduates at the University of Northern Iowa. Participants were recruited through the universities PSPM system in which students received course credit in return for participation in this study.

Materials

A number of materials were required for this study. Materials included a video of a staged crime, photo lineups, a post-video memory test, and cognitive map instructions.

Video. Participants watched a 5-minute video of a staged robbery committed by 4 college-aged individuals (2 female and 2 male). One of the males wore glasses while the other perpetrators did not wear any. The robbery included breaking into a storage garage, taking items from the garage and placing them in the perpetrator's car, and assaulting an unknown individual who catches them in the crime. Each perpetrator looked into the camera for approximately 5-7 seconds, therefore there were opportunities for the participants to view the perpetrators face.

Photo lineups. The present study followed the guidelines of a dual-lineup procedure in which both a blank (target absent) lineup and an actual (target present) lineup are shown. Participants were shown two lineups, one for each of the male perpetrators. These lineups were viewed under one of two conditions. Each condition included a target present lineup and a target absent lineup. In condition A (n=40), participants were shown a target absent lineup of the male without glasses, and a target present lineup of the male with glasses. The perpetrator wearing glasses was in position number four. The second, condition B (n=27), is when participants were

shown a target present lineup of the male without glasses and a target absent lineup of the male with glasses. The male perpetrator without glasses was present in position three of the photo spread. Data was collected over a total of 29 sessions. Participants of the same session were shown lineups under the same conditions, however, sessions were randomly assigned a condition before the beginning of the session. Participants were given as much time as needed to complete the lineups. Lineup instructions warned the participants that the perpetrator might not be present in the lineup, and participants were given the option to indicate that the perpetrator was not present on their answer sheet.

Post-video memory test. The post-video memory test consisted of open-ended questions asking the participants to describe the details of the staged robbery as seen in the video. Some of the questions involved the appearance of the perpetrators (e.g., "What was the approximate age of each perpetrator?"; "What was the gender of each perpetrator?"). The remainder of the questions were concerned with the events of the crime (e.g., "Who was driving the car upon arrival?";"What was used to knock-out the owner of the garage?"). Participants took the post-video memory test in one of two conditions. The test, as administered in condition A (false condition) consisted of 20 open-ended questions. Seven of these questions were misleading and suggestive while the remaining thirteen questions were unbiased. The misleading questions were presented in the same format as the unbiased questions and concerned the same material (e.g. appearance of the perpetrators and events of the crime). The only difference between the misleading questions and the unbiased questions is that the misleading questions asked about things that were not present or did not happen in the staged crime video; things the participant should have no memory of. Condition B (true condition) received a test that included only unbiased questions. These questions were the same thirteen unbiased questions asked in

condition A. For both conditions participants were asked to assess their confidence at the end of each question. These individual assessments asked them to rate how confident they were that they answered the previous question correctly. Furthermore, at the end of both post-video tests participants were asked to rate their confidence on their test performance as a whole. All confidence assessments were measured using a Likert scale from 0 (not confident) to 10 (very confident). Participants were given as much time as they needed to complete the post-video memory test.

Cognitive sketch activity. Participants were given a blank sheet of computer paper and asked to make a sketch of the crime scene as depicted in the video. They were instructed to include as much detail as possible including people, objects, signs etc. It was emphasized that drawing skill levels were not important, but that they should do the best they can. There was no time constraint on how long they had to complete the activity.

Volunteer Survey. This survey measured the amount of time each participant spent volunteering, what kind of volunteering they engaged in, and how far out of their way a participant was willing to go to help others. The scale was composed of 15 statements, 14 of which were answered using a Likert scale from 0 (definitely not) to 10 (absolutely). The remaining question was an open-ended question asking participants how many hours a week they volunteered on average. The following are a few examples of statements that were present on the volunteer survey: "I am likely to volunteer myself to help with disaster relief organizations in Japan", "I volunteer mainly in order to build a good resume", "I am likely to donate money to charity".

Procedure

Participants completed the study in groups ranging in size from one to five and each group was assigned to a predetermined condition. There were a total of eight conditions in the present study, as outlined in Figure 3. Conditions were based off of three things: the photo lineups (target present and target absent), the post—video memory test (false condition or true condition), and the order in which the photo lineups and the post-video memory test was administered. Participants of the same session completed each task at the same time. We did not move on to the other task until everybody had completed the present task.

Upon arrival to the testing area participants were instructed to read through a consent form and sign at the bottom. For the first phase of the study participants were gathered around a computer monitor were they were instructed to watch the 5-minute video of a staged robbery. Participants were instructed to position themselves in a way that they could easily see and hear the video. Upon completion of the video, participants were given 10 minutes to work on a filler task which consisted of a word search. Following the filler task participants then completed either the lineups or the post-video memory test (PVT). As a precaution to possible biases, the order in which the lineup task and the post-video memory task were administered was counterbalanced between sessions (Some sessions would view the lineups first while others would take the PVT first). No matter the order in which these two tasks were performed, each task was administered sequentially to one other. When administering the lineups, the participants were first handed their answer sheet, which included at the top a set of instructions. After participants had indicated that they had read the instructions and had no questions they were handed the photo lineups. Next, participants were instructed to draw a sketch of the crime scene in the cognitive sketch activity. Participants were provided with brief instructions as well as a

blank sheet of computer paper. In the last phase of the study participants were given the volunteer survey and asked to complete it as truthfully as possible. Once all participants had completed the volunteer survey, participants were dismissed as a group and thanks for their participation. Figure 3 provides a list of the eight conditions in which participants completed the study.

Results

Evaluation of the Post-Video Memory Test and Photo Lineups

We first divided the data into two groups determined by whether they were in the false condition or the true condition for the post-video memory test. From there we scored each participant's accuracy and confidence ratings on the post-video memory test and the photo lineups. After the initial scoring of these measures, the data was then split into three groups determined by their performance on the photo lineups. The groups were as follows: two correct identification, one correct identification, and zero correct identification. Each data group was then entered into a spreadsheet where we could further compute the correlations among the variables of the study.

Confidence and Accuracy Across PVT Conditions

Participants in the "true" post-video memory test (PVT) condition were more often correct ($m=83.87$) compared to those in the "false" PVT condition ($m=6$; $t=5.411$, $p > .001$). These results suggest that the presence of misleading questions had an affect on the accuracy of participants. Participants who were given the "false" PVT were subjected to the suggestive material and were thus more likely to answer those questions incorrectly because they were being misled (Figure 4).

As for the confidence, there was no significant difference between the two groups. Participants in the "true" condition indicated a mean confidence of 7.9 while those in the "false" condition indicated a mean confidence of 7.5 (t=1.56, p=.123). This indicates that participants are not able to accurately evaluate the accuracy of their responses (Figure 4).

Effects of PVT conditions on the Confidence and Accuracy of Photo Lineups

After running a correlation between PVT conditions and lineups accuracy, it was shown that PVT conditions had no influence on the participant's ability to make identification for either lineup G (m=27% and 35% accuracy for the false and true conditions respectively; t=.70, p=49) or lineup NG (m=27% and 35% accuracy for the false and true conditions respectively; t=70, p=49). Lineup G refers to the male wearing glasses, while lineup NG refers to the male without glasses (Figure 5).

Similarly, after running a correlation between PVT conditions and lineup confidence, confidence of lineup decision was not influenced by the PVT condition for either lineup G (m=54 % and 55% for the false and true conditions respectively; t=.08, p=.93) or lineup NG (m=68% and 62% for the false and true conditions respectively; t=.78, p=.43). The results of both correlations indicate that any difference we find in the results of this study are not due to the different conditions of the PVT (Figure 6).

Scores for Map Complexity

The cognitive maps were graded on complexity by one researcher and an independent evaluator. The evaluators first determined which landmarks from the video were essential for inclusion in a complex sketch. Each of the sketches was then rated for complexity based on the

percentage of essential landmarks that were included. A landmark was scored as included if it is labeled somewhere on the map or if an unlabeled figure can clearly be interpreted as that feature.

The scores provided by the evaluators were highly correlated showing a correlation of .784 making these results significant at the 0.01 level (2-tailed). These ratings were combined to create a mean complexity score. As shown in Figure 7, mean complexity score was 4.44 (SD=1.66). Figure 8 demonstrates a map that was scored as having a low complexity (m=4.5), and Figure 9 was a map scored as having a high complexity (m=7.5).

Comparison of a Lineup Score to the PVT and Map Complexity

A lineup score was created by combining the accuracy from both lineups across each subject (m=.62, sd=.69). Nearly half of the participants were unable to make a correct identification from either lineup (49.3%). A total of 26 participants made one correct identification response (38.8%), and only 11.9% made correct identification for both lineups. These results suggest that participants overall have a tendency to perform poorly on identification tasks (Figure 10).

There was no significant difference between the PVT condition and lineups scores (m= .54 and .71 for the false condition and the true condition respectively; t=.94, p=.16). Similarly, no correlation was found between lineup scores and map complexity (r=-.08) as demonstrated in Figure 11.

Discussion

Summary of Results

In general, eyewitnesses perform poorly when making lineup identifications. The vast majority of participants made incorrect identification on both lineups, and only a few made two correct identifications. Based off the findings of McClure and Shaw (2002) we had hypothesized that complex cognitive maps would be positively correlated with correct eyewitnesses. The results of the present study however, are inconsistent with this hypothesis. The results have shown that participants who drew complex maps were not any more likely to draw a complex map as they were to draw a non-complex map, the correlation was insignificant.

Applying the Findings

These findings suggest that we cannot assume that eyewitnesses who draw complex cognitive maps are also just as likely to make correct identifications. This also means those eyewitnesses who make correct identifications cannot also be expected to draw complex cognitive representations of a crime scene. These findings have created implications for the future use of cognitive mapping in a courtroom. The goal of this research was to uncover the relationship between two key pieces of evidence and how they can be used in conjunction as eyewitness evidence. The results of this study can be used as caution to not assume that the accuracy of one type of evidence predicts the accuracy of the other. By clarifying that this is not necessarily the case, we can eliminate further biases that occur in the courtroom in regards to eyewitness testimony.

Cognitive maps and eyewitness identification measure an eyewitness's memory for different factors in a crime scene. For example, the goals of a cognitive map are to get

a better understanding of how well the eyewitness remembers the surroundings of the crime and the event details. On the other hand, eyewitness identifications are collected as a representation of the eyewitness's memory for the facial features and appearance of the perpetrator(s). The results of the present study suggest that not all eyewitness show the same level of memory accuracy for all types of information perceived at a crime scene. Some eyewitnesses have demonstrated a better memory for facial features and human characteristics, as demonstrated in the lineups results, while others show a greater aptitude for remembering spatial information and event details, as seen in the cognitive maps.

Comparison to Similar Studies

The hypothesis for the present study was largely based off findings of McClure and Shaw (2002) that showed a positive relationship in the complexity of facial sketches and identification accuracy. Our results have resulted in a different conclusion. The difference in findings between the present study and McClure and Shaw's (2002) can be found in what was being measured. McClure and Shaw (2002) largely focused on the facial characteristics of the perpetrator. In their study participants were first shown a photo of the perpetrator, then they were asked to a draw a sketch of the perpetrator, and lastly they were asked to identify the perpetrator out of a photo lineup. All tasks performed by the participants were focused exclusively on the perpetrator and his or her facial characteristics. Alternatively, the present study measured more than the participant's memory for facial characteristics. By utilizing the cognitive sketch activity and the post-video memory test, we were also measuring the participant's memory for event details and spatial memory. Our measurement for facial characteristics was set up

in a similar way as McClure and Shaw's (2002) study in that we also used photo lineups. Whereas McClure and Shaw (2002) were measuring only one aspect of an eyewitness's memory, the present study was comparing one type of memory against another type, facial characteristic memory against spatial memory. This difference between the two studies could contribute to the difference in the results.

Study Limitations

The limitations of this study are comparable to limitations present in most eyewitness research. The crime viewed by the participants of the present study was staged and the participants were informed of this before viewing the event. Furthermore, the crime was viewed through a video therefore participants did not experience a live crime. These two facts create a similar limitation in that the participants of the study did not experience the same stress level and visibility factors as eyewitness of an actual crime.

The video viewed by the participants was not of high definition quality therefore viewing of the crime was not as clear as it would most likely have been if viewed in person. Similarly, visibility of the attack on the owner of the garage was unclear and missed by some of the participants. The only indicator that anybody had been attacked was present in the bottom left hand corner of the screen where participants could see the boots of the owner. There was never a full shot of the owner standing up or laying down on the ground unconscious.

There was a large gap between the percentage of eyewitness who made no correct identification and the percentage of those who made two correct identification. Only a

total of 8 participants made two correct identifications. Having such a small sample size of participants who made correct identification could be a limitation to the statistical findings of this study. In order to overcome this limitation it would be beneficial to run more participants in subsequent research.

Suggestions for Further Research

The concept of cognitive maps has been around since the 1930's however to my knowledge, no research has been done to investigate their reliability as evidence in a courtroom. Furthermore, the relationship between cognitive maps and eyewitness identification, both prevalent forms of evidence provided by an eyewitness, is lacking support in empirical research. Continued investigation into the relationship of cognitive maps and eyewitness identification may prove useful in lending empirical evidence on how cognitive maps and eyewitness identification should be evaluated and used in a courtroom.

Replicating the present study using different materials would be a useful next step in the study of cognitive maps and eyewitness testimony. A replicate study would utilize a different video, which would provide new information to be tested in both the photo lineups and the cognitive sketch activity. Comparing the results to a replicate study against the results of the present study could add to our findings and provide more insight into the relationship of this evidence. Furthermore, the replicate study would help eliminate any of the limitations found in the present study.

The results of the present study suggest that there is no relationship between the complexity of a cognitive map and the identification accuracy of its creator. However,

these findings mean little if we do not determine how much weight a jury actually places on the relationship of these types of evidence. If a jury places a great amount of weight on the relationship between these forms of evidence then it will be even more important to conduct further studies that evaluate the complexity of cognitive maps and eyewitness identification. Therefore, a jury study would be a beneficial follow-up to the present research. In this instance, a jury study would be able to tell use how much weight a jury places on the presence of cognitive maps and eyewitness identification and deem how necessary it is to pass along the findings of the present study to jurors through expert testimony.

The results of our study have resulted in unexpected findings, thus a number of research questions have arisen. The findings of our study have shown that witnesses vary from one to another with respect to how they remember and perceive a crime. Some eyewitnesses are better able to remember the facial characteristics of the perpetrator while other eyewitnesses are more accurate in remembering the spatial orientation and details of the crime. Further research could investigate why it is that individuals have a better memory for specific aspects of the crime. One hypothesis is that these individual differences are a result of where the eyewitnesses focus their attention. Some may focus exclusively on the perpetrator(s) while others may focus only on the surroundings of the crime. If it can be proven that eyewitness focus exclusively on one aspect of a crime then this phenomenon can be seen as a possible explanation for the present study's findings. One way in which further research could measure the focus of an eyewitness is by using eye tracking technology. This technology would be useful in determining where the eyewitness looks throughout the duration of the crime. Through this technology we could

effectively compare the eyewitnesses eye movements against their memory for the perpetrator and the spatial orientation and details of the crime.

References

Brigham J.C., & WolfsKeil M.P. (1983). Opinions of attorneys and law enforcement personnel on the accuracy of eyewitness identifications. *Law and Human Behavior, 7*(4), 337-349.

Fleet, M.L., Brigham, J.C. & Bothwell, R.K. (1987). The confidence-accuracy relationship: The effects of confidence assessment and choosing. *Journal of Applied Social Psychology, 17*(2), 171-187.

Kassin, S.M., Ellsworth, P., & Smith, V.L. (1989). The "general acceptance" of psychological research on eyewitness testimony. *American Psychologist, 44*, 1089-1098.

Lipton, J.P. (1977). On the psychology of eyewitness testimony. *Journal of Applied Psychology, 62*(1), 90-95.

Malpass, R.S., Devine, P.G. (1981). Eyewitness identification: Lineup instructions and the absence of the offender. *Journal of Applied Psychology, 66*(4), 482-489.

McClure, K.A., & Shaw, J.S. (2002). Participants' free-hand drawings of a target face can influence accuracy and the confidence-accuracy correlation. *Applied Cognitive Psychology, 16*, 387-405.

Saarinen, T. (1988) Centering of mental maps of the world. Unpublished address, Department of Geography, University of Arizona.

Stevens, A. & Coupe, P. (1978). Distortions in judged spatial relations. *Cognitive Psychology, 10*(4), 422-437.

Taylor, H.A., & Tversky, B. (1992). Spatial mental models derived from survey and route descriptions. *Journal of Memory & Language, 31*(2), 261-282.

The Innocence Project. (1992). Retrieved from http://www.innocenceproject.org/understand/Eyewitness-Misidentification.php

Watkins v. Sowders, 449 US 341 (1981).

Wells, G.L. (1978). Applied eyewitness-testimony research: System variables and estimator variables. *Personality and Social Psychology, 36*(12), p. 1546-1557.

Wells, G.L. (1984). The psychology of lineup indentifications. *Journal of Applied Social Psychology, 14*(2), 89-103.

Wells, G.L., Lindsay, R.C., & Ferguson, T.J. (1979). Accuracy, confidence, and juror perceptions in eyewitness identification. *Journal of Applied Psychology, 64*(4), 440-448.

Wells, G.L., Small, M., Penrod, S., Malpass, R.S., Fulero, S.M., & Brimacombe, C.A.E. (1998). Eyewitness Identificiation Procedures: Recommendations for Lineups and Photospreads. *Law and Human Behavior, 22*(6).

Cognitive Sketch Evidence

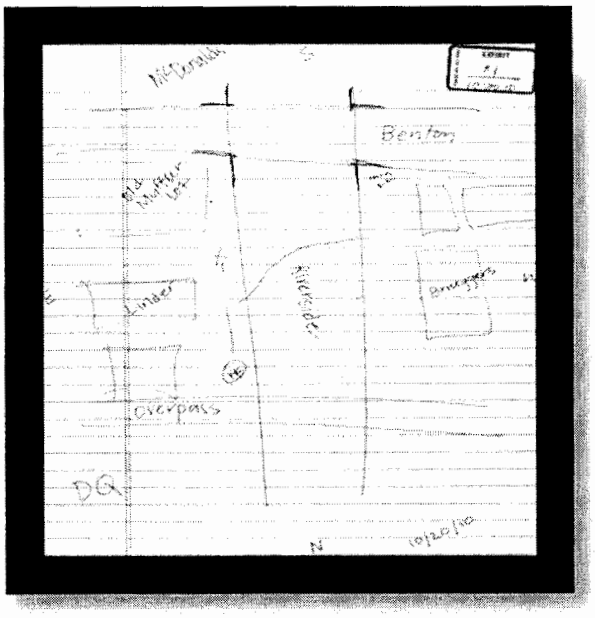

Figure 1. A sketch created by an eyewitness that was used as evidence in a trial.

Stevens and Coupe (1978)

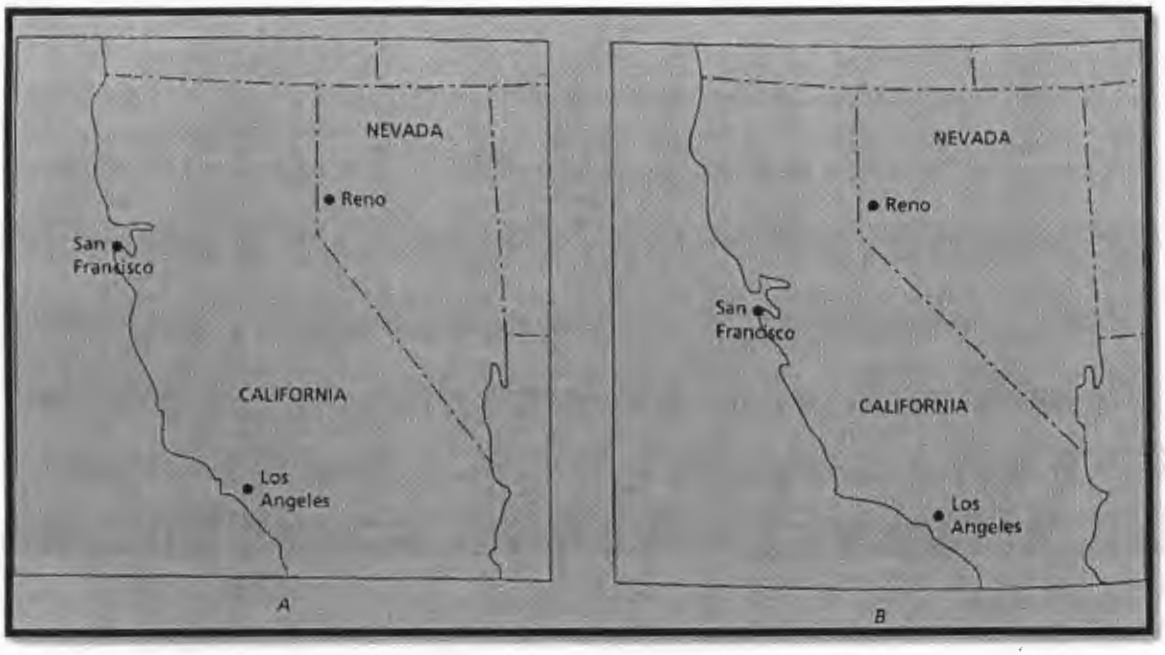

Figure 2. Map A is one of the maps drawn by a participants in Steven and Coup's study (1978) and shows a large spatial distortion. Map B is an accurate depiction of the relationship of San Francisco, Los Angeles, and Reno.

Table of Conditions

Condition One:	Condition B lineups followed by the "true condition" of the post video test
Condition Two:	"true condition" of the post video test followed by the condition B lineups
Condition Three:	Condition B lineups followed by the "false condition" of the post video test
Condition Four:	"false condition" of the post video test followed by the condition B lineups
Condition Five:	Condition A lineups followed by the "true condition" of the post video test
Condition Six:	"true condition" of the post video test followed by the condition A lineups
Condition Seven:	Condition A lineups followed by the "false condition" of the post video test
Condition Eight:	"false condition" of the post video test followed by the condition A lineups

Figure 3. List of the eight conditions used in the present study.

PVT Condition

Group Statistics

	PVT	N	Mean	Std. Deviation	Std. Error Mean
PVT_ACC	.00	33	66.1212	10.40921	1.81201
	1.00	34	83.8735	15.81195	2.71173
PVT_CONF	.00	33	7.5288	1.26349	.21995
	1.00	34	7.9882	1.14118	.19571

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PVT_ACC	Equal variances assumed	2.302	.134	-5.411	65	.000	-17.7523	3.28101	-24.30495	-11.19968
	Equal variances not assumed			-5.443	57.273	.000	-17.7523	3.26142	-24.28252	-11.22212
PVT_CONF	Equal variances assumed	.730	.396	-1.563	65	.123	-.4594	.29396	-1.04653	.12763
	Equal variances not assumed			-1.561	63.893	.124	-.4594	.29441	-1.04762	.12873

Figure 4. Statistics on the differences in PVT conditions.

PVT – Lineup Accuracy

Group Statistics

	PVT	N	Mean	Std. Deviation	Std. Error Mean
LG_ACC	.00	33	.2727	.45227	.07873
	1.00	34	.3529	.48507	.08319
LNG_ACC	.00	33	.2727	.45227	.07873
	1.00	34	.3529	.48507	.08319

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
LG_ACC	Equal variances assumed	1.939	.168	-.700	65	.487	-.0802	.11466	-.30920	.14878
	Equal variances not assumed			-.700	64.898	.486	-.0802	.11454	-.30897	.14854
LNG_ACC	Equal variances assumed	1.939	.168	-.700	65	.487	-.0802	.11466	-.30920	.14878
	Equal variances not assumed			-.700	64.898	.486	-.0802	.11454	-.30897	.14854

Figure 5. Statistics showing the relationship between PVT conditions and lineup accuracy.

PVT – Lineup Confidence

Group Statistics

	PVT	N	Mean	Std. Deviation	Std. Error Mean
LG_CONF	.00	33	5.4242	2.22247	.38688
	1.00	34	5.4706	2.48919	.42689
LNG_CONF	.00	33	5.7879	2.05787	.35823
	1.00	34	6.1765	2.00712	.34422

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
LG_CONF	Equal variances assumed	.242	.624	-.080	65	.936	-.0463	.57711	-1.19891	1.10622
	Equal variances not assumed			-.080	64.558	.936	-.0463	.57612	-1.19709	1.10440
LNG_CONF	Equal variances assumed	.222	.639	-.782	65	.437	-.3886	.49662	-1.38040	.60322
	Equal variances not assumed			-.782	64.802	.437	-.3886	.49680	-1.38084	.60365

Figure 6. Statistics showing the relationship between PVT conditions and lineup confidence.

Map Complexity Scoring

Statistics

MAP_COMP

N	Valid	67
	Missing	0
Mean		4.4478
Median		4.0000
Std. Deviation		1.66773

Correlations

		MAP_COM1	MAP_COM2
MAP_COM1	Pearson Correlation	1	.784**
	Sig. (2-tailed)	.	.000
	N	67	67
MAP_COM2	Pearson Correlation	.784**	1
	Sig. (2-tailed)	.000	.
	N	67	67

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 7. Statistics showing the correlation among complexity scores for the cognitive maps.

Cognitive Sketch Data 1

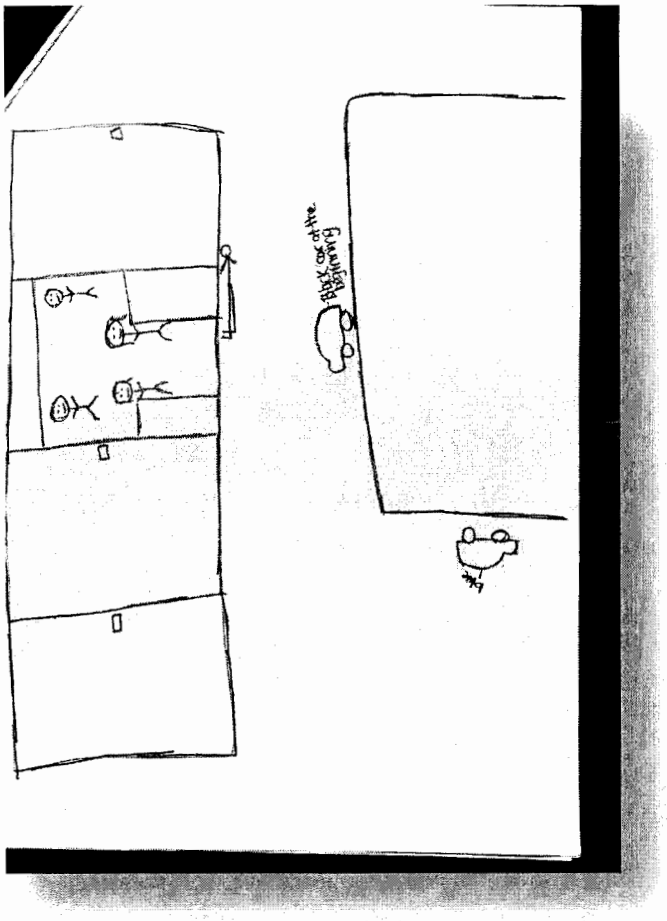

Figure 8. Low complex cognitive map with an average complexity of 4.5.

Cognitive Sketch Data 2

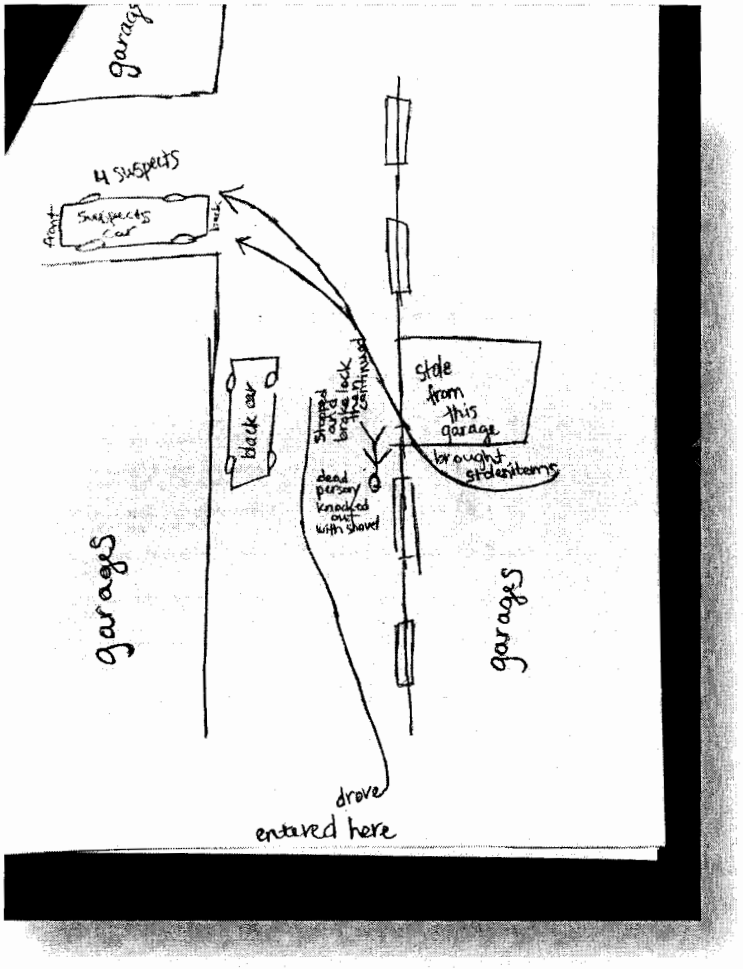

Figure 9. High complex cognitive map with an average complexity of 7.5.

Lineup Score

Statistics

LNUP_SCR

N	Valid	67
	Missing	0
Mean		.6269
Median		1.0000
Std. Deviation		.69273

LNUP_SCR

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	33	49.3	49.3	49.3
	1.00	26	38.8	38.8	88.1
	2.00	8	11.9	11.9	100.0
	Total	67	100.0	100.0	

Figure 10. A lineup score was created by combining the accuracy from both lineups across subjects. This chart shows the rate of accurate identification.

Lineup Score – Map Complexity

Correlations

		MAP_COMP	LNUP_SCR
MAP_COMP	Pearson Correlation	1	-.076
	Sig. (2-tailed)	.	.540
	N	67	67
LNUP_SCR	Pearson Correlation	-.076	1
	Sig. (2-tailed)	.540	.
	N	67	67

Figure 11. This chart demonstrates that there was no significant correlation between the complexity of the map and the lineup score of its creator.

Appendix A

Photo Lineup Instruction and Answer Sheet

In a moment we will show you two photo lineups of the males depicted in the video you just watched. One is referred to as the male with glasses and the other as the male without glasses. Keep in mind that the suspect may or may not be in the video. It is equally important to pick a photo if you recognize the individual as it is to not pick a photo if you do not recognize the individual.

If you recognize the individual from the video indicate below what position number the photo is located at in the space below (the number is directly under the photo).

If you DO NOT recognize the individual, put a zero "0" in the space below.

WITH GLASSES:

For the male WITH glasses, please enter a number between 0 – 6 for which position you think he might be in: 0 – 1 – 2 – 3 – 4 – 5 – 6

Please indicate how certain you are of your response on a scale of 0 to 10 with 0 = "not at all certain" and 10 = "absolutely certain."

How certain are you? 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10

WITHOUT GLASSES:

For the male WITHOUT glasses, please enter a number between 0 – 6 for which position you think he might be in: 0 – 1 – 2 – 3 – 4 – 5 – 6

Please indicate how certain you are of your response on a scale of 0 to 10 with 0 = "not at all certain" and 10 = "absolutely certain."

How certain are you of your choice? 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10

Appendix B

Post-Video Memory Test (False Condition)

Instructions:

Please answer all of the following questions to the best of your knowledge based on what you witnessed in the video. Following each respective question circle the number that corresponds with you level of confidence.

Gender: F M Age: _____

1. A: Approximately how old were the perpetrators?

   B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

   0 1 2 3 4 5 6 7 8 9 10

2. A: How many perpetrators were there?

   B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

   0 1 2 3 4 5 6 7 8 9 10

3. A: Which perpetrator picked up a hammer when they heard someone approaching?

   B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

   0 1 2 3 4 5 6 7 8 9 10

4. A: How would you describe the perpetrator that broke the lock on the garage?

   B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

   0 1 2 3 4 5 6 7 8 9 10

5. A: Two of the perpetrators had an argument, which individuals were involved.

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

6. A: How would you describe the vehicle the perpetrators were driving?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

7. A: How many items were taken out of the garage?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

8. A: Which perpetrator looked out of the garage when they heard a dog barking in the distance?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

9. A: Where was the perpetrator's car parked while the individuals went through the garage?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

10. A: What scared the perpetrators away from the crime scene?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

11. A: What was the gender of each perpetrator?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

12. A: Which perpetrator closed the garage door before fleeing the crime scene?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

13. A: What types of clothing were the perpetrators wearing? (e.g. dress, polo, jeans, tank top etc.)

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

14. A: What was used to knock out the owner of the garage?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

15. A: Did any of the individuals wear corrective lenses?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

16. A: Which perpetrator was driving the car upon arrival?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

17. A: Where did the perpetrators leave the victim's body?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

18. A: Which perpetrator kept a look out throughout the whole robbery?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

19. A: What did the owner of the garage say to the perpetrators when he saw them?

B: How confident are you that you answered this question accurately on a scale of 0 (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

20. A: How would you describe the two perpetrators that attacked the owner of the garage?

B: How confident are you that you answered this question accurately on a scale of (not confident) to 10 (very confident)?

0 1 2 3 4 5 6 7 8 9 10

21. How confident are you that all of your answers are correct?

0 1 2 3 4 5 6 7 8 9 10

Appendix C

Volunteer Survey

Instructions:

Please answer the following questions as truthfully as possible. Circle the corresponding number for each question.

	0 (Definitely Not) .....10 (Absolutely)
1. I only volunteer when a club that I'm a member of organizes and participates as a group.	0 1 2 3 4 5 6 7 8 9 10
2. I am likely to volunteer myself to help with disaster relief organizations in Japan	0 1 2 3 4 5 6 7 8 9 10
3. I enjoy volunteering	0 1 2 3 4 5 6 7 8 9 10
4. I am likely to donate money to charity	0 1 2 3 4 5 6 7 8 9 10
5. I have participated in some form of mission trip	0 1 2 3 4 5 6 7 8 9 10
6. I am willing to spend your spring break doing service projects in other communities	0 1 2 3 4 5 6 7 8 9 10
7. I volunteer mainly in order to build a good resume	0 1 2 3 4 5 6 7 8 9 10
8. I consistently do any kind of volunteering at least once a week?	0 1 2 3 4 5 6 7 8 9 10
9. I spend approximately _____ hours a week volunteering each month.	
10. I am more likely to volunteer when I don't have to go far to do it.	0 1 2 3 4 5 6 7 8 9 10
11. I am usually too busy to volunteer consistently	0 1 2 3 4 5 6 7 8 9 10
12. I usually only volunteer if a friend agrees to volunteer with me.	0 1 2 3 4 5 6 7 8 9 10
13. I am less likely to volunteer if any amount of training is required beforehand.	0 1 2 3 4 5 6 7 8 9 10
14. I only volunteer when it involves fun activities	0 1 2 3 4 5 6 7 8 9 10
15. I feel better about myself when I volunteer.	0 1 2 3 4 5 6 7 8 9 10