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THE EFFECTS OF VERBAL OVERSHADOWING AND SOCIAL ANXIETY ON
FACIAL RECOGNITION: A REPLICATION AND EXTENSION

by

Arielle Rancourt

A Thesis Submitted in Partial Fulfillment
of the Requirements for a Degree with Honors
(Psychology)

The Honors College

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Abstract

There have been 314 post-conviction DNA exonerations, and about 70% of these wrongful convictions were due to witness misidentification. Many factors affect the accuracy of a witness's testimony, including the concept of "verbal overshadowing," in which the verbal reporting of a visual memory interferes with the subsequent recognition of the visual stimuli. The present study seeks to replicate Jonathan Schooler's original findings with regard to this phenomenon (Schooler & Engstler-Schooler, 1990). The first experiment is focused on verbalizing a visual memory that is particularly hard to put into words: the memory of a face. The hypothesis for both the original study as well as the replication is that the verbal recoding will overshadow the visual memory.

Data from 122 participants was used in a replication of Schooler's experiment on verbal overshadowing. First, the participants watched a video of a robbery. Participants in the Description condition then described the robber, and participants in the Control condition listed countries and capitals. After completing a filler task, all participants were asked to pick the robber out of a lineup consisting of the perpetrator and seven distractors and rate their confidence on their decision. The results showed a similar trend as the original study: the participants in the Description condition identified the robber incorrectly more often than the Control condition.

For the second analysis, 104 participants completed both the replication study and a social phobia scale (Mattick & Clarke, 1998). Within a normal population, people with higher anxiety are expected to perform less well on facial recognition tasks, and those with lower anxiety are expected to perform better. Results from the second portion of the study showed that participants considered to be lower in social anxiety in the control

condition identified the robber correctly much more often than did those in the description condition, demonstrating a verbal overshadowing effect. Participants higher in social anxiety were all around worse at identifying the robber in both the description and control conditions. These results show that social anxiety can be a moderator of verbal overshadowing. Within the control condition alone, participants with higher social anxiety were significantly less accurate at identifying the robber than participants with lower anxiety.

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Chapter 1

Introduction

In July of 1984, nine-year-old Dawn Hamilton was found dead in Baltimore County, Maryland. An anonymous call to the police suggested that a man named Kirk Bloodsworth not only was seen near the site of the crime, but was also seen with the victim around the time of the murder. Five additional witnesses helped police create a sketch of the potential killer. These same witnesses testified that it was Kirk Bloodsworth they saw with the victim on the day of the murder. Another witness said that Bloodsworth had mentioned doing something terrible that day that would affect his relationship with his wife.

Bloodsworth was convicted in 1985 and sentenced to death. Due to police withholding evidence from the defense, as well as challenges to statements previously made by Bloodsworth, the case was retried the following year. He was again found guilty, and was sentenced to two consecutive life sentences. At this point, the strongest evidence against Bloodsworth was eyewitness testimony. It was not until 1992 that DNA from the crime was tested; this DNA evidence excluded Bloodsworth from being involved in the murder. He was pardoned in December of 1993 and released from prison in June of 1993; before his exoneration he had spent eight years in jail, two on death row. Kirk Bloodsworth would come to be known as the first person to be exonerated through post-conviction DNA testing.

If you had found yourself on the jury in the Bloodsworth case, deciding whether to send him to prison for life, would witness testimony have been enough evidence to

convict him? Would you have decided that, beyond a reasonable doubt, Kirk Bloodsworth was guilty—with no physical evidence to support the witness testimony?

So far, there have been 314 post-conviction DNA exonerations, 247 of them since 2000. Eyewitness misidentification testimony has been responsible for over 70% of the wrongful convictions overturned by DNA testing. Unfortunately, this kind of injustice has far-reaching consequences for both individuals and society at large: 18 of the 314 exonerated defendants were sentenced to death and executed before their innocence could be proven; the average amount of time already served by the exonerated was 13.6 years; and 70% of the exonerated were people of color. Although the first case of exoneration due to post-conviction DNA testing occurred in 1989, the majority of cases have happened since 2000, 11 years after DNA testing became an efficient way of proving innocence or guilt. While DNA now provides critical assistance in the prosecution of crimes, however, experts say that DNA testing is only possible in 5–10% of criminal cases. This means that accurate eyewitness testimony will continue to be crucial. Unfortunately, there are many factors that affect the accuracy of a witness's testimony. One of these factors is verbal overshadowing.

The Effects of Verbal Overshadowing

Previous research suggests that the verbal rehearsal of an event, such as being the eyewitness to an accident or a crime, might help in recollection of details later on. The idea that verbal rehearsal improves recognition of previously seen stimuli may be limited to situations in which a verbal description could discriminate the correct target face from the wrong faces (Schooler & Engstler-Schooler, 1990). Schooler and Engstler-Schooler

had a different idea about rehearsal and memory. They conducted a study that included six different experiments to test the effect of verbal rehearsal (in this case, a written description) on the memory of a visual stimulus. Schooler's study suggests that there is interference between verbal coding (learning) and visual stimuli. Verbal rehearsal of visual stimuli may also lead to falsely recognizing a picture that fits a certain previously described theme, even though the picture was not in fact there. The term coined by Schooler for this phenomenon is "verbal overshadowing," meaning that a visual memory is not *initially* impaired by verbal information when it is first coded, but later visual memory is overshadowed by intervening verbal information. People are less likely to remember elaborative details, such as the color of someone's eyes, that are not essential to the central theme of a picture, and this can interfere with the details necessary in face recognition. Schooler also pointed out that verbal learning and visual learning are independent processes that use different parts of the brain. This means that verbal processing may limit the amount of visual information learned.

Schooler's first experiment, which is replicated in the current study, tested the effects of verbalizing a visual memory that is difficult to capture in words (a person's face) on the ability to recognize the face later in the study. In the experiment, participants were required to watch a 30-second video of a staged bank robbery, complete a 20-minute filler task, either describe the robber or list the names of states and their capitals for five minutes, choose the correct robber out of an eight-person lineup, and rate their confidence on their selection.

Recognition accuracy (correctly identifying the robber) and confidence in recognition, rated on a scale of 1 (guessing) to 9 (certain), were then evaluated. The

results of Schooler's study were consistent with his previous research; he found that the verbal description of the robber's face impaired participants' ability to distinguish the target face from other faces (known as "distractor" faces) that might be described similarly (e.g., same color hair, same facial hair, etc.; Schooler & Engstler-Schooler, 1990). In the first experiment, participants in the experimental condition were asked to describe the robber from a 30-second video for 5 minutes, whereas participants in the control condition were asked to work on a filler task for the same length of time. Only 38% of participants in the experimental condition correctly identified the robber, while 64% of the participants in the control condition correctly identified the robber.

Schooler and Engstler-Schooler conducted a second experiment that included a face visualization component that asked participants to imagine the face of the robber (instead of describing the robber verbally). The description of the robber in the face visualization condition was much less impaired than the face verbalization condition in correctly identifying the robber, supporting Schooler's theory that interference was due to mixed types of processing information (verbal and visual). The third experiment followed the same paradigm as Schooler's first study, but instead of verbalizing a face, participants were asked to verbalize and visualize a color. Results showed that recognition of the initial color was impaired when participants described the color, but not when they visualized the color, reflecting the results of the previous two studies (Schooler & Engstler-Schooler, 1990). The fourth experiment replicated the first study, but added the additional condition of statement verbalization, requesting participants to recall as much as they could about the statement made by the robber in the video. Participants in the statement verbalization condition were more likely to correctly recall the robber's

statement than those in the control condition, showing a different effect than in the other experiments (Schooler & Engstler-Schooler, 1990). The fifth experiment examined recognition performance for faces and statements two days after participants completed their memory verbalizations. The results showed that the interference due to verbalization of a visual stimulus still existed. The sixth experiment added a time restraint as one of the variables, and the participants who had limited time to make a recognition decision were more accurate than participants who had unlimited time to make a selection (all of the other experiments' participants had an unlimited amount of time to select the robber from the lineup).

From the Schooler and Engstler-Schooler studies above we also learn that faces that would be described using the same language (e.g., brown hair, brown eyes, mustache etc.) make distinguishing the perpetrator from the distractors much more difficult. To go further than just someone's ability to describe a single face, Brown and Lloyd-Jones (2002) more recently found that describing a single face can impair recognition of a number of faces and cars. Unlike in Schooler's original study, Brown and Lloyd-Jones required their participants to describe in detail very specific facial features (such as a mole or freckles), which seemed to create more verbal overshadowing than just generally asking a participant to describe a face with no specific instruction. The results of this experiment showed that when participants received the general description instructions they were significantly worse at discriminating between old and new items in the condition that required participants to describe the robber, and participants were better at discriminating between old and new items in the no-description condition. The results of the experiment supported Schooler's original findings between similar experimental and

control conditions (Brown & Lloyd-Jones, 2002). In the elaborative description condition, there was no significant difference between participants in the description and no-description conditions. Verbal overshadowing occurred for both face and car recognition when participants had previously described a face. This phenomenon did not occur when participants had previously described a car (Brown & Lloyd-Jones, 2002).

Why Does Verbal Overshadowing Occur?

There are two major theories that make up verbal overshadowing, “recoding interference” and “transfer inappropriate processing.” Recoding interference is defined by Schooler as the tendency to rely on a verbally biased recoding at the expense of the original visual memory (Schooler & Engstler-Schooler, 1990). Transfer inappropriate processing shows that the interference caused by the verbalization of visual stimuli in the domain of face recognition is due to a switching over from nonverbal to verbal processes (Brandimonte & Collina, 2008). This shift then overpowers the activation of the part of the brain needed in nonverbal (visual) operations (Schooler, 2002). Brown and Lloyd-Jones (2002) interpreted their data as representing a transfer inappropriate retrieval. When study participants described the face, there was a stronger shift to verbal processing from visual processing than when participants described a car. Brandimonte and Collina (2008) conducted three experiments examining both recoding interference and transfer inappropriate retrieval. The participants were asked to name the object during encoding (learning); if this name was given to the participant again at retrieval, verbal overshadowing was avoided. These results strongly support recoding interference in verbal overshadowing. There was no interference from visual to verbal processes (i.e.,

transfer inappropriate processing), but, rather, the verbal “name” at encoding that was re-presented at retrieval helped memory. This shows that cues, whether verbal or visual, can help memory during retrieval.

While Schooler has suggested that mixing modalities interferes with memory (1990), Vredeveldt, Hitch, and Baddeley (2011) have provided evidence that tasks in the same modality can interfere more with memory. Some strategies, such as eye closure during recall, have been shown to help reduce the effect of verbal overshadowing. With regard to eye closure, one hypothesis is that closing one’s eyes improves memory by eliminating distractions in the environment that would otherwise require split attention, allowing concentration to be focused on one task. A second hypothesis by Vredeveldt, Hitch, and Baddeley is that visual environmental interference will decrease later recall of visual details from a witnessed event, even though everything is being visually processed. The term “modality-specific interference” is used to describe this phenomenon: two visually processed pieces of information, although they use the same visual “mode,” interfere with each other. To help prevent this interference and improve recall of visual details, visualization of the witnessed event is suggested.

Also, in accordance with the concept of modality-specific interference, auditory distraction impairs recall of auditory data. In general, basic information seems to be more ingrained in memory and is therefore remembered more easily than specific details, which are much more easily disrupted by general and modality-specific interference from the environment (Vredeveldt, Hitch, & Baddeley, 2011). These specific details are what distinguish one face from another face, and any environmental disruption, verbal or visual, seems to impair recall of specific details—potentially disrupting eyewitness

testimony. Overall, Vredeveldt, Hitch, and Baddeley found that any sort of distraction would impair recall and potentially create false memories of an event.

Chin and Schooler (2008) described three accounts to attempt to describe verbal overshadowing: the content account, the processing account, and the criterion shift account. Schooler and Engstler-Schooler (1990) first explained the content account as recoding interference in hard-to-describe visual stimulus being overshadowed by verbal recoding. To describe the processing account, Macrae and Lewis (2001) conducted an experiment using a Navon letter (a large letter comprised of small letters). Participants watched a video of a robbery and then were assigned to read either the global letter (the larger letter) or the local letters (the smaller letters) as a filler task; there was also a control condition in which participants completed a filler task. The results showed that verbal overshadowing is present when a processing shift from global reading to local reading occurs, which is represented when participants had to switch from reading the global letter to the local letters, because the brain processes these differently.

The criterion shift account can be illustrated by an experiment conducted by Clare and Lewandowsky (2004) in which there was evidence that a so-called forced-choice paradigm (not giving a “target not present” choice) eliminated verbal overshadowing. If a participant had to choose the robber from the video out of a line up of 8 men, rather than choosing a correct or incorrect robber, “target not present” is a third option. Offering a “target not present” choice leads participants to make more conservative decisions, as if it is an easy way out of making a definite decision.

When Does Verbal Overshadowing Occur?

Meissner and Brigham (2001) conducted a meta-analysis of 29 comparisons on the size of the verbal overshadowing effect. The meta-analysis demonstrated a small but significant interference between using verbal coding and visual stimuli. The length of post-description delay (i.e., whether the participant selects the robber immediately after the descriptions task or must wait a certain amount of time between the description task and the selection of the robber) was also significant. According to Meissner and Brigham's analysis, the verbal overshadowing effect was more likely to occur when the lineup selection immediately followed the description task. In addition, Meissner and Brigham found that the type of description instruction given to the participants had an effect on their recall accuracy. When participants were given elaborate descriptive instructions, beyond the general instruction on free recall, verbal overshadowing was more likely to occur.

Another variable that can affect verbal overshadowing is age. In the current study, the mean age was about 18, with little variance. Kinlen, Adams-Price, and Henley (2007), however, looked at participants of different ages. Older adults are presumed to be more accurate at identifying a visual stimulus after verbally describing the stimuli because they have a wider range of vocabulary that can help them describe harder visuals. Although Kinlen, Adams-Price, and Henley used three conditions instead of the two in the current study (control, verbalization, and visualization), age was found to be a statistically significant factor in whether a participant could correctly identify the robber. 52.9% of the older adults correctly identified the robber in the verbalization condition, while only 10% of young adults correctly identified the robber.

Verbal overshadowing not only affects hard-to-describe visual stimuli like faces, it also affects recall of colors. Each participant in the studies by Schooler and Engstler-Schooler (1990) was assigned to verbalize color (i.e., describe the color using words) or visualize color (i.e., imagine the color silently); there was a control with neither of these. The participants were given the same instructions as in Schooler's experiment with face verbalization, face visualization, and control. The results showed that verbal description of the color reduced memory performance, concurrent with the results from the earlier face recognition results.

If color is used as a retrieval cue of a previously seen image, however, the outcome is different. Brandimonte, Schooler, and Gabbino (1997) conducted a study on verbal overshadowing on easy-to-describe objects (e.g., a cow, a horse, etc.) and hard-to-describe objects (a specific face, color, etc.), and the use of color as a cue at the time of memory retrieval. The results of multiple experiments showed that verbal overshadowing can be caused by verbally recoding, or replacing, visual images at the time of learning, but the original visual representations are not lost, they are simply overshadowed by the verbal representation during memory retrieval. The use of object color, present at learning and again present during retrieval, seemed to prevent verbal overshadowing from occurring by preventing a transfer inappropriate processing shift from affecting memory retrieval (Brandimonte, Schooler & Gabbino, 1997).

Schooler and Engstler-Schooler (1990) suggested that verbal rehearsal of visual stimuli might lead to a participant falsely recognizing a picture that fits into the theme of a previous description, even though the picture was not there. Brainerd and Reyna (1998) conducted multiple experiments testing false memories during "gist memory" word tasks.

The results of their experiments showed that when the word task had many items that cued the general theme (“strong gist”), the distractor words were accepted more (distractors with strong gist were words that had not been previously studied but fit into the previously studied category) than the target words that were previously studied. Therefore, false memories were created based on the category themes that were presented. This evidence could help explain false memories created in eyewitness situations, because witnessed crimes are a powerful theme and statements could include theme-based false memories.

The accuracy of eyewitness testimony depends on many different factors, such as a witness’s state of mind when seeing a traumatic event. Bate, Parris, Haslam, and Kay (2010) looked at the influence of a person’s emotion in social situations—also known as socio-emotional functioning—on face recognition ability. The participants were split by low and high levels of empathy and asked to complete a facial memory test; the results showed that the participants with high empathy achieved higher scores than those with low empathy.

The Effects of Social Anxiety on Face Recognition

Face recognition ability seems to vary within a normal population, and social anxiety is another factor that could moderate facial recognition. Some research has been done on how anxiety may affect someone’s ability to recognize facial expressions and affect, but there has been much less research about social anxiety and the recognition of identity, mainly determined by an individual’s face. One of the original studies on facial

recognition and test anxiety, by Mueller, Bailis, & Golstein (1979), showed that those with lower anxiety showed superior performance on facial recognition tasks.

A study conducted by Davis, McKone, Dennett, O'Connor, and O'Kearney (2011) focused on how social anxiety is associated with recognition of face identity. The results of this study showed that poorer facial recognition on the Cambridge Face Memory Test (the CFMT uses six faces, all with neutral expression, and there have been multiple trials using this method) was associated with an increase in social anxiety (as measured by the Social Interaction Anxiety Scale), but not associated with general anxiety (as measured by the State-Trait Anxiety Inventory). This was a small but statistically significant relationship and focused only on the effect of social anxiety on face recognition rather than any general visual image. The researchers also found that face-only recognition was independent of general cognitive ability; intelligence does not seem to affect facial recognition, at least in the upper-IQ range.

Nowicki, Winograd, and Millard (1979) found a relationship between anxiety and memory. This was a study of women only, suggesting that gender may play a role in impaired memory due to anxiety. In their first experiment, the results showed that low anxiety was associated with better face recognition. Mueller (1979) found a relationship between test anxiety and performance during memory tasks, and concluded that attention is an important component of the process of memory and the heightened arousal in highly anxious people may lessen the focus that is needed to create a solid memory.

Multiple studies have found that patients with social phobia detect angry faces more quickly than happy faces, compared to those without social phobia. In addition, people with social phobia tend to be biased in recognizing faces with negative

expressions. Coles and Heimberg (2003) found that individuals with social phobia recognized more angry faces than accepting or happy faces, and the non-anxious control group tended to show the opposite (accuracy of memory was not tested). The participants in this study had been diagnosed as having social phobia. Foa and Amir (1999) also found that those with generalized social phobia showed greater attention biases for angry faces in a crowd of neutral faces. As in the Coles and Heimberg study, the participants had been diagnosed as having generalized social phobia. A study by Lundh and Ost (1996) showed that participants who were diagnosed with social phobia remembered critical faces more accurately than did the normal population. Little research has been done on social anxiety within the normal population, and how that affects facial recognition.

The Social Phobia Scale (SPS) used in the current study is one of two scales developed by Mattick and Clarke (1998). The SPS assesses fears of being scrutinized during everyday activities. This scale has demonstrated high levels of internal consistency and test-retest reliability and correlates well with measures of social anxiety but not generalized anxiety. The SPS is a 20-question self-report scale formed by combining and modifying items from existing social anxiety inventories. The initial trial started with 164 items and was narrowed down to 20 questions that are self-reported on a five-point scale (0-4).

Safren, Turk, and Heimberg (1998) discussed how the SPS relates to other measures, such as how it correlates with a measure of performance anxiety. In the Mattick and Clarke study (1998), the mean cumulative score of the SPS for participants, both male and female, that were diagnosed with social phobia was 40. Within a random

undergraduate sample, the mean score on the SPS was 14.1, and within a random community sample the mean score on the SPS was 14.4. The random undergraduate and community scale examples were supposed to be representative of a normal population. In the current research, I will use the Social Phobia Scale to examine whether social anxiety moderates the verbal overshadowing effect, as well as the effects of social anxiety alone on facial recognition.

Replication and Extension

A study that shows validity should be replicable. Although replication studies are not published nearly as often as other studies, the importance of replication should not be overlooked. Winerman (2013) recently wrote an article for *Science Watch* expressing the current importance of replication. In the past few years, data fraud has been an issue of great importance. While this is not a new concept, it has received increased attention since Dutch psychologist Diederik Stapel's research data on human behavior was determined to be fraudulent.

Not only have cases of outright fraud come to light in recent years, there have also been several high-profile cases of studies simply failing to replicate. Dr. Darryl Bem, for example, found evidence for extrasensory perception or "precognition," suggesting that future events actually affect participant responses. Although he stands by his work, another psychologist was unable to replicate his findings (Wiseman, 2013).

Wagenmakers, Wetzels, Borsboom, and Van der Maas (2010) suggested, in an analysis and rebuttal of Bem's work on precognition, that Bem had analyzed his data in a way that would support his own theory. When these researchers reanalyzed Bem's data using a

default Bayesian t-test, the analysis showed that the data was not significant and does not support his theory on precognition. Pashler, Harris, and Coburn (2011) were unable to replicate a study conducted by Bargh, Chen, and Burrows (1996) in which reading words related to the elderly caused participants to walk more slowly as they were leaving the lab. The replication study showed the *opposite* trend: those in the elderly-related word condition actually walked more quickly than those in the neutral word condition (Pashler, Harris, & Coburn, 2011). Although, these are examples of failed replications in the recent past, these studies supplied the field of psychology with important information.

Although psychologists agree that replication is important, there is very little incentive to conduct a replication study, as well as a lack of funding (Winerman, 2013). With cases such as Stapel, who merely hid his collected data well and was not challenged or replicated, getting away with data fraud has seemed to be fairly easy. If replication studies were more valued, there might be less of a chance to fake data, at least for the extended period of time that Stapel got away with it.

The current study was conducted at first as a replication study of Jonathan Schooler's classic study of verbal overshadowing, the phenomenon in which verbally reporting a visual memory interferes with a subsequent recognition of the visual stimuli. The first experiment focused on verbalizing a visual memory that is particularly hard to put into words, in this case the memory of a face. The hypothesis both for Schooler's study, as well as the replication, is that verbalizing the visual event will overshadow the visual memory.

The second part of the current study sought to answer the question of whether social anxiety within a normal population affects facial recognition, specifically during a

stressful eyewitness event (the bank robbery reenactment). The data from the replication study is paired with previously recorded Social Phobia Scale results from the participants. Within a normal population, those with higher social anxiety are expected to perform less well on the facial recognition task, and those with lower social anxiety should perform better.

Chapter 2

Method

Study Overview and Hypotheses

The goal of the first part of the study is to replicate Schooler's original finding of verbal overshadowing. Participants in the control condition are expected to perform better on the task than participants in the description condition. This replication study required our lab, along with many others labs around the world, to follow the same basic instructions and protocol while performing our experiments. This study was replicated in an attempt to recreate the same effect size that Jonathan Schooler had in his original study.

The second part of the current study sought to answer the question of whether social anxiety within a normal population affects facial recognition. Within a normal population, those with higher social anxiety are expected to perform less well at a facial recognition task, while those with lower social anxiety should perform better.

Participants

Participants were recruited through the University of Maine Psychology Department experimental sign-up web portal, Sona Systems. We originally chose a sample size of 120 (60 in each condition), with participants pseudo randomly assigned to each condition. We did not exclude anyone from participating in this study, but we did drop participants from data analysis based on prior exclusionary criteria for the

replication study (i.e., participants who were not European-American, ages 18–25). Based on a prior semester’s diversity, we assumed we would have few participants to drop from data analysis. Anyone from the university was allowed to sign up and participate in this study, but some did not meet the exclusionary criteria applied later. The exclusion criteria proved to be more difficult to meet than we expected (there was much more diversity than expected), so we ultimately ran 150 participants, 2 of which were excluded due to incomplete surveys. After the other exclusions discussed in the results section, $N = 122$.

Procedure

The information that participants read before signing up did not reveal that this was a replication study. The sign-up information stated, “We are looking for participants for a study on memory and perception. The experiment will consist of several tasks. You will receive 1 credit for taking part in this experiment. Normal or corrected to normal vision and hearing is required.” The participants were pseudo-randomly assigned to either the description condition or the control condition. Upon arrival to the lab, participants completed a short informed consent form per the University of Maine’s Institutional Review Board Policy. Following the informed consent process, participants began the study.

Unlike the basic requirements of the replication study, our survey (Instructions, tasks, and timing) was almost completely online, creating very few necessary interruptions and interactions with the participant. The video cannot be skipped, so each participant has to watch it in full. The only portion that was not available on the computer

was the crossword puzzle. The computer informed the participants when it was time to take out the puzzle from the folder in front of them, and they proceeded to work on the crossword for 20 minutes. The test location for each of the labs had to fit a very basic criterion, leaving the rooms as empty as possible. The two rooms we used each had two tables, a computer, and a chair. We added a timing component to the survey to see how long it took a participant to choose and submit the perpetrator and level of confidence in their selection on the lineup portion of the survey. The Social Phobia Scale was completed prior to our testing session.

Video Task

After the informed consent process, the experimenter left the room and the participant continued to the first set of instructions on the computer program as follows: “This experiment consists of several tasks. First, please pay close attention to the following video.” Then the 30-second video depicting a bank robbery began to play. The participant could not skip the video.

Description Task

After watching the video, participants received different instructions depending on their condition assignment. The description (experimental) condition read, “Please describe the appearance of the bank robber in as much detail as possible. It is important that you attempt to describe all of his different facial features. Please write down everything that you can think of regarding the bank robber’s appearance. It is important that you try to describe him for the full 5 minutes.” The control condition read, “Please name as many countries and their capitals as you can. It is important that you try to name

them for the full 5 minutes.” After three minutes, the computer gave the following reminder: “Please continue with your task. It is important that you continue working for the full 5 minutes to provide as complete an answer as possible.” The control condition was altered from the original 1990 study conducted by Schooler and Engstler-Schooler to accommodate the labs also replicating the study that are not in the United States. Participants were originally required to list states and their capitals for 5 minutes.

Distractor Task: Crossword

After participants completed either the description task or listing countries, the computer program instructed them to spend 20 minutes on a crossword puzzle that was in a folder next to the computer. The crossword was the only portion of the study that was not on the computer. A small sound alerted the participant to look at the next directions when the 20 minutes was over.

Identification Task

Participants read the following instructions: “Next you will see a lineup with 8 faces. Please identify the individual in the lineup who you believe was the bank robber in the video you watched earlier. If you do not believe the bank robber is present please press 0”. The time of first “click” on the page as well as time to submit their choice were recorded and analyzed.

Confidence Rating

Participants then rated their confidence in their selection on a scale from 1 (guessing) to 7 (certain). The time of first “click” on the page as well as time to submit their confidence level was recorded and analyzed.

Debriefing

Participants were probed for suspicion and none of the participants expressed any suspicion during debriefing. Participants also filled out a simple demographics questionnaire. After participants completed the study, the computer program alerted them that they were at the end of the study. The experimenter came back in and thanked them for their participation and made sure they didn't have any further questions. Participants received course credit for introductory psychology for participating in the study.

Social Anxiety

Participants were asked for permission to link their responses to data collected as part of the Psychology Department's mass testing at the beginning of the semester, which included the Social Phobia Scale. Prior to the testing session, participants (N = 111) submitted the Social Phobia Scale (Mattick & Clarke, 1998) including 20 questions assessing their fears of being scrutinized during everyday activities. Participants answered the 20 questions from 0 (not at all typical of me) to 4 (extremely typical of me). The sum of all 20 scores reflects the social anxiety, with higher scores reflecting higher social anxiety (See Appendix for questionnaire). Question 21 (“Please select answer ‘1’

for this statement”) was added onto the scale as a way to remove participants who did not follow the directions. As mentioned above, SPS has demonstrated high levels of internal consistency and test-retest reliability and correlates well with measures of social anxiety, but not generalized anxiety (Mattick and Clarke, 1998). The current data also demonstrated high levels of internal consistency, with a Cronbach’s alpha = .93. With 7 participants dropped for incorrectly completing Question 21 or having missing data, the N for analyses with social anxiety is 104.

Chapter 3

Results

Preliminary Analyses

As described in the participant section, 28 participants were dropped from analyses based on exclusionary criteria, and an additional 18 failed to complete a Social Phobia Scale, missed questions on the scale, or did not correctly answer Question 21. As a result, the final N for analyses was 122 (104 for analyses involving social anxiety). None of the participants expressed any suspicion of the real nature of the study during debriefing. Correlations and descriptive information is presented in Table 1.

Table 1. Correlations, Standard Deviations, and Means

	1	2	3	4	5	6	7
1. Time first-click choice	–	.38**	.35**	-.05	.08	.13	-.28
2. Time submit choice	.19	–	.27*	.21	.01	-.03	-.15
3. Time confidence submit	.51*	.23	–	-.02	-.01	-.06	-.25
4. Confidence	-.34**	-.01	-.22	–	-.15	-.17	.19
5. Crossword performance	-.02	-.11	-.10	.01	–	.05	-.24
6. Age	-.10	-.10	-.10	-.10	.10	–	-.06
7. Social anxiety	.31**	.35*	.10	-.39*	-.13	-.12	–
Mean (SD)	26.25 (19.97)	38.16 (40.6)	8.56 (3.17)	4.80 (.91)	19.73 (12.0)	18.66 (1.09)	22.06 (16.6)
Mean (SD)	20.96 (12.43)	37.28 (63.03)	8.75 (4.16)	4.62 (1.04)	18.80 (10.65)	18.72 (1.32)	18.34 (12.38)

Note: The correlations presented above the diagonal are for the Description condition and those below the diagonal are for the Control condition. Means containing different subscripts within the same column are significantly different from one another. * $p < .05$ ** $p < .01$

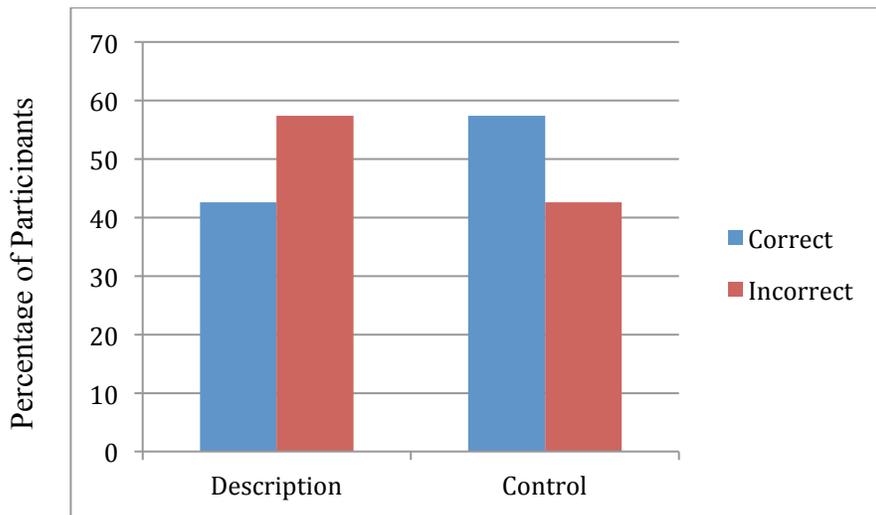
There were no significant differences by condition in any of the variables (all $t_s < 1.76$, all $p_s > .08$). There was a significant negative association between social anxiety and confidence in robber selection in the control condition ($r = -.39$, $p = .005 < .05$), and participants in the description condition tended toward the reverse relationship (the higher the social anxiety, the more confident they were in their robber selection; $r = .19$, $p = .20$). The more socially anxious participants in the control condition were, the slower they were to pick a robber ($r = .31$, $p < .05$). This relationship tended to reverse in the description condition. The higher participants were in the social anxiety measure, the faster they picked the robber ($r = -.28$, $p = .062$).

Is There Evidence of Verbal Overshadowing?

I conducted a chi-square test to examine whether participants would be less accurate in the description condition relative to the control condition. The chi-square examined the percentage of participants in each of four conditions in a two (condition: Description, Control) by two (choice: Correct, Incorrect) table and whether these percentages are equivalent.

The Pearson chi-square test approached significance, but was not statistically significant ($\chi^2(1) = 2.67, p = .103$), the trend was similar to the one in Schooler's original study on verbal overshadowing, although the current effect size was smaller ($\Phi = .15$; Schooler $\Phi = .26$). In the description condition only 26 (42.6%) successfully identified the robber out of the line up of 8 men, 35 participants (57.4%) picked the wrong man. In the control condition, this pattern was exactly reversed: 35 participants (57.4%) correctly identified the robber out of the line up and 26 (42.6%) picked the wrong man. See figure 1.

Figure 1



Is There Evidence that Social Anxiety Moderates Verbal Overshadowing?

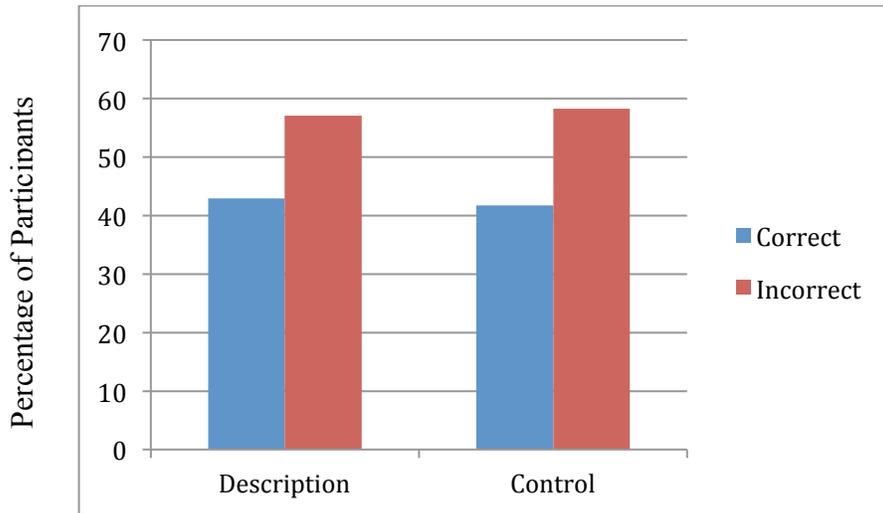
To examine the possible effects of social anxiety on verbal overshadowing, we first examined the verbal overshadowing effect separately for higher and lower social anxiety participants. Participants scoring above the median on social anxiety ($Mdn = 18$) were placed in the Higher Social Anxiety group ($M = 31.49, SD = 14$). Participants at or below the median were placed in the Lower Social Anxiety group ($M = 10.33, SD = 4.62$). We then conducted the same 2(condition) X 2(choice) Chi Square analysis described previously.

Higher Social Anxiety

Consistent with predictions, there was no evidence of verbal overshadowing among participants higher in social anxiety. The chi-squared was not significant, $\chi^2(1) = .008, p = .93, \Phi = .01$. Participants were more likely to pick the wrong man in both

conditions: description condition, 57.1% picked the wrong man; control condition 58.3% picked the wrong man. See Figure 2.

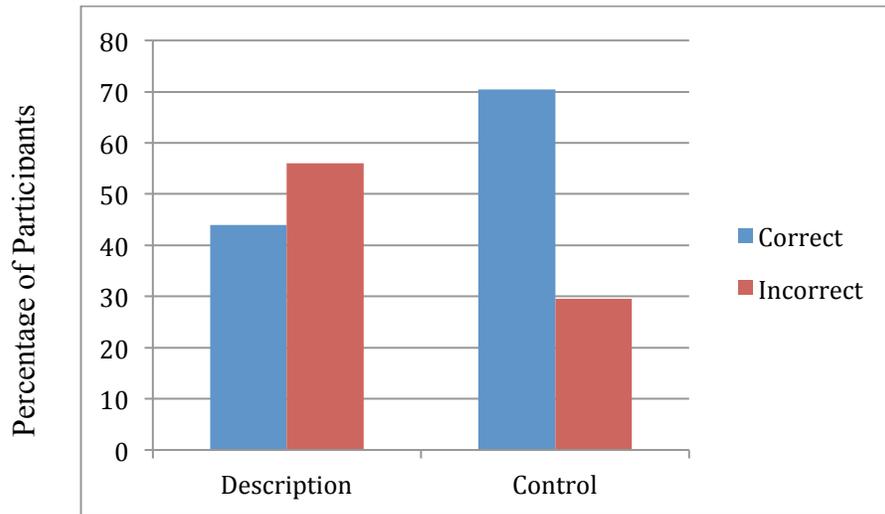
Figure 2



Lower Social Anxiety

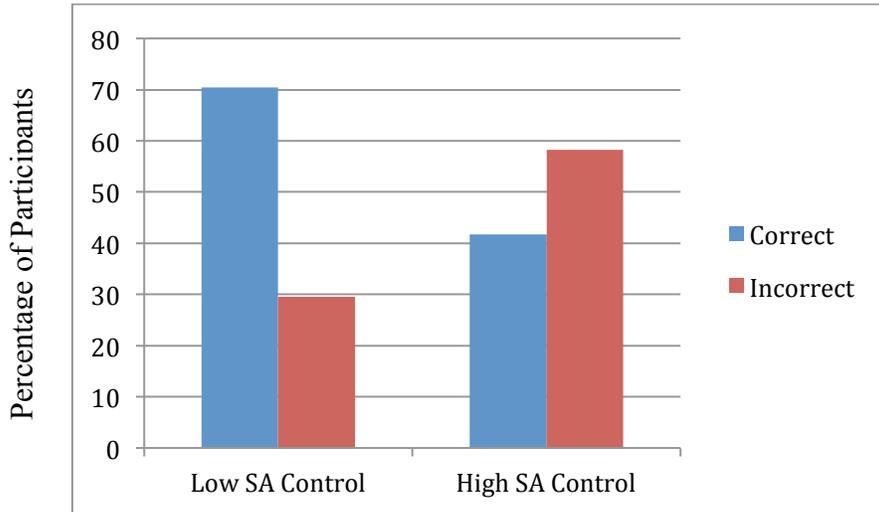
Among lower social anxiety participants there was evidence of a verbal overshadowing effect ($\chi^2(1) = 3.70, p = .05, \Phi = .27$). It is interesting to note that the effect size for the verbal overshadowing effect for participants lower in anxiety was similar to what Schooler reported in the original study ($\Phi = .26$). Participants were more likely to pick the correct robber when they had not previously described him (70.4%) than when they had (44%). See Figure 3.

Figure 3



To further demonstrate this difference, I conducted a chi-squared test comparing social anxiety level (2: Higher, Lower) and choice (2: Correct, Incorrect) just within the control condition. In the control condition, participants lower in social anxiety were significantly more likely to pick the correct robber (70.4%) than participants higher in social anxiety (41.7%; $\chi^2(1) = 4.29, p = .04; \Phi = .20$). See Figure 4

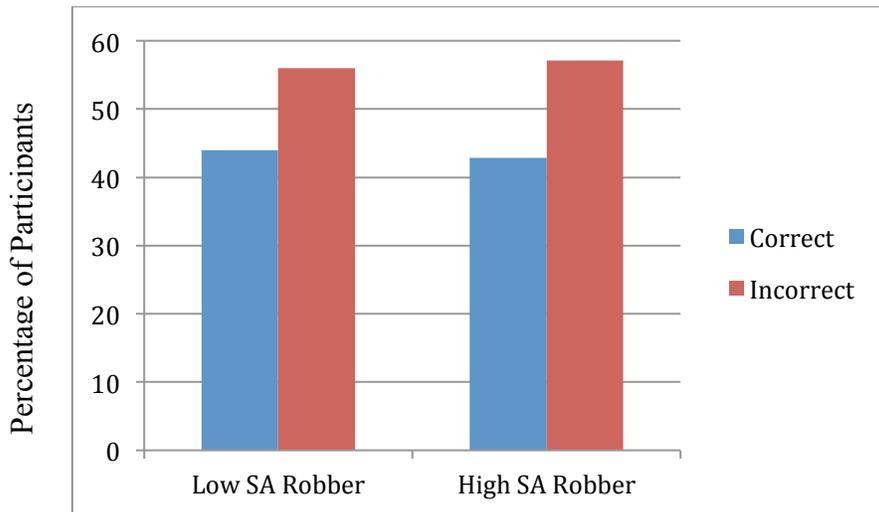
Figure 4



This effect was not observed in the description condition where both higher and lower social anxiety participants tended to pick the wrong man, $\chi^2(1) = .007, p = .93$. See

Figure 5

Figure 5



Are People Who Are Correct More Confident Or Faster?

I next examined whether picking the correct robber was significantly associated with confidence or time spent choosing the robber. I conducted 2(condition: description, control) X 2(choice: correct, incorrect) ANOVA on each of the remaining dependent variables: time to choose, time to submit choice, confidence in choice, time to submit confidence, and crossword performance.

Confidence In Choice

The main effect of choice was significant, $F(1, 118) = 8.88, p = .004$. Participants who picked the correct robber were significantly more confident ($M = 4.95, SD = .81$) than participants who picked the wrong man ($M = 4.48, SD = 1.07$). Within the control condition alone, participants who picked the correct robber were also significantly more confident ($M=4.94, SD= .83$) than participants who picked the wrong man ($M= 4.19, SD= 1.13$). This effect was not found within the description condition alone, and no other effects were significant ($F_s < 2.21, p_s > .14$)

Initial Time-To-Choose

Participants who were correct ($M = 17.36, SD = 7.88$) were also significantly faster than participants who choose the wrong man ($M = 29.85, SD = 20.64; F(1, 118) = 17.62, p < .001$) to make their initial selection from the line up. No other effects were significant ($F_s < 1.52, p_s > .22$).

Time-To-Submit Choice

No effects were observed for how long participants stayed on the selection page (all $F_s < .44$, all $p_s > .52$).

Time-To-Submit Confidence Rating

Although the interaction approached significance ($F(1,117) = 3.29, p = .07$), none of the simple main effects did (all $p_s > .13$). No other effects were significant ($F_s < .12, p_s > .70$).

Crossword Performance

Although participants who picked the correct robber tended to have higher crossword performance ($M = 21.06, SD = 12.38$) than participants who picked the wrong robber ($M = 17.57, SD = 10.01$), this effect was not significant, $F(1, 105) = 2.83, p = .095$. No other effects were significant ($F_s < .43, p_s > .51$).

Chapter 4

General Discussion

The accuracy of eyewitness testimony depends on many different factors, such as a witness's state of mind when seeing a traumatic event. Some research has been done on how anxiety may affect someone's ability to recognize facial expression, but much less has been studied about social anxiety and facial recognition. Many of the studies that looked at the effects of social anxiety on facial recognition and expression used a small population of patients diagnosed with an anxiety disorder. The current study did not look at diagnosed socially anxious participants but, rather, a group of pseudo-random volunteers who represented social anxiety within the normal population. In the current study, I tested the hypothesis that social anxiety moderates the verbal overshadowing effect even at these more moderate levels of social anxiety.

Was There Evidence of Verbal Overshadowing?

Schooler's study suggests that there is interference between verbal coding (learning) and visual stimuli. The term coined by Schooler for this phenomenon is "verbal overshadowing," meaning that a visual memory is not *initially* impaired by verbal information when it is first coded, but later visual memory is overshadowed by intervening verbal information. In the current study, there was a trend much like the one in Schooler's original study on verbal overshadowing. In the original study only 38% of participants in the experimental condition correctly identified the robber, while 64% of

the participants in the control condition correctly identified the robber (Schooler & Engstler-Schooler, 1990). Although the data was not statistically significant in the current study, participants who had previously described the robber picked the correct robber only 42.6% of the time, whereas the participants in the control condition picked the correct robber 57.4% of the time. Overall, it appears that the trend of verbal overshadowing in the current study, although not statistically significant, is similar to the original study. However, this does not necessarily provide evidence toward the ability to replicate this study, since the effect size of the original study was not replicated. Schooler has also tried to reproduce the findings, and the effect sizes have been substantially smaller than in the original study. A variable that I found to be a potential moderator of verbal overshadowing is social anxiety.

Social Anxiety as a Moderator of Verbal Overshadowing

Although we did not recreate the same effect size of verbal overshadowing as Schooler did in his original study, the effect can be found if we take into consideration participant social anxiety. Participants were split into higher and lower social anxiety based on the score on the Social Phobia Scale. We did not observe any evidence of verbal overshadowing for participants higher in social anxiety, because participants in both conditions incorrectly identified the robber more than half of the time. These participants were poor at picking the robber in both the description and control conditions. Unlike the participants with higher social anxiety, participants lower in social anxiety did represent a close to significant verbal overshadowing effect. Participants in the control condition were more likely to select the correct robber than participants in the description condition. The effect size within the lower anxiety condition alone represented almost the

same effect size as in Schooler's original study. The variable of higher social anxiety seemed to interfere with replicating the larger effect of verbal overshadowing experienced in the original study.

To look further into social anxiety not only as a moderator of verbal overshadowing, but also as an individual variable in accuracy of facial recognition, we conducted a chi-square test comparing higher and lower anxiety within the control condition alone. In the control condition, participants lower in social anxiety were significantly more likely to pick the correct robber than participants higher in social anxiety. This effect demonstrates the influence that social anxiety has on facial recognition within a normal population.

What does this effect mean? There are many uses to testing a witness's social anxiety levels before determining if their testimony can be taken at full value. Although there were a few examples of research that studied social anxiety's effect on facial recognition, there needs to be more focus on this phenomenon within the normal population, not specifically focused on patients with diagnosed social anxiety. As shown in this study, social anxiety is an important factor in a person's ability to identify a face correctly. Beyond this study, eyewitness testimony has proved to be an important device used in the court of law. As stated previously, eyewitness misidentification testimony has been responsible for over 70% of the wrongful convictions overturned by DNA testing, and there have been 314 post-conviction DNA exonerations. If social anxiety plays a role in these misidentifications, it is important to consider this variable before securing someone's fate on death row.

Also, the sub-clinical population that experience social anxiety may not be focused on a person's face for others reasons. Those with higher socially anxiety could be focused more on their internal state than their external surroundings. As the SPS shows, people can feel anxious in everyday activities in which they are focusing on how the situation makes them feel. Focusing on ones internal state can take away from focus on the elaborate features necessary to correctly identify an individual.

Testing the speed at which the high social anxiety group identified the robber, not based on accuracy, can provide further insight in this phenomenon. A study conducted by Leber, Heidenreich, Stangier, and Hofmann (2009) tested the speed at which social anxious participants and non-anxious participants classified facial expressions (anger, sadness, fear, disgust, etc.) in a socially threatening situation. High socially anxious participants were faster than controls at classifying angry sad and fearful emotions in a socially threatening situation. The results suggest that socially anxious individuals are more hyper vigilant toward threat-related social cues and that processing facial affect is dependent on the witness's emotional state (Leber, Heidenreich, Stangier, and Hofmann, 2009). If socially anxious participants are, in fact, faster at recognizing negative affect in faces in threatening situation, the focus could be taken off facial identity and directed more towards affect, for those higher in social anxiety. The focus on facial expression could undermine the coding of facial features in a person's memory. All of the men in the line-up used in this current study could be considered threatening, and having negative facial expressions. If higher socially anxious participants were focusing merely on expression, the expression does not differ between the distractors and the robber, and therefore could hinder identification.

Further research could be done on the relationship between social anxiety, peer interaction, and memory conformity (this issue was not addressed in the current study, since only one person participated at a time, with no peer input. This would be relevant to the phenomenon experienced in this study, as well as to real-life eyewitness situations. There are frequently multiple witnesses to a crime, and people with higher social anxiety (related to fear of negative evaluation) are more influenced by peers than those who have lower social anxiety. In a study conducted by Wright, London, and Waechter (2010), responses by high-anxiety individuals were affected by the response of a previous individual, and the results showed a relationship between social anxiety and memory suggestibility. It might be the case that socially anxious individuals might go along with other witnesses because they are less certain and accurate in their own recognition of the robber.

Further Interesting Findings

In terms of confidence, participants in the current research were significantly more confident in correct responses compared to incorrect responses, and this did not vary by condition. This is consistent with the original study that showed no significant difference in the mean confidence of participants between the two conditions. Within the control condition alone, participants who picked the correct robber were also significantly more confident than participants who picked the wrong man, ($F(1, 118) = 9.49, p = .003$). This effect was not seen in the description condition. It seems picking the correct robber tended to be more associated with confidence in the control condition than the description condition. In addition, within the control condition there was a negative association between social anxiety and confidence in robber selection ($r = -.39, p = .005$). The more

confident a participant was, the less socially anxious they were.

What do these effects mean? In terms of social anxiety, participants with lower social anxiety were more likely to correctly identify the robber, and therefore it seems that social anxiety is a moderator in confidence as well. Since we are looking exclusively within the control condition for this particular effect, verbal overshadowing isn't a factor. When presenting eyewitness evidence in a courtroom, the witness needs to be highly confident in what they witnessed, or misidentification can wrongfully place someone in jail. A highly anxious, low confident individual may be the deciding factor between jail and freedom, which is why it is important to investigate the role of social anxiety within the normal population and to determine how valid a witness's statement really is in the court of law.

In the current study, we also measured how long participants took to make their selection of the robber and submit confidence ratings. Participants who identified the correct robber were significantly faster in their initial choice than participants who chose the wrong man. This significance was not reflected in how long a participant took to decide whether to submit their robber choice or not. These results show that participants who correctly identified the robber, independent of condition, were faster in their initial selection of the robber and were also more confident about their choice. It appears that the accurate participants were secure in the fact that they were correct. Speed can be used as a factor in potentially determining how confident a witness really is in their choice. Here we see that participant's *initial* instinct in who was the correct robber in the lineup really reflected if they were accurate or not. Maybe the longer a witness takes to choose their perpetrator out of a line up, the higher the chance is that they may be wrong? These

are the questions that need to be asked to avoid eyewitness misidentification in the future.

Participant's crossword performance was analyzed in the current study. The results showed that although participants that chose the correct robber tended to have higher crossword performance than participants who chose the wrong robber, the effect was not significant.

Limitations

One limitation of not only the current study, but also any replication of Schooler's original study, may be that the eight men were wearing different colored clothing in the lineup. This could be an additional distractor from the facial features that a person is supposed to focus on. If the robber wore the same shirt as all of the distractors, this might help to eliminate the chance of a false positive identification.

If I were to conduct the replication again, I would include a visualization condition or a simple eye-closure condition. As noted above, Schooler and Engstler-Schooler conducted a second experiment with a face visualization component that asked participants to silently imagine the face of the robber. The face visualization condition was much less impaired than the face verbalization condition in correctly identifying the robber, supporting Schooler's theory on interference being due to mixed modality (verbal and visual modes) (Schooler & Engstler-Schooler, 1990). Also, Vredeveldt, Hitch, and Baddeley (2011) also reported that eye closure can hamper verbal overshadowing and found that any sort of distraction can impair recall and create false memories of an event.

Another limitation in the replication aspect of this study was that the replication

protocol was different than the original study in that the crossword was not completed after the video, but actually after the description or list of countries task. This may have a large effect on why the effect size was much smaller in this study than in the original study. Verbally describing the robber right before choosing the perpetrator out of the line up could create a stronger verbal overshadow than if there was a delay between the verbal recoding and appearance of the line up. According to the meta-analysis conducted by Meissner and Brigham (2001), the verbal overshadowing effect was more likely to occur when the lineup selection immediately followed the description tasks. We followed the design of the required replication protocol, and the researcher leading the replication effort later recognized the error. This serves as an example of the importance in paying close attention to all levels of detail when replicating previous research. I am currently conducting the revised replication study, and data collection is ongoing.

Further research could also be done with this replication study comparing participant accuracy in their description of the robber. It would also be interesting to examine how much of the description focused on the face. In the replication protocol, instructions did not focus directly on describing facial features. The verbal overshadowing effect is more likely to occur when participants are given elaborate descriptive instructions instead of general instructions (Meissner & Brigham, 2001). If the instructions had asked the participant to specifically describe the robbers face, as well as other elaborate details, verbal overshadowing in the current study might have been more significant. However, participants higher in social anxiety could perform even worse than they did in the current study if the instructions required them to focus even more closely on the face of the robber. In the current study, higher anxiety should to be a

moderator of verbal overshadowing, and therefore could be an even stronger moderator in a more socially stressful situation.

It is also important to point out that this study had many more female than male participants 89:33. For example, Nowicki Winograd and Millard (1979) found a relationship between anxiety and memory, but only for women. In the current study, there were a slightly higher proportion of women in the higher anxiety group (80% female) than the lower anxiety group (60% female). It could be the case that social anxiety more strongly impairs robber recognition for women. Although this is just one example, if this study were to be redone, having an even amount of males and females could be beneficial in creating a more internally consistent study.

Conclusion

There are many variables to consider when looking at the results of a study, which is why studies need to be replicated more often to weed out the false positive results. Replication studies are not the most popular type of study to conduct. This is for many reasons, such as the general lack of funding that goes towards replication studies, as well as few publication incentives. As discussed by Winerman (2013), researchers tend to only publish positive findings, and negative findings tend to get overlooked, creating the risk that false positives will be published and then never get challenged. One solution is to pre-register studies. Much like the one that this replication was a part of, authors would propose the idea to a journal, and with a review by the original author, and the journal would agree to publish the results, regardless of whether they were positive or negative. I think it would be beneficial to the field of psychology to not only represent the positive outcome of studies, but the negative outcomes as well. There is always a chance of a false

positive, and it is important to represent both the negative results and the positive results, that way any hypotheses tested can be as accurately portrayed as possible and we can uphold the integrity of psychology as a science.

In conclusion, the current study shows that within a normal population, people with higher social anxiety are less accurate at recognizing facial identity than those with lower anxiety. More studies should be done surrounding social anxiety in the normal population, and how that affects face recognition, so that the accuracy of eyewitness testimony can be at the highest level possible, and eyewitness misidentification will no longer be the leading cause of wrongful convictions. This study is simply a stepping-stone in the continuing research on how eyewitness testimony may be improved, so as to lessen the likelihood of falsely imprisoning individuals for crimes they did not commit.

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Appendix A

Office of the Vice President for
Research
*Protection of Human Subjects Review
Board*



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MEMORANDUM

TO: Shannon McCoy
301 Little Hall

FROM: Gayle Jones
Assistant to the Institutional Review Board for the Protection of Human Subjects
(IRB)

SUBJECT: "Schooler Memory and Perception Multicenter Replication Study," #2013-06-22

DATE: September 12, 2013

The above referenced project was approved by the University of Maine's Institutional Review Board for the Protection of Human Subjects (IRB) in an expedited review. The approval period is 6/19/2013 through 6/18/2014 (modifications for final approval accepted 09/12/2013). A continuing review of this project must be conducted by the IRB before the end of the approval period. Although you will receive a request for this information approximately 6-8 weeks before that date, it is your responsibility to submit the information in sufficient time to allow for review before the approval period expires.

Enclosed is an approved, stamped copy of the consent document for this project. The approval for this consent expires on 6/18/2014. **This approved, stamped copy must be duplicated and used when enrolling subjects during the approval period.**

Please remember that each subject must be given a copy of the consent document. Any unanticipated problems or harm to the subject must be reported to the IRB immediately. Any proposed changes to the research must be approved by the IRB **prior** to implementation. Any significant new findings must be reported to the subject.

If you have questions, please contact me at 1-1498. Thank you.

Appendix B

Informed Consent “Memory and Perception”

Shannon McCoy, PhD
University of Maine

You are invited to participate in a research project being conducted by Shannon McCoy, a faculty member in the Department of Psychology at the University of Maine. The purpose of the research is to examine memory and perception. Because you are in Introductory Psychology and are at least 18 years old, you are being invited to participate in this study. The study will consist of a one hour session worth 1 research credit.

What Will You Be Asked to Do?

If you decide to participate, you will be asked to complete some memory and perception tasks. For example, you will be asked to watch a short video and also to complete a word search task

Risks : Except for your time and inconvenience, there are no risks to you from participating in this study.

Compensation: You will receive 1 credit hour of research credit for your participation in this study.

Benefits: While there is no direct benefit to you , it is hoped that the information gained from this study will help us better understand aspects of memory and perception.

Confidentiality: Your name will not be associated with any of the data. The data are anonymous. You will be assigned a participant number which will be used to identify your data. Your name will appear on this consent form but will not be entered into the datafile nor will it be linked to your participant number in any way. All data will be kept on a computer in a locked office for a minimum of 7 years and then destroyed.

Voluntary: Your participation is voluntary. If you choose to continue with this study, you may stop participation at anytime without the loss of credit.

Contact Information: If you have any questions about this study, please contact Dr. Shannon McCoy at (207-581-2029 or email: shannon.mccoy@umit.maine.edu). You may also reach the faculty advisor on this study at (*phone, address, e-mail*). If you have any questions about your rights as a research participant, please contact Gayle Jones, Assistant to the University of Maine’s Protection of Human Subjects Review Board, at 581-1498 (or e-mail gayle.jones@umit.maine.edu).

Your signature below indicates that you have read the above information and agree to participate. You will receive a copy of this form.

_____ 20. I feel awkward and tense if I know people are watching me.

_____ 21. Please select answer "1" for this statement.

Crossword

Across

- 1. "Three men in a ___"
- 4. Outerwear
- 8. Mandela's org.
- 11. Formula ___
- 12. Sharpen
- 13. Not hearing
- 15. Quiche, e.g.
- 16. Elementary particle
- 17. Flower holder
- 18. Take off
- 20. Like socks
- 22. Teacher's offering
- 25. Barn bird
- 28. Life partner?

1	2	3		4	5	6	7		8	9	10	
11				12					13			14
15				16					17			
18			19				20	21				
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25	26	27						28		29	30	31
32					33		34			35		
36			37	38		39		40	41			
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44	45	46						47		48	49	50
51					52	53	54			55		
56					57					58		
	59				60					61		

- 32. Tease
- 33. Church bench
- 35. Polite address
- 36. Former British colony
- 39. Throws
- 42. High level land

- 61. Chess pieces
- Down**
- 1. Spinning toys
- 2. Condo, e.g.
- 3. Bud, for example
- 4. Vegas marriage

- 21. Plus
- 23. Drench
- 24. Used a broom
- 25. Hit the slopes
- 26. Victory
- 27. Append
- 29. Volcanic fallout

- 44. Spiderman's weapon
- 45. Frosted
- 46. "Of ___ I Sing"
- 48. Detail
- 49. Hurting
- 50. Complain

Biography of the Author

Arielle Vanessa Rancourt was born in Damariscotta, Maine, in July of 1992. She attended high school at Lincoln Academy in Newcastle, Maine, and is a candidate for a Bachelor of Arts degree in the field of psychology from the University of Maine. She has been on the Dean's list throughout her time at the university. She has also been inducted in the Alpha Lambda Delta National Honor Society as well as Psi Chi, the International Honor Society in Psychology. She began working in Dr. Shannon McCoy's lab in her third undergraduate year and during her attendance at the University of Maine was accepted into the honors program, where she combined her work with Dr. Shannon McCoy to complete this honor's thesis.