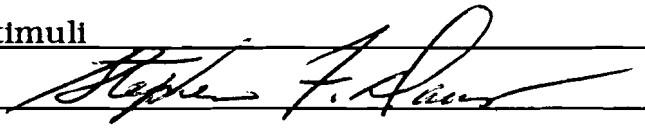
AN ABSTRACT OF THE THESIS OF

Matthew T. Huss for the Master of Science in Psychology presented on May, 1994

Title: Comparison Study of Eyewitness, Verbal Earwitness, and Nonverbal Earwitness Stimuli

Abstract approved by: 

Over the past 20 years, the body of literature on eyewitness identification has increased to such a degree that its application to the courtroom meets with only minimal resistance from the field of psychology. However, the research on verbal earwitness identification or voice identification is much less exhaustive. There is even less empirical evidence regarding nonverbal earwitness identification. For example, do witnesses process shots fired from a gun, the screeching of tires, or the slamming of in the same manner they process faces or voices? This lack of valid and sound research appears to be a serious deficit in the literature.

This study was designed to examine whether some of the same assumptions that hold true for eyewitness and verbal earwitness also hold true for nonverbal earwitness. Data was gathered from 120 undergraduates in 6 introductory psychology classes at a small midwestern university. A questionnaire consisting of 20 items, along with a corresponding Likert type scale for measuring confidence, and a short demographic sheet were used in data collection. Four aspects of eyewitness and earwitness identification were examined: confidence, delay interval, gender, and age.

In order to explore the results 2 (gender) x 3 (delay) x 5 (question type) repeated measures analysis of variance were performed on the dependent variables of accuracy and confidence. The main effects of

delay and question type were found to be significant for both accuracy and confidence. The interaction of delay x question type was significant for subject accuracy. Significant correlations were also uncovered between confidence and three of the five question types (visual, verbal auditory, verbal auditory-visual). A significant correlation resulted when examining age and the verbal auditory question.

The results indicate that similar assumptions can be made in regard to many aspects of eyewitness, verbal earwitness, and nonverbal earwitness stimuli. However, the results also indicate that nonverbal earwitness stimuli also exhibit unique characteristics, separate from eyewitness or verbal earwitness stimuli. The legal implications for these findings and directions for possible future research are also discussed.

A Comparison Study of Eyewitness, Verbal Earwitness, and Nonverbal Earwitness Memory

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A Thesis

Presented to

the Division of Psychology and Special Education

EMPORIA STATE UNIVERSITY

In Partial Fulfillment

of the Requirements for the Degree

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by

Matthew T. Huss

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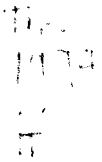

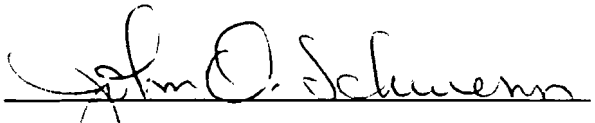

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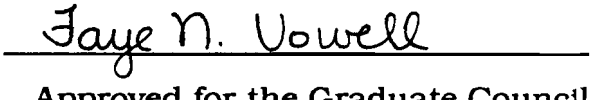

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TABLE OF CONTENTS

LIST OF TABLES

Table

CHAPTER 1

Introduction

Being accused of a crime is one of the most devastating situations that can happen to any one individual, especially if the individual is innocent of the crime. The wrongful identification of innocent individuals appears to be an increasingly problematic occurrence in the United States. In fact, "Analyses of what went wrong in producing more than 1,000 convictions of innocent people have revealed that the single largest factor leading to these false convictions was eyewitness error" (Wells, 1993, p. 554). Evidence relating to the fallibility or infallibility of eyewitness identification has accumulated at an impressive rate over the last 20 years. This occurrence is at least partially due to the fact that eyewitness research offers an ideal problem for psychologists to investigate, given the possibilities of real-life applications. Identifying individuals who are innocent of a serious crime and in turn apprehending those who are indeed guilty of such a crime is in the best interest of those involved and society as a whole. In turn, the aspects of eyewitness recall and recognition that have been explored since Loftus and Palmer's (1974) ground breaking study include an impressive multitude of variables: stress, violence, length of interaction, race, the use of police line-ups, voice disguise, level of illumination, and suggestibility. Additionally, several other aspects of the visual components involved in eyewitness identification have been scrutinized.

Eyewitness Identification

Confidence-Accuracy Relationship

The confidence level of individuals who testify in a court of law or identifies a suspect in a police line-up has long been proposed as an

indication of the accuracy of their memory. It is intuitively appealing that the more confident individuals are of their testimony, the more accurate those individuals must be in their testimony. In fact, the U.S. Supreme Court explicitly lists confidence as one of the criteria on which to evaluate the accuracy of identification evidence (Neil v. Biggers, 1972).

Research also indicates that jurors place too much emphasis on the testimony of witnesses who are confident in testifying, regardless of the accuracy of such testimony (Wells, Lindsay, & Ferguson, 1979). In fact, Cutler, Penrod, and Stuve (1988) found that the witness's level of confidence was the most important determiner for judging the truthfulness of the witness. However, psychological research has indicated that it is not always correct to associate increased confidence with increased accuracy. Wells and Murray (1984) reviewed the available evidence and found several studies indicating a positive relationship between confidence and accuracy, several indicating a negative relationship between confidence and accuracy, and several indicating no significant relationship between confidence and accuracy. They concluded there was little if any relationship between the confidence of witnesses and their level of accuracy.

However, as studies regarding confidence and accuracy have grown in sophistication and depth, the murky relationship has been clarified. For example, Sporer (1993) showed a 5.5 minute film depicting the robbery of a cashier box from a refreshment stand. Subjects were then shown a photo lineup consisting of 6 of a possible 14 individuals, all similar in appearance to the perpetrator in the original film clip, and asked to identify the perpetrator. They were told that the perpetrator might or might not be present in the photos. Subjects were either in a

simultaneous or a sequential presentation condition, i.e., subjects were either exposed to the six photographs all at one time or individually, one right after the other. Results indicate differences in the relationship of confidence to accuracy for those individuals who chose one of the photographs as being the original perpetrator versus those individuals who did not choose one of the photographs. Sporer (1993) concluded from the results that confidence may be more indicative of accuracy in situations where individuals have made an initial positive identification. Other studies manipulating a variety of variables have also concluded that particular conditions will have dramatic effects on the accuracy-confidence relationship (Brigham, 1988; Sporer, 1992). The latest review of the confidence-accuracy literature has concluded that the average correlation across studies is $\underline{r} = .25$. However, this correlation is affected by the length of interaction between the witness and the target; the longer the exposure of the target witness, the stronger the correlation between the witness's confidence and accuracy of identification (Bothwell, Deffenbacher, & Brigham, 1987).

Delay Interval

Another variable often examined in relationship to eyewitness identification is the length of time between the presentation of the initial stimuli and later recall or recognition of that stimuli, the delay interval. As was the case with confidence, there is also a straightforward intuitive explanation with regard to accuracy and the length of the delay interval: as the delay interval increases, the accuracy of subject identification decreases. The U.S. Supreme Court's previously mentioned ruling (Neil v. Biggers, 1972) indicates that courts should take the length of time between the crime and the initial identification into consideration, when

evaluating the accuracy of an eyewitness.

Unlike the accuracy-confidence relationship, the effect of delay between initial presentation and later recall or recognition may seem fairly clear. After all, it is well-established that forgetting increases with the passage of time. This idea is one of the oldest in psychology (Ebbinghaus, 1885/1964). However, eyewitness research has demonstrated the relationship between accuracy and delay to be much more complex than was first thought. In an often cited study, Bahrick, Bahrick, and Wittlinger (1975) found that recognition for familiar faces is remarkably resistant over extremely lengthy periods of time. They found that subjects were able to identify 90% of the faces of their high school classmates for as many as 35 years after graduation and were even remarkably durable for up to 48 years afterward. However, most crimes do not involve interaction between two individuals who have spent a significant portion of their lives together. Most eyewitness identifications are based on the recognition of unfamiliar faces. Therefore, eyewitness research has tended to focus upon such situations.

The evidence regarding the identification of unfamiliar stimuli tends to be mixed in regard to eyewitness testimony. Several studies have indicated that accuracy does not decrease with the simple passage of time for 2-day (Berger & Herringer, 1991), 1-week (Laughery, Fessler, Lenorovitz, & Yoblick, 1974), and 2-week delays (Deffenbacher, Carr, & Leu, 1981). However, Shepard, Davies, and Ellis (1981) found a dramatic decline in accuracy following a 12-month delay interval versus, 1-week, 1-month and 3-month delays. In general, the research has indicated that accuracy does not decline significantly with the passage of time, up to approximately 30 days (Wells & Murray, 1983).

However, research has begun to focus on not only the length of the delay but on the length of exposure and what occurs during the delay interval. Studies have indicated that the if exposure time is limited and subjects are not given additional visual cues (e.g., a series of mugshots) then delay effects are more pronounced (Ellis, 1984). For example, McKelvie (1988) exposed subjects to photographs of individual faces for either 1 or 3 seconds. Presentation of the initial stimuli and later recognition were separated by either 10-minute or 7-day delays with subjects exposed to no additional relevant cues. Subjects demonstrated significantly poorer accuracy in the 7-day delay as compared to the 10-minute delay. In large part, it was believed that limited exposure time and the lack of additional cues were responsible for the delay effect. The evidence seems to indicate that delay intervals have minimal, if any, effect when exposure time is substantial and/or events occur between initial presentation and later recognition that may influence accuracy (e.g., mugshots). However, if exposure time is limited and the delay interval is free from outside interference, delay does have an effect on accuracy (Wells & Murray, 1983).

Age

Individual differences such as age, gender, and other personality attributes have been comparatively unexplored in the eyewitness research (Yarmey, 1984). However, in a court of law these differences may be meaningful. Should the testimony of a 4-year-old child be given as much credibility as that of an adult? For that matter, should the testimony of a 65-year-old retiree be given the same credibility of an individual who is 29 years old? The literature has attempted to answer these and many other questions concerning the effect of age on the performance of

eyewitnesses. In one study, O'Rourke, Penrod, Cutler, and Stuve (1989) tested the performance of subjects ranging from 18 to 74 years of age. Subjects were initially presented a videotape reenactment of a robbery with several variables such as target presence in lineup, lineup instructions, and contextual aids being manipulated. Results indicated that age was an accurate predictor of accuracy, with performance declining with age. Specifically, it was found that accuracy rates fell substantially after 50 years of age. This finding was somewhat consistent with previous research in regard to a cut-off age (Smith & Winograd, 1978).

Additional research has further explored the relationship between age and performance across a wider age continuum. Bringmann, Tyler, McAhren, and Bringmann (1989) compared two groups of children, one younger (grades 1-3) and one older group (grades 4-6). Bringmann et al. found performance differences between these two groups of children, the older children were significantly more competent at answering factual questions and made fewer errors on leading questions. Young adults also demonstrate superior recall for the details of a crime compared to elderly adults (Yarmey & Kent, 1980). However, the same study found face recognition performance to be unrelated to subject age. List (1986) found that college students (mean age = 20.1) demonstrated significantly greater recall than older adults (mean age = 67.6) or children (mean age = 10.7) and that older adults were less accurate than children.

It is apparent that significant differences do exist between different groups across the age continuum. Older adults (age 50 to 60 and up) appear to be less accurate than younger adults and older children. However, young children (age 3 or 4 and below) have a tendency to be

less accurate than older children and adults. Hence, both groups may be poor witnesses in a court of law (Yarmey, 1984). Though general age differences have been found between extreme ages, little research has been conducted on the subtle differences that may exist between individuals in the age group that makes up the bulk of individuals to testify in courts of law, those 18-50 years of age (Yarmey, 1984).

Gender

Eyewitness gender has also been examined in order to uncover any effect that it may have on performance accuracy. William Stern (1903-1904) has been credited with completing some of the classic work involving gender differences in eyewitness behavior as a result of his turn of the century studies (as cited in Cunningham & Bringmann, 1986). In Stern's original work, he provided evidence that males demonstrate superior accuracy compared to females on eyewitness tasks. However, later studies have not consistently found similar results. Cunningham and Bringmann (1986) took great care to replicate Stern's original findings. In the replication, a group of 20 male and 35 female college students served as volunteers and were tested individually in an empty classroom. After being told to carefully attend to a short term memory task, subjects were presented a 35-mm slide depicting an old-fashioned kitchen. Immediately after the slide was projected, subjects were asked to identify a list of 80 objective test items taken directly from Stern's original interview guide. Each response was given orally, recorded and assigned a value of 1 for correct and 0 for incorrect. Cunningham and Bringmann (1986) found there were no significant sex differences in accuracy of recall or in resistance to suggestibility.

These contradictory findings are very much in keeping with the

general findings of the rest of the literature on gender differences in eyewitness identification. Some studies, such as Stern's original research, have found that men demonstrate superior performance, others have found that women perform better (Lipton, 1977), while still others have found no significant differences between men and women (Christiaansen, Sweeney, & Ochalek, 1983; Cunningham & Bringmann, 1986). This compilation of data indicates that results looking for straightforward gender effects are inconclusive.

However, several studies have delved into the issue of gender differences and eyewitness testimony more closely and uncovered some interesting results. For example, Clifford and Scott (1978) tested a group of undergraduate volunteers by exposing them to one of two videotapes (one of a nonviolent incident and the other of a violent incident) and testing their performance afterward. Clifford and Scott (1978) found no significant main effect for gender. However, they did find an interaction effect for gender and type of film. Women demonstrated significantly poorer accuracy when exposed to the violent film compared to men; there were no significant gender differences between men and women in the nonviolent film condition.

Another study found that not only are gender effects present when the amount of violence is manipulated, but also when the gender orientation of the subject material is examined (Powers, Andriks, & Loftus, 1979). Powers et al. (a) showed subjects a series of slides, (b) had subjects fill out an accuracy questionnaire, (c) had subjects read a suggestibility paragraph, and (d) and had subjects take a final test. The findings suggested there were no significant gender differences in accuracy or in subject confidence. However, upon closer examination,

the researchers found differences on gender specific questions; women were significantly more accurate on questions referring to such things as women's clothing or actions. The results also found that women were more suggestible than men on male-oriented items, whereas the reverse was true for female-oriented items. Christiaansen, Ochalek, and Sweeney (1984) also replicated these results.

It can be ascertained that results regarding a conclusive statement concerning the relationship between accuracy and gender differences is premature at this point. Gender effects depend on situational specifics, such as gender orientation of the material and the presence or absence of violence.

Verbal Earwitness Identification

Though eyewitness identification has accumulated a considerable body of research, the auditory component of eyewitness identification, or earwitness identification, has lagged behind. For many years the focus of eyewitness research has been on the visual cues such as faces, car speeds, or weapon type etc. Hence, the information accumulated regarding auditory aspects of eyewitness events is not as considerable. However, it has become evident that not only can auditory descriptions (earwitness testimony) supplement visual descriptions (eyewitness testimony) (Melara, DeWitt-Rickards, & O'Brien, 1989), but they may be the only evidence in cases of extremely poor illumination. In some crimes, voice contact may be the only source of information, such as over the telephone. Due to this fact, more interest has been shown in the area of earwitness testimony and how it applies to the judicial system (Bull & Clifford, 1984).

Though Clifford (1980) reports many of the basic flaws and

assumptions of eyewitness testimony have counterparts in earwitness testimony, there are clear differences between the two. The beginning of earwitness testimony and voice identification research can be traced to the trial involving the Lindberg kidnapping at which Charles Lindberg identified the voice of the defendant as the one he had heard three years previous (McGehee, 1937). McGehee began her landmark article by stating that "the reliability of court procedure with reference to identification of voices is open to serious question from a psychological point of view" (p. 249). In her initial studies, McGehee found differences regarding the number of voices, length of delay, the disguising of the voice, ethnic origin of the voice, and the gender of the participants or the source voice. From this study and the replication (McGehee, 1944), earwitness testimony has developed into an area with its own identity, separate from eyewitness testimony.

Confidence-Accuracy Relationship

Unlike eyewitness research, earwitness research has consistently yielded positive relationships between confidence and accuracy, except in cases where the target voice is absent (Clifford, 1980). In one particular study, subjects were asked to participate in a psychological investigation of clairvoyance (guessing the correct suit for individual playing cards). While working on the clairvoyance task in the experimental room subjects were interrupted by a loud voice from an adjoining room. Subjects were to later identify the voice from a five person voice lineup. Consequently, subject's accuracy rates did positively correlate with their perceived level of confidence. Saslove and Yarmey (1980) also reported a small positive correlation (r= .26) between voice recognition accuracy and confidence.

Delay Interval

A witness is not usually presented with a list of voices or asked how many shots were fired seconds after the crime has occurred. A witness needs to be able to retain information for hours, weeks, or even months after the fact. McGehee (1937) reported significant reduction in accuracy after 1-week, 3-week, and 5-month delays. Later McGehee (1944) replicated the study using taped instead of live voices and found similar results. Additionally, Bull and Clifford (1984) report a study in which subjects witnessed a live incident in which a stooge entered room, had a brief conversation with the experimenter, and then left. After 1, 2, or 3 weeks, the witnesses' abilities to recognize the voice were tested. After a delay of 1 week identification was about 50%, after 2 weeks it was 43% and after 3 weeks it fell to 9%. Analysis of the data revealed no significant differences between the 1-week and the 2-week delay. However, the drop in performance during week 3 was significant. The present results indicate little decrease in accuracy appears after a 24-hour delay period, but after about 2 to 4 weeks, accuracy may be negatively affected.

In another study, subjects attempted to identify unfamiliar men's and women's voices from a "voice parade" of 20 distracter voices, after delays of 10 minutes, 24 hours, 7 days, and 14 days (Clifford, Rathborn, & Bull,1981). The mean accuracy percentages for each condition were 55.4%, 32.1%, 30.4%, and 37.5%, respectively. Post hoc analysis revealed that the 10-minute delay was significantly different from the other delay conditions, but none of the remaining delay conditions were statistically different from each other.

It is clear that the research points to some type of effect for delay

on accuracy. However, the extent to which the delay affects accuracy or the rate at which it does so are not clear. As Bull and Clifford (1984) concluded, "A definitive statement on delay and accuracy thus awaits further research" (p. 119).

Age

The age of the listener may also play a part in the accuracy of earwitness identification. While there is a lack of substantive research on the effects of age on earwitness testimony, some studies have examined the issue. For example, Bartholomeus (1973) presented preschoolers slides of classmates' faces and a 1-sentence voice sample delivered over head phones. The children were then presented either the face or the voice to identify. The children performed much better at facial recognition than speaker identification tasks and demonstrated lower rates of accuracy when compared to their teachers. One theoretical explanation is that it is more difficult for young children to identify an individual by his/her voice because there are fewer distinctive features in vocal, as opposed to facial stimuli. It is also possible that the effect is due to individual's processing non-verbal cues immediately and auditory cues during or after the stimulus is presented. This factor would indicate some sort of inefficiency in processing the auditory stimuli in children. Bull and Clifford (1984) reported another study in which 13- to 14-year-olds performed more poorly than did 15- to 16-year-olds when listening to a 2-sentence speech sample, thus indicating a possible developmental effect.

While focusing on adults, Clifford et al. (1981) found that "middle aged" (21-40 years) subjects were significantly more accurate than "old" (over 40) subjects. Subjects between the ages of 16 and 40 demonstrated

similar abilities in identification. Likewise, Kausler and Puckett (1981) reported a declining ability, among listeners over 40, in differentiating between the sex of voices. It can be concluded from the available evidence that caution should be exercised in earwitness identification by older adults (over 40 years of age) and children under the age of 16. However, any statement above and beyond this is unadvisable.

Gender

The possibility of gender differences in earwitness research has also been investigated. Subjects usually have little trouble in accurately identifying the gender of the speaker in voice identification situations. In other words, subjects can easily indicate whether the speaker is a man or a woman. However, the accuracy of male and female earwitness reports is not as clear. In a review of the literature, Bull and Clifford (1984) reported slightly greater accuracy for men, but more recent research has not even found this small gender effect. Yarmey (1986) reported no reliable sex differences regarding voice identification accuracy in one study. After observing a series of slides depicting a rape scene narrated by the perpetrator, subjects successfully picked out the assailant using a five-person, randomized voice line-up and uncovered no differences between gender. Thompson (1985) reported similar results in a reconstruction of an earlier study. A gender effect for memory is often explained by such things as the absence of stress or the gender orientation of the material. Thus, men might more accurately recognize sports topics and women, family issues. This effect is very similar to that present in eyewitness testimony. However, inconsistent evidence for the main effect of gender warrants further investigation.

Nonverbal Earwitness Identification

Earwitness research has almost exclusively focused on verbal recognition or voice identification. Nonverbal auditory stimuli such as the number of gun shots or the direction of a sound have been largely ignored. McAllister, Bregman, and Lipscomb (1988) offer the lone study on the retention of nonverbal auditory stimuli. In their study, subjects were exposed to a car accident and had to estimate the speed of the car under three different conditions: a video and audiotape, only a videotape, or only an audiotape consisting only of nonverbal sounds. Subjects' visual estimates and combined visual/auditory estimates were significantly more accurate than their auditory estimates. However, there was no consistent difference between subject's visual estimates compared to only the visual/auditory estimates. McAllister and colleagues delved into some of the elementary aspects of nonverbal earwitness testimony, such as accuracy. Yet, they did not explore any of the parallels that exist in eyewitness testimony. Clifford's (1980) comment that many of the basic flaws and assumptions of eyewitness identification have earwitness counterparts is yet to be seen in regard to the nonverbal aspects of earwitness testimony. For example, what is the relationship between accuracy and confidence when confronted with nonverbal cues?

The present study attempted to uncover whether some of the same assumptions that hold true for visual and verbal stimuli are valid with nonverbal stimuli. Specifically, the following research questions were addressed: (a) Do varying delay intervals between presentation of the initial stimuli and later recall result in decreased accuracy and confidence ratings across the different perceptual modalities (e.g.,

nonverbal, verbal, and visual)? (b) Is the relationship between accuracy and confidence consistent across the different perceptual modalities? (c) Do the gender or age of the subjects affect accuracy of confidence across the different perceptual modalities?

CHAPTER 2

Method

Subjects

Volunteers were obtained from 6 different introductory psychology classes at a medium sized, regional midwestern university. The sample consisted of 120 (48 men and 72 women) students. The mean age for the sample was 21.6 years of age (SD = 5.1).

Materials

A 2.5 minute videotaped clip of the television show The Commish was utilized. This scene depicted a living room in which a man threatens a woman and demands to know the location of a particular object. Twenty questions about the scene were included in a questionnaire, of which 5 assessed the relevant perceptual information: visual (V), verbal auditory (VA), verbal auditory-visual (VA-V), nonverbal auditory (NA), and nonverbal auditory-visual (NA-V). These questions are depicted in Table 1.

Accuracy on each question was coded as either correct or incorrect (1 = correct, 2 = incorrect). Following each question was a 9-point Likert type scale for rating response confidence. Also, included in the questionnaire packet was a demographic sheet assessing several subject characteristics.

Procedure

Subjects were tested in their normal classroom environment. After being told they would be exposed to a videotape depicting a violent scene followed by several questions to answer, the subjects' informed consent forms were collected and they were exposed to the videotape. The videotape was shown on a 20 inch Sony color television set. The

Table 1

Key Questions for Each Modality

Modality	Question
Visual	What color was the blonde woman's sweater?
Verbal Auditory	What does the blonde woman say the tapes are behind?
Verbal Auditory/Visual	Who was the villain going to get from the other room?
Nonverbal Auditory	How many shots did the villain fire?
Nonverbal Auditory/Visual	What noise did you hear as the police entered the home?

television was placed in a central location at the front of the classroom and the sound was kept at a constant level across subject groups. Depending on assignment, as determined by normal class make-up, subjects completed the questionnaire either immediately (N = 47), after a 2-day delay (N = 39), or after a 7-day delay (N = 34). Thus, subjects in the immediate condition were shown the videotape and then answered the questionnaire. Subjects in the 2-day delay were shown the videotape and answered the questionnaire 48-hours later. Likewise, subjects in the seven day delay were shown the videotape and answered the questionnaire after a 1-week delay.

As the subjects watched the videotape, the amount of time they were exposed to the relevant perceptual information (i.e., the "answer" to each of the five questions) differed between questions, though it was held constant between delay conditions. Subjects were exposed to the visual stimuli for the relevant question for 56 seconds. They were exposed to the verbal auditory stimuli for 4 seconds and the nonverbal auditory stimuli for 11 seconds. Subjects were exposed to both the verbal auditory-visual stimuli and the nonverbal auditory-visual stimuli for 3 seconds, for the relevant questions.

CHAPTER 3

Results

Accuracy

A 2 (gender) x 3 (delay) x 5 (question type) repeated measures analysis of variance was performed on the accuracy dependent variable. Significance was obtained for the main effects of question type, $F(4, 424) = 37.33$, $p < .0001$, and delay, $F(2, 106) = 13.22$, $p < .0001$, and the interaction of delay by question, $F(8, 424) = 3.05$, $p < .01$. Subsequent $Fishers_{LSD}$ tests reveal significant differences between question types across delays. Table 2 depicts these results. All significant differences are at the $p < .05$ level of confidence.

Table 3 depicts aggregate means for accuracy scores on all five questions within each delay condition. Subsequent $Fishers_{LSD}$ tests indicate that subjects were more accurate in the immediate condition than the two-day delay and the seven-day delay. Subjects were also more accurate in the two-day delay condition than in the seven-day delay condition.

Table 4 depicts the means for accuracy scores on each question type. Subsequent $Fishers_{LSD}$ tests indicate subjects were more accurate on the verbal auditory questions than any of the other question types. There was no significant difference between accuracy scores on the visual and the nonverbal auditory-visual questions though subjects were more accurate on these question types than the strictly verbal auditory and the nonverbal auditory. There was no significant difference between the verbal auditory condition and the strictly nonverbal auditory condition.

Table 2

Results of the Fishers LSD Test for the Means in the Delay x Question Interaction

V/AV-2	V/AV-1	V/AV-3	V-1	N/AV-1	VA-1	N/AV-3	NA-2	N/AV-2	VA-2	V-3	NA-1	V-2	NA-3	VA-3
1.03	1.04	1.18	1.22	1.43	1.54	1.61	1.63	1.65	1.66	1.70	1.72	1.77	1.79	1.88

Note. All underlined means are not significantly different.

Note. 1 = immediate delay, 2 = two day delay, and 3 = seven day delay.

Note. Lower scores correspond to greater accuracy.

Table 3

Results of the Fishers LSD Test for Mean Question Accuracy Across Delay Conditions

	Delay 1	Delay 2	Delay 3
Totaled Accuracy	6.95	7.75	8.15

Note. All underlined means are not significantly different.

Note. Lower scores correspond to greater accuracy

Table 4

Results of the Fishers LSD Test for Mean Accuracy Across All Key Questions

	Verbal Auditory-Visual	Visual	Nonverbal Auditory-Visual	Verbal Auditory	Nonverbal Auditory
Accuracy	1.08	1.53	1.55	1.68	1.71

Note. All underlined means are not significantly different.

Note. Lower scores correspond to greater accuracy.

Confidence

A 2 (gender) x 3 (delay) x 5 (question type) repeated measures analysis of variance was performed on the confidence dependent variable. Significance was obtained for the main effects of question type, $F(4, 404) = 19.85$, $p < .0001$, and delay, $F(2, 101) = 6.37$, $p < .01$. Subsequent $Fishers_{LSD}$ tests reveal differences between means. Table 5 depicts aggregate means for confidence on all five questions within each delay condition. All significant differences are at the $p < .05$ level of confidence. Subsequent $Fishers_{LSD}$ tests indicate that subjects are significantly more confident in the immediate delay than two-day delay and the seven-day delay. Subjects were also significantly more confident in the two-day delay than the seven-day delay.

Table 6 depicts the means for confidence scores on each question type. Subsequent $Fishers_{LSD}$ tests indicate that subjects were significantly more confident on the visual and the nonverbal auditory-visual questions than the nonverbal auditory question, the verbal auditory question, and the verbal auditory visual question. However, there was no significant difference between the visual and the nonverbal auditory-visual question. Subjects were significantly more confident on the nonverbal auditory question than the verbal auditory or the verbal auditory-visual question. However, there was no significant difference between the verbal auditory and the verbal auditory visual question.

Accuracy-Confidence

A Pearson product moment correlation was utilized to test the relationship between accuracy and confidence. A significant

Table 5

Results of the Fishers LSD Test for Mean Confidence Across Delay Conditions

	Delay 1	Delay 2	Delay 3
Totaled Mean Confidence	25.45	26.85	30.90

Note. All underlined means are not significantly different.

Note. Higher scores correspond to greater confidence.

Table 6

Results of the Fishers LSD Test for Mean Confidence Across All Key Questions

	Visual	Nonverbal Auditory-Visual	Nonverbal Auditory	Verbal Auditory	Verbal Auditory-Visual
Confidence	4.38	4.68	5.37	6.55	7.08

Note. All underlined means are not significantly different.

Note. Higher scores correspond to greater confidence.

relationship was found between overall accuracy and overall confidence (r = -.36, p <.01). Significant relationships were also found among the visual question (r = -.47, p < .01), verbal auditory question (r = -.43, p < .01), and the verbal auditory-visual question (r = - .50, p < .01). No significant correlations were found between confidence and accuracy on the nonverbal auditory and nonverbal auditory-visual questions. It should be noted that as a result of the data coding for the accuracy rating (1 = correct, 2 = incorrect), the above significant correlations indicate that as subjects become more confident in their responses they also become more accurate.

Age and Accuracy

The analysis of the relationship between age and accuracy was examined utilizing Pearson product moment correlations. Only the verbal auditory question demonstrated a significant relationship with age (r = -.22). Again, it should be noted that as a result of the data coding for the accuracy rating (1 = correct, 2 = incorrect), the above significant correlations indicate that as subjects become older they also become more accurate on this particular question.

CHAPTER 4

Discussion

The results of this study suggest several interesting conclusions. Results involving the main effect of accuracy indicate that (a) the visual component improves accuracy when compared to the auditory only, (b) there is no difference in accuracy between purely verbal and nonverbal information, (c) and if visual information is added to verbal and nonverbal material, verbal accuracy improves dramatically more than the accuracy of nonverbal information. The results of the present study are also similar to data reported by McAllister et al. (1988), where the relationship between dual modality questions and questions with only visual component were examined. Subjects do not appear to be consistently more accurate on auditory information with a visual component than solely visual information. This finding stands in contrast to what one might intuitively expect. It may be that at times dual modality information confuses subjects or that the processing of such information is more complex and more subject to inaccuracy at the time of recall when compared to only visual information. However, both the present study and McAllister et al. (1988) indicate that subjects are more accurate at recalling visual information and visual-auditory information than auditory information alone.

Therefore, witnesses whose conclusions are solely based on visual information or auditory-visual information would appear to be more accurate than those witnesses who rely solely on auditory information. The lack of consistent significant differences for dual modality information compared to solely visual information becomes important when a jury is faced with the dilemma of conflicting testimony between

witnesses when one witness bases it on visual information and the other witness a combination of auditory and visual information. Intuitively it makes sense that the individual who has received information via both senses would be more accurate. However, according to the results of the present study and McAllister et al. (1988), this is not necessarily the case.

It is apparent that as the delay interval increases, subjects are generally less accurate at recalling information. When collapsing all question types for each delay, subjects were significantly more accurate in the immediate condition than in either the two-day delay or in the seven-day delay. Subjects were also more accurate in the two-day delay condition than in the seven-day delay condition. These results appear to be in keeping with general intuition, as the delay progressively increases subjects become less accurate across the board. They also provide a consistent relationship between delay and accuracy that has not been evident in the literature.

Although results indicate that overall subject accuracy decreases with delay, this effect is also dependent on the question type. For example, subjects were significantly more accurate on the three verbal auditory-visual questions than every other question, except the visual question in the immediate delay. There appeared to be no difference in the verbal auditory-visual accuracy scores across delay intervals and subjects were also the most accurate on questions involving this modality. Therefore, for verbal auditory-visual information there appears to be no delay effect. Because previous research has failed to make this distinction in stimuli it is difficult to tell whether these results are consistent with other empirical evidence. It would appear that when an

individual witnesses something both visually and verbally that the memory is salient enough to not be affected by up to a one-week delay.

Differences also exist between the nonverbal auditory-visual questions and the visual questions across the differing delays. Subjects were most accurate in the immediate delay for both question types. They were significantly less accurate in the two-day delay and the seven-day delay condition. Therefore, there appears to be a delay effect for the nonverbal auditory-visual information and the strictly visual information with some type of floor effect after two days. However, without a delay interval longer than seven days, it is impossible to state how far this floor effect continues. Again, without prior empirical distinction for nonverbal auditory-visual information, it is impossible to make a comparison. However, comparison of the results for visual information are possible. Because the exposure time was moderately lengthy (56 s) for the visual question it was unexpected that a delay effect would be present, especially when comparing the immediate condition with the seven-day condition. These results stand in direct contrast to earlier results involving eyewitness identification and the effect of a 2-day (Berger & Herringer, 1991) or 7-day delay (Laughery, et al., 1974). Hence, a definitive statement regarding delay and eyewitness identification is still not possible.

The results regarding the solely verbal and solely nonverbal information are somewhat curious. Under the verbal auditory condition subjects were significantly more accurate under the immediate condition than the seven-day delay condition but not the two-day delay condition nor did subjects differ between the two-day and the seven-day delays. Therefore, for the pure voice recognition condition a delay effect occurred

after the one-week interval compared to immediate recall. These results again point to the probability of a shorter delay effect for earwitness information compared to eyewitness information, but it is still not definitive as to the point in time of this effect. Under the nonverbal-auditory questions a curious result was uncovered. There was no significant difference between the immediate condition and the two-day delay condition. Nor was there a significant difference between the immediate condition and the seven-day delay condition. However, subjects were significantly more accurate in the two-day delay condition than the seven-day delay condition. There is support for this bowed curve relationship in the literature (cf. Clifford et al., 1981). The safest conclusion is that although delay does have a detrimental effect, that the effect is far from catastrophic. These results indicate a complex relationship between the differing question types under certain delay conditions.

The confidence results across delay conditions appear to be counter intuitive. They indicate that as the delay interval increases, subjects become more confident in their performance. One would hypothesize that as the time between initial presentation of the stimuli and later recall increases, subjects grow less confident in their ability to accurately recall those events. It could be that with the passage of time subjects conveniently forget how much they actually can recall. It may also be that with the passage of time the memory consolidates and blends with other memories thus creating a more solidified picture of the past (Neisser, 1994).

There also appear to be significant differences in how confident subjects are on different types of questions. Subjects appear to be the

most confident when answering visual questions. Subjects also appear to be more confident when answering nonverbal questions, whether auditory visual or only auditory, than the verbal questions, whether auditory-visual or auditory. This difference between verbal modality and nonverbal modality questions may have significant implications for the courtroom. It appears that even though eyewitnesses or earwitnesses may not be more accurate, they are in fact more confident.

As far as the accuracy-confidence relationship is concerned, significant correlations exist between accuracy and confidence regarding all perceptual information, except the questions with a nonverbal components. These results indicate that the more accurate subjects profess to be, the more accurate they actually are. These results are, therefore, very much in keeping with the consistent positive correlations found in voice identification research and the positive relationship eventually found in eyewitness research. However, there were no significant relationships between confidence and accuracy on the nonverbal questions, nonverbal auditory and nonverbal auditory-visual. The lack of a significant correlation involving these perceptual modalities may be a direct result of the rather brief exposure of each of the specific stimuli (3 seconds). Hence, future studies should lengthen the exposure time for nonverbal stimuli and explore this relationship further.

The age and accuracy results were not surprising considering the present sample. The students' ages ranged from 17 to 47 with only 11 subjects above the age of 30. The only question type that did reveal a significant correlation was the verbal auditory question. The results revealed that subjects actually became more accurate as their age increased. This result is most probably not due to any significant

psychological phenomena and is likely to be irrelevant to future investigators.

Eyewitness and earwitness testimony are becoming increasingly more important in courtroom settings. However, nonverbal aspects of earwitness testimony have almost been completely ignored. The results of this study suggest that the recall of nonverbal information does produce results similar to voice identification and eyewitness testimony in some aspects, but not in all. This study has uncovered information that nonverbal earwitness testimony may exhibit its own unique characteristics separate from eyewitness and verbal earwitness testimony. Future research should concentrate on extending the length of the delay interval, controlling for exposure time, and creating quality questions that discriminate between these distinctive modalities.

References

Bahrick, H., Bahrick, P., & Wittlinger, R. (1975). Fifty years of memory for names and faces: A cross-sectional approach. Journal of Experimental Psychology: General, 104, 54-75.

Bartholomeus, B. (1973). Voice identification by nursery school children. Canadian Journal of Psychology, 27, 464-472.

Berger, J. D., & Herringer, L. G. (1991). Individual differences in eyewitness accuracy. Journal of Social Psychology, 13, 807-813.

Bothwell, R. K., Deffenbacher, K. A., & Brigham, J. C. (1987). Correlations of eyewitness accuracy and confidence optimality hypothesis revisited. Journal of Applied Psychology, 72, 691-695.

Brigham, J. C. (1988). Is witness confidence helpful in judging eyewitness accuracy? In M. M. Gruneberg, P. E. Morris, & R. N. Sykes (Eds.), Practical aspects of memory. Chichester, England: Wiley.

Bringmann, M. W., Tyler, K. E., McAhren, P. E., & Bringmann, W. G. (1989). A successful and unsuccessful replication of William Stern's eyewitness research. Perceptual and Motor Skills, 69, 619-625.

Bull, R., & Clifford, B. R. (1984). Earwitness voice recognition accuracy. In G. L. Wells & E.F.Loftus (Eds.) Eyewitness testimony: Psychological perspectives (pp. 92-123). New York: Cambridge University Press.

Christiaansen, R. E., Ochalek, K., & Sweeney, J. D. (1984). Individual differences in eyewitness memory and confidence judgments. The Journal of General Psychology, 110, 47-52.

Christiaansen, R. E., Sweeney, J. D., & Ochalek, K., (1983). Influencing eyewitness descriptions. Law and Human Behavior, 7, 59-65.

Clifford, B. R. (1980). Voice identification by human listeners: On earwitness reliability. Law and Human Behavior, 4, 373-394.

Clifford, B.R., Rathborn, H., & Bull, R. (1981). The effects of delay on voice recognition accuracy. Law and Human Behavior, 5, 201-208.

Clifford, B. R., & Scott, J. (1978). Individual and situational factors in eyewitness testimony. Journal of Applied Psychology, 65, 352-359.

Cunningham, J. L., & Bringmann, W. G. (1986). A re-examination of William Stern's classic eyewitness research. Perceptual and Motor Skills, 63, 565-566.

Cutler, B. L., Penrod, S. D., & Stuve, T. E. (1988). Juror decision making in eyewitness identification cases. Law and Human Behavior, 14, 185-192.

Deffenbacher, K. A., Carr, T. H., & Leu, J. R. (1981). Memory for words, pictures and faces: Retroactive interference, forgetting, and reminiscence. Journal of Experimental Psychology: Human Learning and Memory, 7, 299-305.

Ebbinghaus, H. (1964). Memory: A contribution to experimental psychology. New York: Dover (Originally published in 1885).

Ellis, H. D. (1984). Practical aspects of face memory. In G. L. Wells & E. F. Loftus (Eds.) Eyewitness testimony: Psychological perspectives (pp. 12-38). New York: Cambridge University Press.

Kausler, D., & Puckett, J. (1981). Adult age differences in memory for sex of voice. Journal of Gerontology, 36, 44-50.

Laughery, K., Fessler, P., Lenorovitz, D., & Yoblick, D. (1974). Time delay and similarity effects in facial recognition. Journal of Applied Psychology, 59, 490-496.

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

List, J. A. (1986). Age and schematic differences in the reliability of eyewitness testimony. Developmental Psychology, 22, 50-57.

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. Journal of Verbal Learning and Verbal Behavior, 13, 585-589.

McAllister, H. A., Bregman, N. J., & Lipscomb, T. J. (1988). Speed estimates by eyewitnesses and earwitnesses: How vulnerable to postevent information? Journal of General Psychology, 115, 25-35.

McGehee, F. (1937). The reliability of the identification of the human voice. Journal of General Psychology, 17, 249-271.

McGehee, F. (1944). An experimental investigation of voice recognition. Journal of General Psychology, 31, 53-65.

McKelvie, S. J. (1988). The role of spectacles in facial memory: A replication and extension. Perceptual and Motor Skills, 66, 651-658.

Melara, R. D., DeWitt-Rickards, T. S., & O'Brien, T. P. (1989). Enhancing lineup identification accuracy: Two codes are better than one. Journal of Applied Psychology, 74, 706-713.

Neil v. Biggers, 409 U.S. 188 (1972).

Neisser, U. (1994). An ecological and developmental cognitive psychology. Invited address at the annual meeting of the Southern Society for Philosophy and Psychology, Atlanta, GA.

O'Rourke, T. E., Penrod, S. D., Cutler, B. L., & Stuve, T. E. (1989). The external validity of eyewitness identification research. Law and Human Behavior, 13, 385-395.

Powers, P. A., Andriks, J. L., & Loftus, E. F. (1979). Eyewitness accounts of males and females. Journal of Applied Psychology, 64, 339-347.

Saslove, H., & Yarmey, A. D. (1980) Long-term auditory memory: Speaker identification. Journal of Applied Psychology, 65, 111-116.

Shepard, J. W., Davies, G. M., & Ellis, H. D. (1981). Perceiving and remembering faces. London: Academic Press.

Smith, A. D., & Winograd, E. (1978). Age differences in remembering faces. Developmental Psychology, 14, 443-444.

Sporer, S. L. (1992). Post-dicting eyewitness accuracy: Confidence decision-times and person descriptions of choosers and nonchoosers. European Journal of Social Psychology, 22, 157-180.

Sporer, S. L. (1993). Eyewitness identification accuracy, confidence, and decision times in simultaneous and sequential lineups. Journal of Applied Psychology, 78, 22-33.

Thompson, C. P. (1985). Voice identification: Speaker identifiability and a correction of the record regarding sex effects. Human Learning, 4, 19-27.

Wells, G. L. (1993). What we know about eyewitness identification? American Psychologist, 48, 553-571.

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

Wells, G. L., & Murray, D. M. (1983). What can psychology say about Neil v. Biggers criteria for judging eyewitness accuracy. Journal of Applied Psychology, 68, 347-362.

Wells, G. L., & Murray, D. M. (1984). Eyewitness confidence. In G. L. Wells & E. F. Loftus (Eds.) Eyewitness testimony: Psychological perspectives (pp. 155-170). New York: Cambridge University Press.

Yarmey, A. D. (1984). Age as a factor in eyewitness memory. In G. L. Wells & E. F. Loftus (Eds.) Eyewitness testimony: Psychological perspectives (pp. 142-154). New York: Cambridge University Press.

Yarmey, A. D. (1986). Verbal, visual, and voice identification of a rape suspect under different levels of illumination. Journal of Applied Psychology, 71, 363-370.

Yarmey, A. D., & Kent, J. (1980). Eyewitness identification by elderly and young adults. Law and human Behavior, 4, 359-371.

APPENDICES

APPENDIX A

Questionnaire

Questionnaire sheet

Please answer the following questions as they relate to the videotape you have previously viewed. In addition, please circle the number indicating how confident you are of each answer. **Mark all of your answers on the answer sheet provided.** Please give only one answer to each question. **Please answer all the questions even if you are unsure of your answer.**

1.) How many violent acts occurred? (one number)
2.) What animal was in the painting above the fireplace?
3.) What did the villain do with the toy motorcycle, after he picked it up?
4.) Who does the man say he "is going to have a talk with"?
5.) Did you hear the villain cock the gun?
6.) What color was the blonde woman's sweater?
7.) Was the fire crackling?
8.) What does the blonde woman say the tapes are behind?
9.) How many shots did the villain fire? (one number)
10.) Did the "villain" have a mustache?
11.) Who was the villain going to get from the other room?
12.) Did the plain-clothes policeman say, "freeze, police"?
13.) How many shots did the police fire? (one number)
14.) Was there a piano in the room?
15.) Did the plain-clothes policeman kick the villain's gun after he was shot?
16.) What does the woman say at the end of the video clip, as she is looking down at the villain?
17.) What noise did you hear as the police entered the home?
18.) How many police sirens did you hear in the background? (one number)
19.) Did the villain catch the tapes as they fell?
20.) Did the villain tell the woman he was going to burn her with the fireplace poker?

APPENDIX B
Questionnaire Answer Sheet

Violence Report-Answer Sheet

1. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

2. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

3 _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

4. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

5. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

6. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

7. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

8. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

9. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

10. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

11. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

12. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

13. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

14. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

15. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

16. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

17. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

18 _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

19. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

20. _____

1 2 3 4 5 6 7 8 9
Not at all confident Extremely confident

APPENDIX C

Demographic Sheet

Demographic Sheet

Gender: Male Female

Classification: Fr. So. Jr. Sr. Grad.

Age: _____

How many hours of TV do you watch a week? _____

How many hours a week do you listen to the radio?_____

Do you play a musical instrument? _____

Have you ever watched this T.V. show before? _____

Have you ever watched this scene from this T.V. show before? _____

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A Comparison Study of Eyewitness, Verbal Earwitness, and Nonverbal Earwitness Me
Title of Thesis/Research Project

Mary Cooper
Signature of Graduate Office Staff Member

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