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EYEWITNESS ACCURACY AND THE MISINFORMATION EFFECT

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Because people largely reconstruct their memories for events, they are somewhat vulnerable to the effects of misleading postevent information. The reasons for this misinformation effect are in dispute. Lindsay and Johnson (1989b) reported that providing source options rather than yes/no options on a memory test negated the misinformation effect. However, they presented the misleading text immediately after the stimulus event. Real-life eyewitnesses may testify years after an event. The present study was a replication of Lindsay and Johnson (1989b) modified in two ways. First, a one week retention interval was added (i.e., more ecologically valid research) on the premise that a longer retention interval might cause even source monitoring subjects to be suggestible. Second, when eyewitnesses read postevent misinformation (e.g. in a newspaper) they may convert verbal information into

imagery which influences their memory for the actual event. Therefore, the variable imagery was added. Despite the retention interval, source monitoring prevented the misinformation effect. High relative to low imagers better remembered the stimulus picture but were more vulnerable to misleading suggestion. Future eyewitness researchers should a) include imagery ability as a variable, b) investigate memory integrations, c) promote longer retention intervals, and d) shift from the squabble over reasons for the misinformation effect to finding ways to reduce it.

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by

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CHAPTER 1

INTRODUCTION

Bartlett (1932) and Hasher and Griffin (1978) demonstrated that humans reconstruct their memories to fit their schema rather than reproduce information verbatim. Memories of visual events are also likely to be reconstructions. In fact, Loftus and Loftus (1980) suggest that information in long-term episodic memory is not permanent, despite evidence such as Penfield and Perot's (1963) electrical brain stimulation model of memory, psychoanalysis, and hypnosis. According to Loftus and Loftus, Penfield's patients, who thought they were reliving events once experienced, may actually have experienced a conglomeration of memory fragments similar to dreams. Reconstruction of memories may be enhanced by the relaxed states produced by psychoanalysis or hypnosis.

Understanding memory for visual events is essential because of the eyewitness's role in the legal system. Researchers have attempted to assess the veracity of the eyewitnesses' testimony for a visual event.

Concern about the accuracy of eyewitness information began around 1900. Psychologists such as intelligence test pioneer Alfred Binet (Siegler, 1992) and Cornell University's Guy Whipple were aware of some people's extreme susceptibility (Whipple, 1909) to the power of suggestion. They were especially concerned about children's testimony. Children, possibly influenced by leading suggestions, testified to having seen people fly away on brooms or transpose themselves into animals during the Salem witch trials (Ceci, Ross, & Toglia, 1987). Whipple (1913) suggested that "the child is uncritical in filling in the gaps in his memory and uses freely, material supplied through custom, through his own imagination, or through suggestion" (p. 266). Reporting numerical measurement values (e.g., time, speed, height, weight, and colors) seem especially prone for inaccuracy (Whipple, 1909).

Interest in eyewitness accuracy declined after 1930, for reasons not evident in the literature, but related studies (e.g., Festinger's (1957) theory of cognitive dissonance; Sperling's (1960) investigation of whether observers see more than they can report) in perception and memory continued. Marshall (1966)

compiled these psychological data, related them to the courtroom, and expressed a need for joint research by lawyers and social scientists. He devoted a chapter of his book to the vagaries of recall. In particular, Marshall (1966) addressed the importance of the time period between the event and the testimony (i.e., retention interval). This issue warrants careful examination when evaluating the research support for the hypotheses to eyewitness memory presented below. Elizabeth Loftus and her colleagues rekindled psychological eyewitness memory research in the early 1970's. They considered retention interval to be an important issue; subsequent researchers have not.

Alteration Overwriting Hypothesis

Loftus and Palmer (1974) based their research on a U.S. Air Force investigation reported by Marshall (1966) during which subjects reported the speed of a vehicle as 50 mph when it was actually moving at 12 mph. They showed subjects a film segment depicting a traffic accident and gave them one of four questionnaires to complete. The questions were identical except for the leading question which was "About how fast were the cars going when they (hit,

smashed, bumped, or contacted)?" Mean speed estimates of subjects in the "smashed" condition were significantly higher than those in the other conditions. In a second experiment, subjects given the "smashed" question reported nonexistent broken glass on a second questionnaire administered one week later. The researchers believed that the verb smashed had actually changed the memory representations so that the remembered accident was more severe than the original. Memory for complex visual events is highly malleable and can be influenced by different experimental conditions. Misled subjects chose the incorrect information presented in the misleading question significantly more often than the nonmisled. This result is referred to as the misinformation effect (ME).

Loftus (1975) replicated the ME with a modified method. After viewing a videotape of an auto accident, half of the subjects completed a questionnaire including the misleading question, "How fast was the white sports car going when it passed the barn while traveling along a country road?" No barn appeared in the videotape, however. The other subjects were asked,

"How fast was the car going?" A week later all subjects were asked, "Did you see a barn?" Subjects in the misled condition responded yes significantly more often than those in the nonmisled condition. A second experiment demonstrated that just being asked, "Did you see a barn?" immediately after viewing the videotape significantly increased yes responses for the same question a week later.

Field experiments have also demonstrated the impact of postevent information. Christiaansen, Sweeny, and Ochalek (1983) arranged for a student confederate to barge into a classroom of unsuspecting subjects. They were later telephoned and told that the confederate was either strong and aggressive or weak and passive. Subjects in the "strong" relative to "weak" condition reported higher weight estimates for the confederate.

In an elegant experiment, Loftus (1977) showed subjects color slides of an auto accident involving a blue car and then presented a narrative which mentioned a green car. The final testing apparatus was a color wheel containing 30 different color strips. On the test, the misled subjects were more likely to choose a

green or blue-green color.

With the exception of the color shifting experiment, Loftus always presented the stimulus event visually, and the postevent information and memory test verbally. If visual and verbal information are stored separately in memory, ME might occur simply because the misleading information and the test were both verbal. To control for this modality interference, Loftus, Burns, and Miller (1978) used visual recognition tests.

During a slide sequence, Loftus, Burns, and Miller (1978) showed half of their subjects a slide of a red car at a stop sign and the others saw a red car at a yield sign. After the slides, one-third of the subjects received verbal postevent information which was consistent with the critical slide they had seen. One-third received a misleading critical question and a control group received no subsequent information. One week later subjects heard an unrelated, 20 minute filler story. Then they performed a visual recognition test requiring the selection of one slide from each of many slide pairs. The critical pair showed the red car at a stop sign and the red car at a yield sign. The misled subjects had significantly less "hits" and more

"false alarms" than control and consistent questionnaire subjects. Thus, ME was obtained.

Loftus et al. (1978) mentioned the possibility that in Experiment 1, the subjects, fully aware of the sign they had originally seen, might have used the critical question as a clue (demand characteristic) to oblige the perceived experimental hypothesis. Experiment 2 showed this to be unlikely. Experiment 4 demonstrated that subsequent verbal information did not simply introduce a sign to memory where none had existed (response bias). At least 50% of the subjects had encoded the original sign.

Assuming no distributed practice, memory representations fade as the retention interval is increased (Ebbinghaus, 1885/1964). In Experiment 3, Loftus et al. (1978) demonstrated misinformation's impact on the original memory is greater the longer into the retention interval it occurs. The memory, weakened over time, is more susceptible to the new information. Marshall (1966) recognized the importance of this issue. "The time interval between the crime, the accident or other cause of action and the trial is usually several months if not years. During that

interval the witness's impression of the incident is subject to numerous stresses (p. 26)."

To account for all of the aforementioned results, Loftus developed the alteration overwriting hypothesis (AO) that can best be understood by a computer analogy. When a student saves an altered file under the same file name, the old file is overwritten. Similarly, memory representations for an original visual event can be altered and overwritten by subsequent information.

In some studies, such as Loftus and Palmer (1974) the researchers concluded that memory representations are altered, then overwritten. But, the Loftus, (1977) color shifting experiment would imply that new information is blended with the old instantaneously and irreversibly.

A competing hypothesis proposes that under certain conditions old memory representations can be reaccessed. As another illustration using the computer, an altered file is saved under a different name so that the original file also exists. Likewise, memory representations for the original event and subsequently presented information coexist. The original memory is impaired but can be reaccessed with

the appropriate retrieval cues. This is the memory impairment hypothesis.

Memory Impairment Hypothesis

Recall is effective to the extent to which the cues that were present at the time of encoding are present during retrieval (Tulving & Thomson, 1973). Bekerian and Bowers (1983) replicated Experiment 1 of Loftus et al. (1978) but placed the test slides in the same order as they had been presented originally rather than randomizing them. However, they did not include a 1 week retention interval as Loftus et al. (1978) had. Because they obtained no ME, Bekerian and Bowers concluded that the original information coexisted, but had been made inaccessible by the lack of retrieval cues.

Christiaansen and Ochalek (1983) presented slides of a shoplifting, accompanied by a neutral or misleading narrative. Forty-five minutes later, half of the misled subjects were warned on the recognition test that they <u>had</u> been misled. Subsequently they eliminated the ME and reported that they had made the original information reaccessible.

People appear to reaccess the originally encoded

information when certain cues are provided. Perhaps memory representations are altered instantly but only overwritten with the passage of time. A period of time may be needed for alterations to "sink in." Providing retrieval cues may have been effective after both Bekerian and Bower's (1983) and Christiaanson and Ochalek's (1983) short retention intervals. The memory representations may not yet have been consolidated. If both memory impairment studies had replicated Loftus et al., (1978) precisely--with a one week retention--they might have obtained a ME.

Nonretention Hypothesis

McCloskey and Zaragoza (1985a) modified the Loftus et al. (1978) visual recognition test by testing the subjects on their recognition of the original information and completely new information. For instance, a hammer was presented in the original slide, a screwdriver was mentioned in the narrative and the choices on the visual recognition test were between a hammer and a wrench. These circumstances produced no ME.

McCloskey and Zaragoza (1985a) argued that Loftus et al. (1978) had obtained a misinformation effect

because of response bias, demand characteristics, and guessing. Loftus, Schooler and Wagenaar (1985) responded by reiterating that response bias and demand characteristics had been controlled but McCloskey and Zaragoza (1985b) replied that Loftus et al. (1978) did not consider guessing and failed to show the nonexistence of the other two factors. They merely showed that taken separately, response bias and demand do not account for all of the ME. McCloskey and Zaragoza believe that the combination of the three account for the ME. Zaragoza, Jamis, and McCloskey (1987) replicated McCloskey & Zaragoza (1985a) using a recall test instead of a recognition test. Again no ME was obtained.

Source Misattribution Hypothesis

People often misattribute the sources of their memories. In fact, people sometimes mistake something they imagined or dreamed for an actual event. Johnson, Raye, Wang, and Taylor (1979) presented subjects with pictures two, five, or eight times and then asked them to imagine each picture two, five, or eight times. Later the subjects estimated the number of times each picture had been presented. Good relative to poor

imagers were less able to differentiate between presented and imagined events.

Johnson, Foley, and Leach (1988) instructed subjects to imagine words being spoken in their voice or to imagine words in the voice of another person. Then the subjects determined which words had actually been spoken by the speaker. The subjects showed a better ability to discriminate if they had imagined themselves saying the words.

These findings are meaningful because they show that people can convert verbal information into visual imagery which may compete with the original information. The findings also provide a basis for Lindsay and Johnson's (1989b) source monitoring experiment. All subjects were divided into four groups, depending upon whether they received misinformation or not and whether their memories were tested using a yes/no (Y/N) recognition or a source monitoring (SM) test. After viewing a stimulus slide, those in the two misled conditions received a text which mentioned objects that did not appear in the slide.

Those in the two control conditions read an

accurate narrative. An incidental memory test was then administered. Half the subjects were tested with a Y/N recognition test which asked them to indicate whether or not items had appeared in the slide picture. The remaining subjects were given a source monitoring test which asked them whether an item had appeared in the picture, narrative text, both, or neither. Both tests also included items presented only in the picture, only in the text, or in both. The ME was eliminated by making subjects think about the sources of their memories (Lindsay & Johnson, 1989b).

Lindsay and Johnson (1989b) did a second experiment. The Experiment 1 test instructions had required Y/N recognition subjects to respond whether or not the items were "present in the picture." Thus, because of the wording of the instructions they may have responded yes to an item even though they were aware that they had only read about the item in the narrative and had not actually seen the item in the picture. Experiment 2 was changed to read whether or not you "remember seeing" an item. Also, Experiment 1 instructions (e.g., Choose items present only in the text.) for the source monitoring subjects may have

functioned as a warning (Christiaansen & Ochalek, 1983) about the existence of text-only items. Experiment 2 instructions did not warn the subjects. The results were the same as Experiment 1; no ME was in incurred in SM subjects. No retention interval was included in these experiments.

Rationale for New Research

Recently, Loftus and Hoffman (1989) indicated that the AO hypothesis had eroded to a point where a response bias (they call it misinformation acceptance) interpretation seems better. Loftus and Hoffman believe that researchers can learn about the creation of new memories where none had existed. They may have abandoned Loftus's original position prematurely. A number of studies still offer support for her original position. One of them is her own 1977 study; no others like it exist in the eyewitness memory literature. The study has been challenged by McCloskey and Zaragoza (1985b) who said that color shifting showed nothing more than deliberate color compromises by the subjects. However, they presented no supportive evidence and their own work was convincingly disputed by Chandler (1989).

McCloskey and Zaragoza (1985a) eliminated social demands and response bias as extraneous variables by eliminating the misleading interpolated item (screwdriver) from the recognition test, forcing the subjects to choose the original (hammer) or a new item (wrench). However, their modified recognition test was not sensitive enough to produce ME. Chandler (1989) used the same modified recognition procedure with less discriminable items. Experimental subjects saw a section of a lily pond (original) another section of the same lily pond (interpolated) and on the test were forced to choose between the original and a completely new section of lily pond. But, unlike McCloskey and Zaragoza, Chandler obtained a ME and attributed it to an unknown cause, possibly alteration. Weinberg, Wadsworth, and Baron (1983) reported that demand characteristics accounted for some, but not all of the ME as did Chandler (1989). Guessing was ruled out by Belli (1989), Chandler (1989), Loftus and Hoffman (1989), and Tversky and Tuchin (1989) because of the subjects' high confidence ratings for their answers and their short response latencies.

Ceci et al. (1987) used McCloskey and Zaragoza's

(1985b) modified visual recognition procedure on children under 12, and obtained a ME. Perhaps, the 2 day retention interval allowed the misleading information to consolidate. If adults are less suggestible (cf. Ceci et al., 1987) than young children, then an even longer retention interval might bring about the ME in adults. As Table 1 indicates, Loftus and Palmer (1974), Loftus, (1975), Loftus et al. (1978), Christiaansen et al. (1983), and Ceci et al. (1987) have used retention intervals longer than 2 hours. Loftus included 1 week retention intervals in her studies; those most critical of her results (e.g., McCloskey & Zaragoza, 1985a) have included only 20 minute distractor tasks. The short time span is particularly noticeable in Lindsay and Johnson's (1989b) research. Identifying memory sources may be more difficult if the retention interval is increased. Thus, subjects may be misled more easily after a longer retention interval than if they are presented with an immediate memory test. Therefore, a replication of Experiment 2 of Lindsay and Johnson (1989b) is in order, but with a longer retention interval (1 week to parallel Loftus's studies) and a test for imagery

Table 1

Misinformation Effect as a Function of Retention Interval

	Retention Interval			
Research	-2hrs	+2hrs	2days	1wk
Loftus & Palmer (1974)				Yes
Loftus (1975)				Yes
Loftus (1977)	Yes			
Christiaanson et al. (1983)		Yes		
Loftus et al. (1978)				Yes
Bekerian & Bowers (1983)	None			
Christiaansen & Ochalek (1983)	None			
McCloskey & Zaragoza (1985a)	None			
Lindsay & Johnson (1989b)	None in SM subjects			
Chandler (1989)	Yes			
Ceci et al. (1987)			Yes	

ability.

The conversion of verbal information into visual imagery is the basis for the source misattribution hypothesis. Lindsay and Johnson (1989b) discussed the importance of imagery in relation to source confusion but did not include a way to examine it. If the source misattribution hypothesis is true, high relative to low imagers may be more easily misled on both the Y/N recognition, and SM tests.

Any one of a number of studies could be replicated with an increased retention interval and an imagery ability assessment, but Lindsay and Johnson's (1989b) study is the only support for the source misattribution hypothesis. The test measure also offers multiple response choices and is more sensitive than most in the eyewitness memory paradigm. Chandler (1989) showed that response bias and demand characteristics are not the only explanations for the ME. If the source misattribution hypothesis is eliminated, then the controversy will be reduced to one between AO and memory impairment. If not, source misattribution hypothesis will continue to be a viable alternative.

Increasing the retention intervals in eyewitness

memory studies increases ecological validity. Eyewitness memory research has already led the Supreme Court to enact rules pertaining to leading questions (cf. Ceci et al., 1987). Eyewitnesses may testify weeks, months, or even years after an event, with ample opportunity for exposure to misinformation to occur.

Lindsay and Johnson (1989b) eliminated the ME by making subjects aware of the sources of their memories. The present study will attempt to address the following research questions: (a) Will a longer retention interval produce the ME when subjects are asked to provide the sources of their memories? (b) Will high imagers make more incorrect responses than low imagers? (c) Will the longer retention interval allow alterations to "sink in?"

CHAPTER 2

METHOD

Subjects

The subjects were 186 volunteer, undergraduate and graduate students of both genders. They were derived from 100-800 level psychology, art therapy, and educational administration courses.

Design

This study had a 2 (Narrative: misleading or control) X 2 (Test: yes/no recognition (Y/N) or source monitoring (SM) X 2 (Imagery: high (HI) or low (LO)) quasi-experimental fixed effects design. Subjects were blocked on imagery and randomly assigned to one of four different treatment conditions: Y/N-misled, Y/N-control, SM-misled, and SM-control. Imagery ability was determined by the modified Questionnaire Upon Mental Imagery (QMI), (Betts, 1909; Sheehan, 1967; Richardson, 1969).

Materials

A consent form (Appendix A) was included. The QMI (Appendix B) was first developed by Betts (1909) and has been improved several times (Ashton and White, 1980; Richardson, 1969; Sheehan, 1967) in the last 80

years. The shortened form which was used in this study appears in Richardson (1969). The modified QMI requires that subjects rate the vividness of their mental image on Likert-type items which appeal to the senses. The test is a reliable (odd-even, .95 (Juhasz, 1972), test-retest, .72-.75 (Westcott & Rosenstock, 1976)) measure of imagery ability.

Lindsay and Johnson (1989b) used a color slide made of a photograph published in Psychology Today (See June, 1985, p. 56-57.) depicting four people amidst a cluttered office. The same slide was used in the present study (photograph in Appendix C).

Lindsay and Johnson's (1989b) 400 word narrative about the slide photograph was also used for this study (see Appendix D). They had generated a list of 16 items which appear in the slide. Eight randomly selected items from the list are included in the control narrative, producing a picture-and-text set. The remaining 8 are included in the picture-only set.

Another list of 16 items does not appear in the slide. Eight of these items were randomly selected from the list to be included in the misleading narrative, producing the misleading-text-only set. The

remaining 8 in the "new" set serve as distractor items on the memory tests. The misleading narrative was created by inserting misleading-text-only items, in phrases, at appropriate places in the control narrative. Therefore, the misleading narrative is slightly longer than the control narrative.

Both the Y/N recognition test and a SM test included the same 32 items from all four sets (see Appendix E). The 32 items were randomly ordered with no more than 2 items from a given set appearing successively. The basic difference between the two tests are the response alternatives (see Appendix F). The SM test has the heading, "Source?" above the items, with alternatives: "Text," "Pict.," "Both," and "None." The Y/N recognition test has the heading, "In Picture?" with alternatives "Yes" or "No." The instructions were on the tests.

Lindsay and Johnson (1989b) did not consider the possibility that the subjects may have seen the picture previously in Psychology Today. Therefore, a precautionary statement was included at the end of each test: "I (have) (have never) seen the office photograph prior to the presentation of it in this

study one week ago." The data from two subjects who had seen the photograph previously were dropped.

Procedure

Subjects were tested in groups, that is, intact classes of students were used. After filling out informed consent forms, the subjects were given the QMI, and told to read the instructions carefully as the experimenter read the instructions aloud. After the QMI was completed, the experimenter asked the subjects to study the slide projection of the cluttered office. Lights in the room were turned off. The slide projector was turned on for 20 seconds. Then the subjects were told that they would write a brief interpretation of the slide 1 week later. The subjects were also asked not to discuss the study with anyone until they were debriefed.

Upon their return, 1 week later, they wrote a 2 minute interpretation of the slide scene; a facade to support the purpose of the study as an investigation of the way people interpret complex visual events and verbal explanations of those events (cf. Lindsay & Johnson, 1989b). Subjects' treatment condition was determined by the random mix of packets in the stack.

After writing their brief interpretations, the subjects turned the pages (A blank page was inserted so that the subjects could not see through the pages.) to either the misleading or control narrative. The subjects were instructed to read carefully, to look up and not to turn the page when they were finished. When instructed, they turned the pages to either the Y/N or SM incidental memory tests, and were asked to read the test instructions. After the test instructions were understood, the subjects began the memory test. After the memory tests, subjects were debriefed and thanked for their participation.

CHAPTER 3

RESULTS

A total of 186 graduate and undergraduate student subjects participated in the study. The first session included completing consent forms and imagery questionnaires and then viewing the stimulus picture of a cluttered office for 20 seconds. One week later, subjects wrote a brief interpretation of the scene, read the misleading or control text, and then completed the source monitoring or recognition test.

The QMI score is based on 35 items on the test. Each item was rated on a 1-7 Likert type scale with 1 being indicative of high imagery and 7 being low. The scores could range from 35-245. When tallied, the scores ranged from 52-207. In the present study, low and high imagery was operationalized as scores on the Bett's QMI that existed .5 standard deviations above or below the mean, respectively. Thus, only 99 of the 186 subjects were included in the analysis.

As did Lindsay and Johnson (1989b) both memory tests contained 32 items, 8 from each of the following four categories: 1) present in the stimulus picture, 2) present only in the misleading text, 3) present in both

the picture and text, and 4) not present in either the picture or test (i.e., new items). The data of interest were how many non-picture items were remembered as being part of the picture.

Memory performance in each of the categories was operationalized as the number of remembered items attributed to the picture and was treated per Lindsay and Johnson (1989b) as separate dependent variables. The instructions for the yes/no (Y/N) recognition test required subjects to answer yes to all items seen in the picture. For each "yes" item, one point was awarded to the corresponding dependent variable. The Source Monitoring (SM) test, however, required subjects to indicate whether the item was presented in the picture, text, both or neither. For all items marked as picture, one point was awarded to the corresponding dependent variable. Scores for each of the four dependent variables could range from 0 to 8.

Separate Imagery (high or low) X Text (misleading or control) X Test (SM or Y/N) between-subjects analyses of variance were run on each of the four dependent variables. Fisher's Least Significant Difference (LSD) tests were used for all post hoc

analysis. Results of the analyses for each dependent variable are presented in Tables 2, 4, 6, and 8 respectively. Similarly, means and standard deviations for the respective dependent variables are presented in Tables 3, 5, 7, and 9.

For the memory of items in the stimulus picture correctly attributed to the picture, the only significant main effect was test, $F(1, 91) = 7.34$, $p < .01$. Subjects taking the recognition test correctly attributed more picture-only items ($M = 3.48$) to the picture than SM subjects ($M = 2.24$). The imagery by text interaction (see Figure 1) was also significant, $F(1, 91) = 4.66$, $p < .03$. Misled high imagers ($M = 3.31$) and control low imagers ($M = 3.46$), which did not differ, attributed significantly more picture-only items to the picture than misled low imagers ($M = 1.91$). The control high imagers did not differ from the three other groups ($M = 2.65$).

For the memory of stimulus items appearing only in the misleading text, but incorrectly attributed to the picture, significant effects were obtained for imagery, $F(1, 91) = 3.77$, $p < .05$, and test, $F(1, 91) = 9.82$, $p < .01$. High imagers incorrectly attributed

Table 2

Imagery X Text X Test Analysis of Variance for Picture Only Items Attributed to the Picture

Source of Variation	DF	SS	MS	F
Imagery (I)	1	3.37	3.37	.86
Text (Tx)	1	.86	.86	.22
Test (T)	1	28.91	28.91	7.34**
I X Tx	1	18.38	18.38	4.66*
I X T	1	.78	.78	.20
Tx X T	1	.25	.25	.06
I X Tx X T	1	.62	.62	.16
Error	91	358.60	3.94	

*$p < .05$

**$p < .01$

Table 3

Means and Standard Deviations for Recall of Picture Only Items Attributed to the Picture

	Text		
	Misleading	Control	Overall
Low imagers			
Yes/No	2.89	3.72	3.31
	(2.03)	(2.37)	(2.20)
Source	1.29	2.67	1.98
	(1.20)	(2.16)	(1.68)
Total	1.91	3.46	2.65
	(1.52)	(2.32)	(1.94)
High imagers			
Yes/No	3.83	3.18	3.51
	(1.95)	(1.83)	(1.89)
Source	2.94	2.17	2.56
	(2.16)	(1.85)	(2.01)
Total	3.31	2.65	3.04
	(2.07)	(1.84)	(1.95)
Overall	2.61	3.06	2.79
	(1.80)	(2.08)	(1.95)

significantly more text-only items to the picture (*M* = 1.92) than low imagers (*M* = 1.32). Recognition (*M* = 2.10) relative to SM (*M* = 1.16) subjects incorrectly attributed significantly more text-only items to the picture. An imagery by text interaction was also obtained, $F(1, 91) = 2.26$, $p < 0.10$. Misled high imagers (*M* = 2.38) attributed more misleading items to the picture than misled low imagers (*M* = 1.22), control high imagers (*M* = 1.35), and control low imagers (*M* = 1.42), all of which did not differ.

For the memory of stimulus picture items actually appearing in both the picture and the text, but attributed to the picture, a main effect for test was obtained, $F(1, 91) = 10.19$, $p < .01$. Recognition (*M* = 4.61) scores were higher than SM (*M* = 2.61).

For items which did not appear in the picture or the control or misleading text, but were incorrectly attributed to the picture, an imagery by text interaction (see Figure 1) was obtained, $F(1, 91) = 3.96$, $p < .05$. Misled high imagers and control low imagers identified significantly more (*M* = 1.48 and *M* = 1.67, respectively) "new" items as part of the stimulus

Table 4

Imagery X Text X Test Analysis of Variance for Misleading Text Only Items Attributed to the Picture

Source of Variation	DF	SS	MS	F
Imagery (I)	1	9.31	9.31	3.77*
Text (Tx)	1	7.83	7.83	3.17
Test (T)	1	24.22	24.22	9.82**
I X Tx	1	6.82	6.82	2.76
I X T	1	2.09	2.09	.85
Tx X T	1	1.17	1.17	.47
I X Tx X T	1	.05	.05	.02
Error	91	224.49	2.47	

*$p < .05$

**$p < .01$

Table 5

Means and Standard Deviations for Recall of Misleading Text Only Items Attributed to the Picture

	Text		
	Misleading	Control	Overall
Low imagers			
Yes/No	1.78	1.56	1.37
	(2.05)	(1.29)	(1.67)
Source	.86	1.00	.93
	(1.41)	(1.26)	(1.34)
Total	1.22	1.42	1.15
	(1.67)	(1.28)	(1.51)
High Imagers			
Yes/No	3.33	1.91	2.61
	(1.87)	(1.51)	(1.69)
Source	1.71	.83	1.27
	(1.96)	(.72)	(1.34)
Total	2.38	1.35	1.94
	(1.92)	(1.10)	(1.52)
Overall	1.80	1.39	1.55
	(1.80)	(1.19)	(1.52)

Table 6

Imagery X Text X Test Analysis of Variance for Recall of Items Appearing in Both the Picture and Text, but Attributed to the Picture

Source of Variation	DF	SS	MS	F
Imagery (I)	1	14.18	14.18	3.19
Text (Tx)	1	6.48	6.48	1.46
Test (T)	1	45.33	45.33	10.19**
I X Tx	1	2.01	2.01	.45
I X T	1	.46	.46	.10
Tx X T	1	.04	.04	.01
I X N X T	1	.08	.08	.02
Error	91	404.94	4.45	

*$p < .05$

**$p < .01$

Table 7

Means and Standard Deviations for Recall of Items Appearing in Both the Picture and Text, but Attributed to the Picture

	Text		
	Misleading	Control	Overall
Low imagers			
Yes/No	3.11	4.06	3.59
	(1.54)	(2.58)	(2.06)
Source	1.93	2.67	2.30
	(1.77)	(2.80)	(2.29)
Total	2.39	3.72	2.94
	(1.68)	(2.63)	(2.18)
High imagers			
Yes/No	4.42	4.63	4.53
	(2.19)	(2.34)	(2.27)
Source	2.82	3.08	2.95
	(1.68)	(1.93)	(1.81)
Total	3.48	3.82	3.74
	(1.89)	(2.13)	(2.04)
Overall	2.94	3.77	3.35
	(1.79)	(2.38)	(2.11)

picture than misled low imagers (M = .57). Control high imagers (M = 1.35) were not significantly different from the other groups.

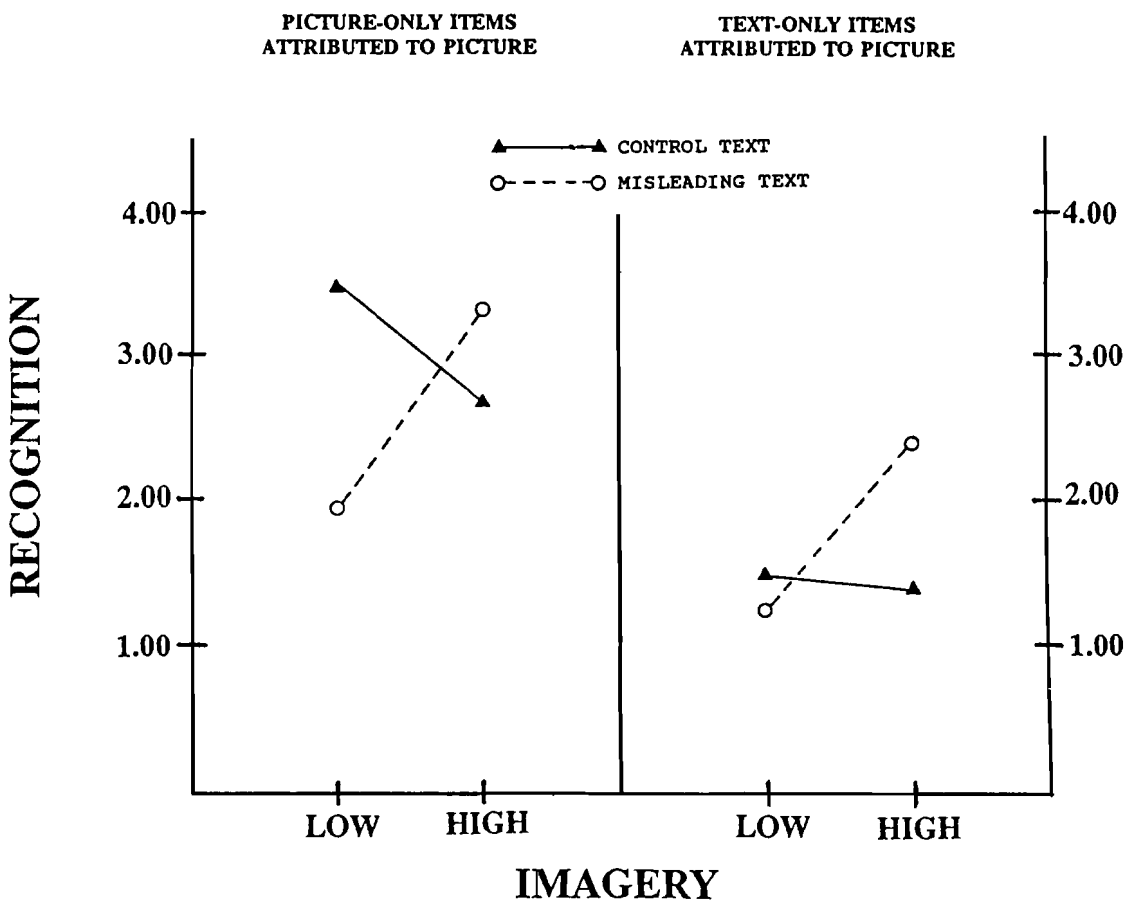

Figure 1: Imagery Interactions

Table 8

Imagery X Text X Test Analysis of Variance for New Items Appearing in Neither the Picture or Text, but Attributed to the Picture

Source of Variation	DF	SS	MS	F
Imagery (I)	1	3.14	3.14	1.41
Text (Tx)	1	3.85	3.85	1.72
Test (T)	1	3.59	3.59	1.61
I X Tx	1	8.84	8.84	3.96*
I X T	1	1.99	1.99	.89
Tx X T	1	.23	.23	.10
I X Tx X T	1	1.08	1.08	.49
Error	91	203.01	2.23	

*$p < .05$

**$p < .01$

Table 9

Means and Standard Deviations for Recall of New Items Appearing in Neither the Picture or Text, but Attributed to the Picture

	Text		
	Misleading	Control	Overall
Low imagers			
Yes/No	.56	1.72	1.14
	(1.01)	(1.64)	(1.33)
Source	.57	1.50	1.04
	(1.34)	(1.64)	(1.49)
Total	.57	1.67	1.27
	(1.21)	(1.64)	(1.41)
High imagers			
Yes/No	2.08	1.55	1.82
	(1.44)	(1.97)	(1.71)
Source	1.06	1.17	1.12
	(1.34)	(1.40)	(1.37)
Total	1.48	1.35	1.47
	(1.38)	(1.67)	(1.54)
Overall	1.03	1.51	1.37
	(1.29)	(1.65)	(1.48)

CHAPTER 4

DISCUSSION

Lindsay and Johnson (1989b) reported that subjects tested on the source of their memories were less misled by an intervening text than those given a recognition test. They thus claimed that source monitoring eliminated the misinformation effect.

The present study was a replication of Lindsay and Johnson (1989b), modified in two ways. The first modification was increasing time between the stimulus presentation and memory test to 1 week to assess whether a longer retention interval might change Lindsay and Johnson's (1989b) results. With a longer retention interval, subjects might forget the memory sources of the target items.

The longer interval did not change the results. Rather, source monitoring (SM) relative to those who completed the yes/no recognition test attributed significantly fewer misleading text items to the stimulus picture, replicating Lindsay and Johnson (1989b). SM subjects also attributed fewer correct items to the picture. This might seem anomalous but is not.

Lindsay and Johnson (1989b), whose SM relative to recognition subjects did attribute fewer items to the picture on all four dependent variables (i.e. Pict, Text, Both and New), explained that the same exacting criteria induced by the SM test which helped subjects edit misleading suggestions also caused them to misattribute to the text some memories actually derived from the picture.

In a society where a defendant must be proven guilty beyond a reasonable doubt, it is better that eyewitnesses be overcautious rather than under. By making eyewitnesses more cautious, source monitoring can be very useful indeed.

The second modification was manipulating imagery to determine whether high imagers would be more misled than low imagers. Johnson et al., (1979) demonstrated that high imagers had more difficulty discriminating between real and imagined picture presentations than low imagers. In the present study, high relative to low imagers attributed more items from the misleading text to the picture. In contrast, misled low relative to high imagers chose the fewest picture-only items. Interestingly, misled high relative to low imagers also

misattributed to the picture more new items. Misled low imagers misattributed the least new items of any group.

High imagers better remembered the slide but were more likely to add items they had not seen. These results suggest that high imagers better remember visual information but may also be more vulnerable to suggestion.

While the legal system would like to eliminate confusion between the real and imagined, others value it. Clinical psychologists sometimes help phobics with invitro flooding therapy whereby the subject relaxes while imagining the avoided stimulus. This technique is often as effective as overexposure to the real stimulus (James, 1986). Basketball players told to imagine making free throws perform significantly better at the real thing than those not so instructed (e.g. Wrisberg & Anshel, 1989). Imagery can be as vivid as the real event.

Eliminating confusion between real and imagined events is the basis for the entire eyewitness paradigm. Yet no studies until now have related individual differences in imagery ability to eyewitness report.

Other individual differences such as age have been examined. Younger children may be more suggestible than older children and adults (Bringmann, Tyler, McAhren, & Bringmann 1989; Ceci et al., 1987; Whipple 1909, 1913). Five percent of children aged 6-12 have eidetic imagery ability; virtually no adults have it (Haber, 1980a). This strikes an interesting parallel. The present research showed that adult high imagers are more suggestible. Young children may rely on imagery more than adults which may also explain why they are more suggestible. Future studies should add imagery as a variable, especially if children are the subjects.

Future eyewitness studies hinge on the various related hypotheses. In 1974, Loftus believed that eyewitnesses' original memories were overwritten by the memory with the new misleading information. Human memory, however, is likely more complex than simply overwriting a file on a computer disk with another file Alteration, if defined as integration or blending, may occur. Loftus (1975), Chandler (1989) and Metcalfe (1990) provide supportive evidence.

Continuing the computer metaphor, speaking of memory wholistically is inappropriate. Rather,

memories contain bits of information, bits for real events and bits for imagined events. Certain integratable bits, blue and green, for example, may be blended as blue-green when stored.

In other situations bits are not integratable. Hammerdriver? Screwhammer? Hammer may be impaired by screwdriver because screwdriver is more recent and thus more salient (cf. Bekerian & Bowers, 1983). However Lindsay and Johnson (1989a) obtained a suggestibility effect when they presented a misleading narrative before the stimulus. Can the stimulus be made reaccessible in a reversed suggestibility situation? Such results would eliminate recency as the only determinant of memory impairment.

In still another situation, hammer is not encoded, so screwdriver inappropriately fills in the gap (McCloskey & Zaragoza, 1985a). Loftus and Hoffman (1989) call this substitution misinformation acceptance. The present research attempted to determine whether misinformation would be more accepted with an increased retention interval.

Is time required for memory alterations to "sink in?" First, the data did not support the contention

that with an increased retention interval, SM subjects would forget the same as recognition subjects. But, the retention interval was only one week long. A more ecologically valid study would include an even longer retention interval. Also, real eyewitnesses are likely exposed to leading police questions or newspaper accounts in the middle of a retention interval. Therefore the misinformation should be placed at times other than just before the memory test.

Secondly, no one knows if alteration occurs and if so, the present study was not designed to investigate it. Misleading text items fit but were not part of the stimulus picture. High imagers added more suggested items, but would they also be more inclined to integrate items?

For the next study, the misleading information should attempt to alter existing items rather than add new information. For example, a color slide of various items could be presented and imagery ability could also be manipulated. A week later another slide of the same items would be presented but with altered colors. A week later the subjects should receive a narrative which depicts the critical item with yet a different

color. On the test the subjects view a noncolored slide of the same scene and are asked to identify the colors of various items. If the subjects give the critical item an intermediate color, integration will have occurred. If the subjects choose the color depicted in the misleading slide or text, memory impairment or misinformation acceptance will have occurred. Color could be replaced with size in another experiment. Any experiment designed to determine if subjects make intermediate choices, which are not deliberate compromises based on demand characteristics, would be adequate to determine if and when alteration occurs.

True alterations may only occur in certain circumstances such as when identifying colors or sizes of objects. Impairment or misinformation acceptance explanations may apply to most other situations. If one knows the etiology of an eyewitness's memory, one can prescribe a technique to facilitate accuracy. For example, providing source options would help people whether they integrate information, whether it is impaired, or whether they accept misinformation.

The only agreement across the large body of

eyewitness research is that misinformation acceptance can occur. Although failure to encode original memory bits and acceptance of new ones may well be the most frequently occurring eyewitness memory phenomena, evidence warrants continued investigation into memory bit impairment and integration.

Eyewitness researchers are constantly coining new terms for the same phenomena causing confusion. This study has attempted to reduce the confusion by using understandable terms consistently and by organizing the various hypothetical explanations for the misinformation effect. Some of the focus has now been shifted from a squabble over these hypotheses to real life ways to reduce the misinformation effect. The present results strengthen the notion that providing memory source options makes eyewitnesses less likely to be misled and highlights imagery ability as an important determinant of suggestibility.

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Appendix A

Informed Consent Form

Please read the following statements and if you agree with them sign your name at the bottom of the form and fill out the biographical information.

I agree to participate in this research which is being conducted by Brian D. Nuest who is investigating how people interpret a complex visual scene. I understand that this study will take about 15 minutes of my time today and will take about 15 minutes one weeks from this date. I am fully aware that I may withdraw from this research at any time and that I will not be penalized in any way for doing so. I also understand that my confidentiality will be protected. My name will not be used in the report of this research.

Signature _____

Appendix B

Modified Bett's QMI

Purpose:

The purpose of this questionnaire is to rate the vividness of the mental images formed from the test items. Your ratings will be combined with other's ratings to provide data determining normal responses to the items, and will be of use to researchers in future studies.

Instructions:

The test contains 35 items. You are to read an item carefully and then assess the vividness of the mental image that is formed, using the following rating scale:

1 - Perfectly clear and as vivid as the actual experience

2 - Very clear and comparable in vividness to the actual experience.

3 - Moderately clear and vivid.

4 - Not clear or vivid, but recognizable.

5 - Vague and dim.

6 - So vague and dim as to be hardly discernible.

7 - No image present at all, you only "knowing" that you are thinking of the object.

If your image is "vague and dim" you give it a rating of 5. Record your answer in the brackets provided after each item. Before you turn to the items on the next page, familiarize yourself with the different categories on the rating scale, and pick one when judging the vividness of each image. A copy of the rating scale will be printed on each page. Please do not turn to the next page until you have completed the items on the page you are doing, and do not turn back to check on other items you have done. Complete each page before moving on the next page. Judge each item separately, and not based on how you have judged previous items.

An example of an item on the test would be one which asked you to consider your mental image of a red apple. If your visual image was moderately clear and vivid you would check the rating scale and mark '3' in the brackets as follows:

Item	Rating
5. Seeing, a red apple	[3]

Now turn to the next page when you have understood these instructions, and begin the test.

Item		Rating
1)	Seeing, a relative or friend walking toward you.	[ ]
2)	Feeling, the prick of a pin.	[ ]
3)	The feeling in your body, reaching up to a high shelf.	[ ]
4)	Tasting, your favorite soup.	[ ]
5)	Smelling, roast beef.	[ ]
6)	The sensation of, hunger.	[ ]
7)	Smelling, an ill-ventilated room.	[ ]
8)	Feeling, sand.	[ ]
9)	The sensation of being full, as from a very big meal.	[ ]
10)	Tasting, oranges.	[ ]
11)	Hearing, the sound of escaping steam.	[ ]
12)	The feeling in your body, kicking something out of the way.	[ ]
13)	Seeing, the sun rising above the horizon into a hazy sky.	[ ]
14)	Hearing, the honk of an automobile.	[ ]
15)	Feeling, fur.	[ ]

16) The feeling in your body, running upstairs. [ ]

17) Hearing, the mewing of a cat. [ ]

18) Seeing, the front of a shop to which you often go. [ ]

19) The feeling in your body, springing across a gutter. [ ]

20) Hearing, the whistle of a Locomotive. [ ]

21) Tasting, jelly. [ ]

22) Smelling, new leather. [ ]

23) Seeing, a lake in the country. [ ]

24) Tasting, salt. [ ]

25) The sensation of, drowsiness. [ ]

26) Feeling, the warmth of a tepid bath. [ ]

27) Smelling, fresh paint. [ ]

28) The sensation of, a sore throat. [ ]

29) Tasting, granulated (white) sugar. [ ]

30) Hearing, the clapping of hands in applause. [ ]

31) Seeing the exact contours of face, head, shoulders, and body of a relative or friend. [ ]

32) Feeling, linen. [ ]

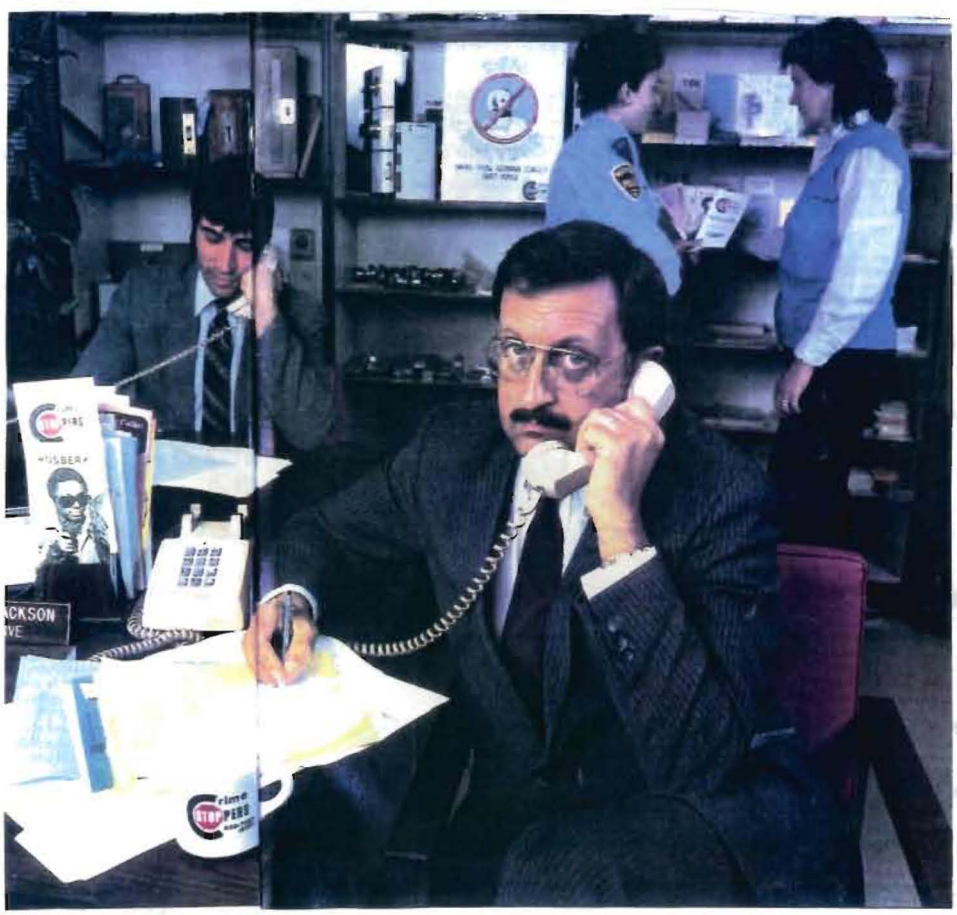
33) The sensation of, fatigue [ ]

34) The feeling in your body, drawing a circle on paper. [ ]

35) Smelling, cooking cabbage. [ ]

Appendix C

Photograph



Appendix D

Narrative

(The narrative was taken from the appendix provided by Lindsay and Johnson, 1989b, p. 357.) (Picture-and-text items are in italics and misleading-text-only items are shown in boldface. Brackets ({ }) surround context material presented only in the misleading narrative, and braces ([ ]) surround context material presented only in the control narrative. The new items were clock, computer printout, Coke, gunbelt, handcuffs, handkerchief, man smoking, and typewriter. The picture-only items were blue sweater, coffee cup, desk nameplate, man with eyeglasses, mustache, pamphlets on desk, and pamphlets on shelves.)

"Crime Stoppers" is an organization that offers monetary rewards for information concerning crimes. Although they are usually fairly small, Crime Stoppers offices are busy and intense places. Earlier you were shown a picture of a Crime Stoppers office. The following is a description of that picture.

There are two men and two women in the room. The two men are seated, and both are holding telephone receivers. The two women are standing in the

background to the right.

The man in the foreground is wearing a *pinstripe suit* with a solid *burgundy tie* [and a **tie tack**]. He is looking into the camera with a very stern look on his face and is holding a telephone receiver in his left hand. He is seated in front of a desk that is cluttered with objects such as a telephone[,] {and} a *yellow writing pad* [, and a **pencil holder**]. There is also a small stand-up desk calendar on the desk, as well as lots of papers and other things.

The man in the background (over to the left of the picture) is dressed in a *grey suit*. He has *dark hair*. He's sitting at a desk talking on the telephone. There {are} [is a **coat rack** in the corner behind him and] some shelves on the wall directly behind him. These shelves run the length of the back wall. There is an open file folder [and a **ruler**] on the desk in front of him. The base of the telephone is also on the desk, but it is not in the picture. Standing a few yards to his left (that is, on the right side of the picture) are two women who appear to be engaged in conversation. The woman closer to the center of the picture is wearing a *police uniform*. Behind them, against the

back wall, are the shelves. There {are} [is a **coffee pot** and] a number of *door locks*, door knobs, and various kinds of hinges on the shelves probably high-security locks and related gadgets. [The woman on the right side of the picture is holding a bunch of **keys** in her left hand.] The woman in uniform is holding some pamphlets in her right hand. [There is a **police hat** on one of the shelves above her head, although most of it isn't in the picture.] The women are standing almost directly behind the man in the foreground, who is sitting in a *reddish-orange desk chair*. There is a **filing cabinet** behind the woman on the right--near the right hand edge of the picture. The floor is grey carpet or tile. The ceiling is not pictured. Overall, the picture suggests a rather hectic atmosphere.

Appendix E

Yes/No Recognition Test

For each of the items on the following pages, please indicate whether or not you remember seeing the item in the picture, by checking the box in the appropriate column. If you do remember seeing the item, mark the box in the yes column. If you do not remember seeing the item mark the box in the no column.

In the Picture?	Yes	No
1. Clock	[ ]	[ ]
2. Filing cabinet	[ ]	[ ]
3. Reddish-orange desk chair	[ ]	[ ]
4. Coffee pot	[ ]	[ ]
5. Coke	[ ]	[ ]
6. Gunbelt	[ ]	[ ]
7. Pinstripe Suit	[ ]	[ ]
8. Tie tack	[ ]	[ ]
9. Man with eyeglasses	[ ]	[ ]
10. Silver pen	[ ]	[ ]
11. Yellow writing pad	[ ]	[ ]
12. Coat rack	[ ]	[ ]
13. Police uniform	[ ]	[ ]
14. Blue sweater	[ ]	[ ]

		Yes	No
15.	Burgundy tie	[ ]	[ ]
16.	Coffee cup	[ ]	[ ]
17.	Desk nameplate	[ ]	[ ]
18.	Ruler	[ ]	[ ]
19.	Police hat	[ ]	[ ]
20.	Handkerchief	[ ]	[ ]
21.	Mustache	[ ]	[ ]
22.	Man smoking	[ ]	[ ]
23.	Computer printout	[ ]	[ ]
24.	Pamphlets on desk	[ ]	[ ]
25.	Dark hair	[ ]	[ ]
26.	Pencil holder	[ ]	[ ]
27.	Pamphlets on shelves	[ ]	[ ]
28.	Handcuffs	[ ]	[ ]
29.	Door locks	[ ]	[ ]
30.	Type writer	[ ]	[ ]
31.	Keys	[ ]	[ ]
32.	Grey suit	[ ]	[ ]

Please circle the appropriate choice.

I [have] [have never] seen the office photograph prior to the presentation of it in this research one week ago.

Appendix F

Source Monitoring Test

For each of the items on the following pages, please indicate whether you remember noticing the item: (a) in the picture (b) in the text (c) in both the picture and the text or (d) in neither the picture nor the text.

Source?	Text	Pict.	Both	None
1. Clock	[ ]	[ ]	[ ]	[ ]
2. Filing cabinet	[ ]	[ ]	[ ]	[ ]
3. Reddish-orange desk chair	[ ]	[ ]	[ ]	[ ]
4. Coffee pot	[ ]	[ ]	[ ]	[ ]
5. Coke	[ ]	[ ]	[ ]	[ ]
6. Gunbelt	[ ]	[ ]	[ ]	[ ]
7. Pinstripe Suit	[ ]	[ ]	[ ]	[ ]
8. Tie tack	[ ]	[ ]	[ ]	[ ]
9. Man with eyeglasses	[ ]	[ ]	[ ]	[ ]
10. Silver pen	[ ]	[ ]	[ ]	[ ]
11. Yellow writing pad	[ ]	[ ]	[ ]	[ ]
12. Coat rack	[ ]	[ ]	[ ]	[ ]
13. Police uniform	[ ]	[ ]	[ ]	[ ]
14. Blue sweater	[ ]	[ ]	[ ]	[ ]
15. Burgundy tie	[ ]	[ ]	[ ]	[ ]

		Text	Pict.	Both	New
16.	Coffee cup	[ ]	[ ]	[ ]	[ ]
17,	Desk nameplate.	[ ]	[ ]	[ ]	[ ]
18.	Ruler	[ ]	[ ]	[ ]	[ ]
19.	Police hat	[ ]	[ ]	[ ]	[ ]
20.	Handkerchief	[ ]	[ ]	[ ]	[ ]
21.	Mustache	[ ]	[ ]	[ ]	[ ]
22.	Man smoking	[ ]	[ ]	[ ]	[ ]
23.	Computer printout	[ ]	[ ]	[ ]	[ ]
24.	Pamphlets on desk	[ ]	[ ]	[ ]	[ ]
25.	Dark hair	[ ]	[ ]	[ ]	[ ]
26.	Pencil holder	[ ]	[ ]	[ ]	[ ]
27.	Pamphlets on shelves	[ ]	[ ]	[ ]	[ ]
28.	Handcuffs	[ ]	[ ]	[ ]	[ ]
29.	Door locks	[ ]	[ ]	[ ]	[ ]
30.	Type writer	[ ]	[ ]	[ ]	[ ]
31.	Keys	[ ]	[ ]	[ ]	[ ]
32.	Grey suit	[ ]	[ ]	[ ]	[ ]

Please circle the appropriate choice. I [have] [have never] seen the office photograph prior to the presentation of it in this research one week ago.

I, Brian Dale Nuest, hereby submit this thesis to Emporia State University as partial fulfillment of the requirements for an advanced degree. I agree that the Library of the University may make it available for use in accordance with its regulations governing materials of this type. I further agree that quoting, photocopying, or other reproduction of this document is allowed for private study, scholarship (including teaching) and research purposes of a nonprofit nature. No copying which involves potential financial gain will be allowed without written permission of the author.

Signature of Author

5/7/93

Date

AND THAT'S THE WAY IT WAS?

EYEWITNESS ACCURACY AND THE MISINFORMATION EFFECT

Doug Cooper

Signature of Graduate Office Staff Member

May 11, 1993

Date Received