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13. ABSTRACT *(Maximum 200 words)*

Misinformation effects occur in laboratory settings despite disagreement over the mechanism(s) responsible for such effects. Both memory impairment and non-impairment hypotheses explain the phenomenon. The effects of misinformation were examined using the Concealed Knowledge Test (CKT), a psychophysiological detection of deception technique. Ninety-six subjects watched a videotaped crime used to induce guilt. One week later, subjects were given misinformation about three crime details, took a CKT inquiring about the three misled details and three non-misled crime details, and took a 20-item memory test concerning the crime. The six questions asked during the CKT were included in the memory test. Subjects who chose the misinformation on a misled detail were labeled as successfully misinformed. Significant differences were found between the misled and non-misled CKT series, with misinformation leading to a lower score (i.e., higher probability of being categorized as truthful). An interaction was found between CKT detail type and information manipulation with univariate procedures identifying skin resistance amplitude, skin resistance half-recovery time, and abdominal respiration as significant dependent measures. These findings support the memory impairment hypotheses.

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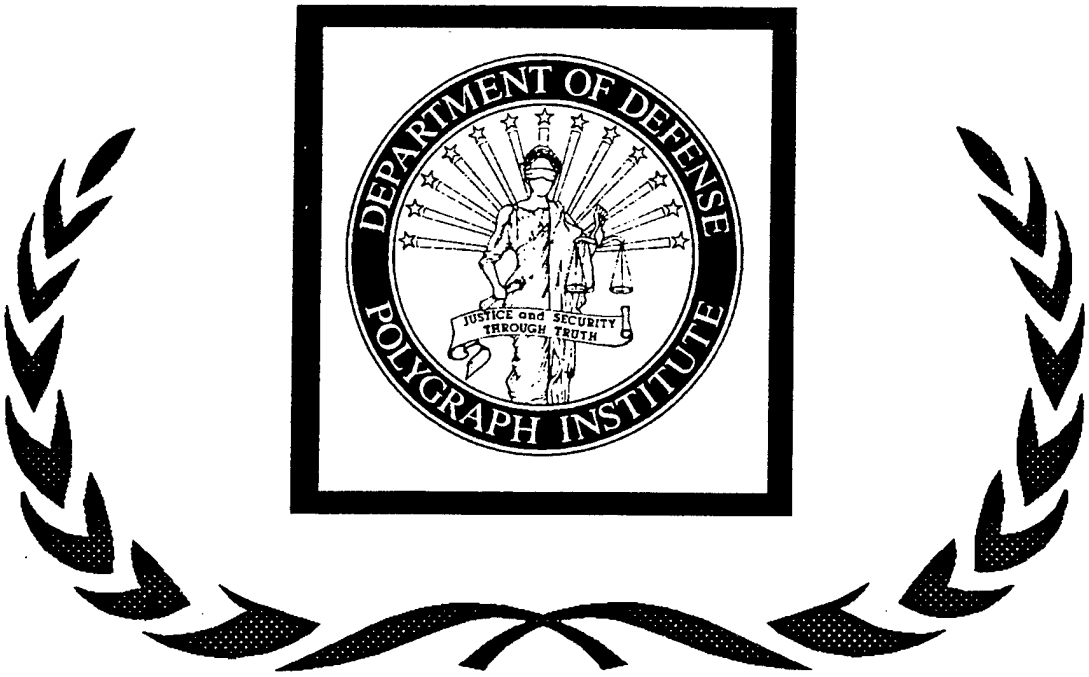

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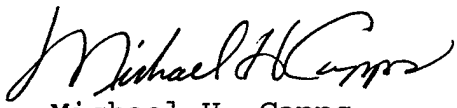
Director's Foreword

This project was partially funded as a Department of Defense Polygraph Institute Dissertation Research Grant to the University of North Dakota. There are numerous reports in the literature concerning the validity of psychophysiological detection of deception (PDD) examinations. Very few reports, however, address a psychological manipulation beyond those necessary to manipulate and determine examinee veracity. This study is unusual because it was designed to test theories of forgetting using a PDD paradigm. The project is among the first in the PDD discipline designed to investigate the effect of presenting false information to examinees prior to a PDD examination.

An infrequently used examination format, the concealed knowledge test (i.e., commonly called a guilty knowledge test) was employed, possibly reducing the generalizability of the results. The data, although exploratory and preliminary in nature, clearly suggest that presentation of false information can influence the magnitude of physiological responses recorded during a PDD examination. Further research should be completed to further examine this phenomenon.



Michael H. Capps
Director

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I would like to express my sincere appreciation to everyone who assisted in this project, from start to finish. First and foremost, the financial assistance from the Department of Defense was critical to the timely completion of this project.

The support, advice, and expertise of my mentor, Dr. Charles Honts, never dwindled--and I sincerely thank him for that. You have been a superb mentor during my graduate studies, Charles, and I look forward to working with you in the future!

I would also like to thank Dr. Joseph Plaud, my dissertation co-chair, who gave up part of his lab space and provided guidance during this project. Also, the work of my committee members has been appreciated--Thank you Drs. Doug Peters, F. Ric Ferraro, and Susan Koprince.

My research assistants' hard work, despite long hours, reliability, and "scientific sixth sense" enabled me to sleep at night. I could have never done it with out your help! Patty Hunter, Kathy Mayer, Matt Peters, and Gretchen Hanson--your futures are bright!

I would also like to acknowledge the assistance of Drs. John Kircher and David Raskin, who supplied the software necessary for data collection and transformation. Dr. Kircher--thanks for your quick response to our request for special accommodations in your software, it was appreciated!

In sum, my dissertation is the culmination of the hard work, commitment, and expertise of numerous individuals. I truly mean it when I say "WE did it"!

Abstract

SUSAN L. AMATO-HENDERSON. Effects of misinformation on the concealed knowledge test. August 1996. Report No. DoDPI97-R-0001. Department of Defense Polygraph Institute, Ft. McClellan, AL 36205.--Misinformation effects occur reliably in laboratory settings despite disagreement over the mechanism(s) responsible for such effects. Both memory impairment hypotheses (e.g., Lindsay & Johnson, 1987; Loftus 1975, 1977, 1979; Loftus & Hoffman, 1989; Tversky & Tuchin, 1989) and non-impairment hypotheses (e.g., McCloskey & Zaragoza, 1985; Zaragoza, McCloskey, & Jamis, 1987) have been used to explain the phenomenon of misinformation. The present study examined the effects of misinformation on the Concealed Knowledge Test (CKT), a psychophysiological detection of deception technique. Furthermore, the psychophysiological measurements were used to elucidate the controversy surrounding the misinformation effect. Ninety-six subjects watched a videotaped crime used to induce guilt. One week later, subjects were given misinformation about three details of the crime, took a CKT inquiring about the three misled details and three non-misled details of the crime, and took a 20-item recognition memory test concerning the crime. The six details questioned during the CKT were also included in the memory test. Subjects who chose the misinformation on a misled detail were labeled as successfully misinformed regarding that detail. Significant differences in the Lykken (1959) method of scoring the CKT were found between the misled and non-misled CKT series, with misinformation leading to a lower score (i.e., higher probability of being categorized as truthful). A MANOVA demonstrated a significant interaction [Wilks $F(18, 3946) = 5.36$, $p = .000$] between type of detail on the CKT (key, misinformation, foil) and information manipulation (non-misled, unsuccessfully misled, and successfully misled) with univariate procedures identifying skin resistance amplitude, skin resistance half-recovery time, and abdominal respiration as significant dependent measures. Follow-up analyses demonstrated that on successfully misled CKT charts, subjects' responses to the misinformation were significantly stronger than were responses to both the original detail and neutral foils (which did not differ). These findings, supportive of memory impairment hypotheses, are discussed in terms of the (un)permanence of memory.

Key-words: forensic psychophysiology, concealed knowledge test, psychophysiological detection of deception, misinformation effect, memory impairment

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Mechanisms Accounting for an Apparent Loss of Information from Memory

Everyone is familiar with the phenomenon of forgetting: the car keys that have temporarily disappeared; the ingredients for a dish that you have made numerous times; the answer to an item on a test that you are certain you learned. The clear existence of the phenomenon of forgetting, however, does not necessarily establish an underlying process of forgetting.

The issue of concern when we speak of forgetting is the mechanism(s) through which this phenomenon is observed. Are memories, once stored, permanently in place akin to a book on a shelf in a library? However hard it might be to locate the book, upon retrieval the pages can be read in their original form--the story does not change over time. Conversely, can once-stored information simply vanish from memory through the passage of time or the introduction of newer information?

The decay theory of forgetting suggests the latter, that with the passage of time memories fade or erode; hence, memory is not permanent. The time-dependent mechanism of decay, however, is quite difficult (if not impossible) to test. According to the decay theory, the passage of time alone is responsible for the loss of information from memory. To test this theory, one would have to provide an individual with information, prevent that individual from attending to anything during the retention phase, and then later test their memory. Obviously, this completely unambiguous test of decay is nearly impossible to perform.

Despite the inability to unambiguously investigate the decay theory of forgetting, some researchers have devised methods to study memory decay under more ambiguous conditions. For example, many have manipulated the state of arousal between learning and recollection. Subjects who sleep during the retention interval are compared to subjects who remain awake (e.g., Ekstrand, 1967, 1972; Hockey, Davies & Gray, 1972; Jenkins & Dallenbach, 1924). This testing paradigm is thus comparing retention intervals which consist of varying amounts of interference, an alternative hypothesis of forgetting, rather than a paradigm in which a retention interval is interference free.

Conclusions regarding the decay theory, based on the results from both the above mentioned studies and numerous others, are somewhat limited. According to Schwartz and Reisberg (1991), the decay theory is correct in its prediction that remembering tends to be worse after longer retention intervals. However, this could be due to either decay, interference, or a combination of the two. In sum, there is no firm evidence in favor of the decay theory alone.

The interference theory of forgetting has a long history. Both proactive interference (PI, the interference of old information on new information) and retroactive interference (RI, the interference of new information on old information) and the

characteristics of each under varying conditions have been identified. According to the interference theory, the phenomenon of forgetting occurs because of the acquisition of information which interferes with older (RI) or newer (PI) learning.

Two mechanisms were proposed to explain the phenomenon of interference. The first of these, response competition, suggested that both the old and new information coexist and were in "competition" with each other under conditions that allowed only one correct answer (e.g., McGeoch, 1942). This notion of response competition is similar to the more recent notion of parallel processing. According to this view, the permanence of memory is upheld due to the existence of the original information.

The second mechanism proposed to explain the phenomenon of interference suggests that "unlearning" occurs, an idea compatible with the view that memory is not permanent, or that a true process of forgetting occurs. Unlearning was described as similar to the notion of extinction in Pavlovian conditioning.

Historically, the interference theory of memory dominated discussions of forgetting (Schwartz & Reisberg, 1991). Much of the early work, which utilized serial learning or paired-associate learning tasks, was based upon recall procedures to test memory. However, studies utilizing recognition procedures to test memory resulted in incompatible findings. It was demonstrated that recognition paradigms are, for the most part, immune to the effects of interference (e.g., McGovern, 1964; Postman & Stark, 1969). The effects of interference were then thought of in terms of accessibility of information--interference renders prior learning less accessible or less easily located in memory. With enough search time or a sufficiently strong cue, the information could be retrieved (e.g., Shiffrin, 1970; Tulving & Psotka, 1971). Once again, the permanence of memory took the foreground.

Schwartz and Reisberg (1991), following a detailed discussion of the historical attempts to differentiate between a true process of forgetting and the opposing view of memory's permanence concluded that three effects are all that is needed to explain the phenomenon of forgetting: retrieval failure, repisodic blurring (the blurring of repeated episodes) and reconstruction of memory according to schema theory. Hence, no mechanism of forgetting is needed to explain the available data.

Upholding the notion that memory is permanent, retrieval failure suggests information simply becomes harder and harder to locate. Information does not "disappear" from memory. As discussed above, the appropriate cues and/or ample search time will eventually lead to the preserved memory. Repisodic blurring, the second mechanism used to explain the phenomenon of forgetting by Schwartz and Reisberg (1991), suggests that memories for repeated episodes tend to blend together. This

process results in the memory for an event comprised of pieces from similar events. The elements of the individual events are correctly recalled, but are blended together inconsistently with regard to the historical sequence of events. Repisodic blurring, then, also explains the phenomenon of forgetting in a manner which maintains the permanence of memory.

Reconstructive memory is the final mechanism used to explain the phenomenon of forgetting (Schwartz & Reisberg, 1991). The schema theory of memory, originally proposed by Barlett (1932) over half a century ago, suggests that what we remember is the product of our interpretation. When encountered with a situation, we seek to understand it in terms of both our prior knowledge or schemata and the current information available to us. Thus, we understand in terms of a "schematized world," or the fit between current knowledge and prior information based on how things "ought to be."

The schema theory accounts for several possible errors in memory, including the seemingly apparent phenomenon of forgetting. Of relevance to the current discussion is the reconstructive nature of memory. According to the schema theory, there is a certain amount of redundancy in our environment--so much so that it would be extremely inefficient to process and store every detail. Details which are irrelevant are thus ignored, leading to "gaps" in our memory. Later, these gaps are filled through a process of reconstruction according to our schema of how things must have been. In this situation, forgetting has not occurred due to the fact that the information was never attended to in the first place.

Reconstruction effects, or the recollection of the past according to current knowledge and beliefs of how it should have been, appears to occur if a subject learns new information about an event after the event has already occurred. In other words, misinformation leads to a higher probability that an event will be reconstructed. Misinformation effects have been explained from both sides of the ultimate issue regarding memory's permanence.

Effects of Misinformation on Memory

An eyewitness's recollection of a crime has been shown to be susceptible to change through subsequent information received concerning the crime. This phenomenon, termed the misinformation effect, has been demonstrated in numerous studies of eyewitness memory (Loftus & Hoffman, 1989). Although the empirical study of this phenomenon only dates back to the early 1970's (Loftus, 1975), it has since been the focus of numerous laboratory studies in Australia, Canada, Germany, Great Britain, the Netherlands, and the United States (Loftus & Hoffman, 1989).

The typical design used in studies of misinformation has involved three stages or phases. First, subjects witness an event. This is typically presented to subjects as a sequence of slides depicting an event, such as a car accident or theft. Secondly, subjects are supplied with information that is contradictory to what had been witnessed in the original event. This misinformation is typically provided to subjects in postevent questioning. For example, in a now-famous study conducted by Loftus, Miller and Burns (1978), subjects were misled by asking them how fast a car was traveling when it passed a yield sign, when in fact the car had passed a stop sign in the original event.

Another method of introducing the misinformation is to include it in a narrative which is alleged to be descriptive of the original event. Finally, subjects' recognition memory for the original event is tested. For example, an item on the memory test concerning what type of sign had been passed in the study by Loftus et al. (1978) would provide alternatives consisting of the correct item (stop sign), the misled item (yield sign), and possibly several incorrect or control items (one-way, pedestrians crossing, and speed limit signs). Misled subjects typically perform more poorly than control subjects on the test items that they had been misled on. In the above example, subjects who were exposed to the misinformation were more likely to select the yield sign alternative than were subjects who had not been misled (Loftus, et al., 1978).

Suggested Mechanisms Accounting for the Misinformation Effect

Misinformation was originally thought to impair a person's memory for the original event (Loftus 1975, 1977, 1979). Following these original claims, numerous investigations were conducted which altered the conditions of acquisition, retention, and retrieval of memories in an attempt to further understand the underlying process(es) responsible for the misinformation effect. Despite its establishment as a reliable empirical phenomenon, interpretation of misinformation's influence on the original memory for an event remains hotly debated.

One alternative interpretation of the misinformation effect is that the original memory is not impaired by misleading postevent information (e.g., McCloskey & Zaragoza, 1985; Zaragoza, McCloskey & Jamis, 1987). The misinformation effect would simply be the result of encoding only the misinformation (the original information was never encoded, and hence is not accessible), encoding neither the original nor the misinformed information (guessing), or deciding to report the misinformation although both traces were encoded and remembered. Hence, the permanence of memory is once again upheld according to these theories.

Other researchers continue to support the original claim that the misinformation somehow impairs the memory trace from the original event (e.g., Lindsay & Johnson, 1987; Loftus, 1975, 1977, 1979; Loftus & Hoffman, 1989; Tversky & Tuchin, 1989). Many of these impairment theories suggest that the misinformation updates or alters the original memory trace. Others who support an impairment hypothesis suggest that the misinformation somehow interferes with retrieval of the original memory (e.g., Chandler, 1991).

In summary, there are two classes of memory impairment hypotheses--those that claim the impairment occurs at the level of storage and those that claim the impairment is retrieval-based. Storage-based impairment theories imply that the misinformation somehow disintegrates, weakens, or alters features of the memory for the original event. Consequently, the memory trace of the original event is somehow changed. Retrieval-based impairment hypotheses suggest that the misinformation interferes with the retrieval of an intact memory for the original event. Hence, the original memory exists in an unaltered form (see Belli, Windschitl, McCarthy & Winfrey, 1992, for a review of these two classes of hypotheses).

The mechanism(s) responsible for the misinformation effect continue to be the source of controversy. Supporters of the non-impairment theories uphold the notion that once stored, memories are permanent. Conversely, the impairment theorists (with the possible exclusion of those supporting retrieval-failure) suggest that memories are susceptible to change, and hence are not permanent. Once again, the ultimate issue of memory's permanence is challenged.

Based upon a review of studies which shed some light on the ultimate issue regarding the permanence of memory, Schwartz and Reisberg (1991) concluded the following:...[T]he evidence is fully compatible with the "it's all in there" suggestion. Memories are never lost and gone forever; they are merely not found. Old memories do not die; they merely become immensely difficult to locate....If you worry about the plausibility of this, so do we. In fact, we are willing to believe that some future data may force us to include something like decay in our theorizing....Maybe, once we set aside retrieval failures, and schematic mistakes, and repisodic blurring, it is "all in there somewhere" (pp. 532-533). Schwartz and Reisberg (1991), apparently resistant to this conclusion, felt that no evidence existed which adequately challenged the assumption that memories are permanent. One goal of the current study, utilizing a psychophysiological detection of deception (PDD) paradigm to test the misinformation effect, was to elucidate the controversy regarding the underlying mechanism(s) of the misinformation effect. However, it also tests the ultimate issue of memory's permanence.

The Concealed Knowledge Test

The PDD utilizes physiological methods to assess credibility. Autonomic nervous system indices are recorded by a polygraph while a subject is asked a series of questions concerning a past event about which his or her credibility is in question. There are two different types of PDD tests: knowledge-based tests, and deception-based tests.

One type of knowledge-based test, the Concealed Knowledge Test (CKT), assesses a suspect's knowledge of certain information. The CKT, first described by Lykken (1959), presents subjects with a series of multiple choice questions. Each question consists of six alternatives, one item of information known to be associated with the matter under investigation and five foils. It is assumed that only the guilty subject knows certain details of a crime, and would therefore respond stronger physiologically to those details about the crime as compared to foils (i.e., neutral or incorrect question alternatives). Innocent subjects are not expected to have knowledge of the crime and therefore are expected to react randomly to all question alternatives. Hence, the strongest responses would vary across all of the alternatives rather than be systematically present on the key.

Although the CKT has been recommended as an objective test for the detection of information (Lykken, 1981), and has produced high accuracy estimates in laboratory settings (Lykken, 1959; 1960), Elaad and colleagues (Elaad, 1990; Elaad, Ginton & Jungman, 1992) found a higher frequency of false negative decisions in their examinations of the accuracy of the CKT in actual crime settings. To reconcile the differential error rates between laboratory and realistic settings, Elaad (1990) and colleagues (1992) suggested that the guilty suspects in the realistic studies may not have noticed all of the relevant details while committing the crime. Despite their participation in the crime, these subjects may not have been aware of the relevant information tested in the CKT, and therefore appeared innocent.

Elaad (1993) noted that almost no empirical attention has been directed to the study of how the absence of direct and clear knowledge by the suspect influences physiological responses obtained on the CKT. He suggested that uninformed subjects (both guilty and innocent) may guess about relevant information during a CKT. These guesses may rely on information obtained during prior interrogation or from the media. To investigate this issue, Elaad (1993) studied whether the act of guessing affected physiological responsivity. He found that although physiological responses to the guessed items were stronger than those to irrelevant, non-guessed items, detection efficacy for guessed items was significantly less than that for known relevant items. Elaad (1993) suggested future studies investigating the effects of correct guessing by both guilty and innocent suspects were

needed to further understand the implications of guessing on the CKT.

Often innocent suspects need not guess about crime-relevant information. Bradley and Rettinger (1992) investigated whether innocent suspects with crime-relevant information could be found innocent on the CKT. Although these innocent (but knowledgeable) suspects had CKT scores less indicative of guilt (when compared to a guilty suspect group), 50% were misclassified as guilty. Recall and recognition memory tests for crime-relevant information revealed no significant differences in scores obtained by the guilty and innocent-aware groups. Similarly, Iacono, Cerri, Patrick and Fleming (1992) have found that innocent subjects who coincidentally obtained high scores on a recognition memory test of mock crime details tended to also obtain higher guilt scores on the CKT.

The focus of the above mentioned studies was on understanding the effect of memory for crime-relevant information in innocent suspects on the CKT. Others (e.g., Waid, Orne, Cook, & Orne, 1978; Waid, Orne, & Orne, 1981) have studied the relationship between later memory for CKT test items and the detection of deception. Their findings suggest a relationship between memory for items and frequency of detection, with a higher probability for detection associated with a better memory for test items.

Previous research, some of which was discussed above, has examined the role of memory and knowledge for crime-relevant information within the CKT detection of deception paradigm. None of this research, however, has investigated the effect of changes in memory of a crime on the detection of deception. While prior studies have attempted to bridge the gap between traditional memory studies and forensic psychophysiology, the second goal of the present study was to understand one of memory's basic weaknesses (susceptibility to misinformation) in an applied, socially significant context--the detection of deception.

In conclusion, the current study was designed to investigate two main issues: the controversy surrounding the misinformation effect (as described previously) and the possible influence of misinformation on knowledge-based PDD methods.

The Use of Psychophysiological Measures to Understand Memory Phenomenon

The application of a PDD paradigm to understand memory phenomena is not new--Bauer (1984) utilized the concealed knowledge test procedure to evaluate covert recognition of faces in a patient (P.K.) diagnosed with prosopagnosia. Prosopagnosia is a neurological syndrome characterized by an inability to recognize faces despite an intact ability to recognize objects (Bodamer, 1947). P.K., who scored at chance when attempting to overtly match a spoken name with a picture of a face, was shown a series of famous faces while asked whether each face "matched" a

series of alternative names. An increase in skin conductance (the basic measure employed on the CKT) to over half of the correct name/face pairings was reported, suggesting that a covert recognition ability existed (Bauer, 1984). Despite the past use of psychophysiological measures to understand memory phenomena such as prosopagnosia, the application of these measures to the misinformation effect is novel.

Hypotheses Concerning the Misinformation Effect

The present study assessed psychophysiological responses to both misinformed and non-misinformed details of a crime. It was assumed that if misinformation does not impair the original memory, physiological responses to the original/key detail would be similar to responses elicited on misled items. Similar reactivity would imply that two separate memory traces exist (one for the original detail and another for the misinformed detail) and that some response selection process was responsible for reporting the misinformation on the memory test.

If a misinformed subject (as measured on the recognition memory test) shows a stronger response to the original details when compared to the misinformed details, the role of impairment hypotheses would again be questionable. Although reporting the misinformation on the memory test, the subject's autonomic reactions would indicate that the original memory trace was retained. Moreover, this would suggest that the subject could discriminate between the original detail and the misinformation.

Evidence in favor of the impairment hypotheses would exist if a misinformed subject showed stronger autonomic reactivity to the misinformed details when compared to the original details. This would imply that the original memory no longer exists or that it is not accessible due to the introduction of misinformation. The strongest support for the impairment hypothesis would occur if the subject showed strong physiological responding to the misinformation item and the original item was not distinguishable from the neutral foils.

In conclusion, this study was designed to assist in understanding one of the long debated issues in misinformation effect interpretation--whether or not misinformation actually impairs a person's ability to remember event details. If the misinformed subject shows an increase in reactivity to both the original detail and the misinformation provided about that detail, this would be evidence against the impairment hypothesis. Alternatively, if the misinformed subject does not respond autonomically to the original detail (or responds less autonomically as compared to the misled detail), evidence in favor of the impairment hypothesis would exist.

Possible Effects of Misinformation on the Concealed Knowledge Test

Although the misinformation effect has been primarily investigated in terms of an eyewitness's recollection, this study

investigated the same phenomenon in suspected perpetrators of crime. Since the "best" eyewitness to a crime is the perpetrator, the effects of misleading postevent information on the perpetrator's memory for the crime were investigated.

There are many possible sources of misinformation that could contaminate a perpetrator's memory of a crime. The media typically reports numerous details provided "anonymously" following a crime. The accuracy of these reports may be questionable. Another possible source of misinformation in the criminal justice system is the investigation process. If the investigating officer develops a hypothesis concerning the crime, it is possible that this hypothesis may lead to a skewed or even incorrect version of the details of the crime. This incorrect information could be presented to suspects during a subsequent interview or interrogation, and might result in misinformation effects on a guilty suspect's memory for the crime. A final source of misinformation that could affect a guilty suspect's memory for a crime is the pretest interview conducted just prior to the administration of the CKT.

The misinformation effect has been demonstrated numerous times on tests of eyewitness memory. Given Elaad's (1993) findings that physiological responses to guessed items were stronger than those to the irrelevant items that were not guessed, it appears that any contamination by misinformation may lead to differential responding on the CKT. When guessing, subjects may make an assumption about details of a crime based on logic, deductive reasoning, scripts about "typical" crimes, or common sense. The effects of misinformation on perpetrator memory and CKT performance could be more severe than that of guessing, given the impairment hypotheses suggested by past researchers (as discussed above).

If the guilty suspect's memory for the original event is impaired through the receipt of misinformation, the rate of false negative errors on the CKT could increase. A growing body of research has found a substantial number of false negative errors both in the field (Elaad 1990; Elaad, Ginton, & Jungman 1992) and in the lab (Honts, Devitt, Winbush, & Kircher, 1996) on the CKT. Considering the added possibility of memory impairment due to the presentation of misinformation, the utility of the CKT would be questionable.

The Present Study

The present study investigated the effects of receipt of postevent misinformation by guilty subjects on CKT performance. A videotaped crime depicting an unidentified intruder committing a burglary served as the to-be-remembered event. One week later, misinformation was provided to the subjects in a narrative description of the videotaped crime. Loftus, Miller and Burns (1978) varied the length of time between exposure to the original event and the introduction of misinformation, and found that misleading information has a greater impact when presented just

prior to the final test of memory (at the end of the retention interval) rather than following the presentation of the original stimulus (at the beginning of the retention interval). Also, it is not likely that misinformation from the media, police investigations, or CKT pretest interviews would be presented immediately following the event in question. Therefore, presentation of the misinformation occurred in the second phase of this experiment, just prior to the CKT. Following the presentation of the misinformation, subjects were given a CKT to assess their knowledge of the event. Finally, subjects were given a paper-and-pencil recognition memory test.

The methods employed in this study were similar to those used by previous misinformation studies insofar as their ability to conform to the Concealed Knowledge paradigm of detecting information. Although several different encoding, storage, and retrieval conditions have been used in previous misinformation research, the methods chosen for this study were based on their likelihood of successfully inducing misinformation effects. The rationale for choosing methods which will maximize the probability of misinformation effects is rather straightforward: to investigate the effects of misinformation on CKT performance, misinformation effects *must* occur.

Methods

Subjects

Ninety-six undergraduates (35 males, 61 females) at the University of North Dakota enrolled in Introduction to Psychology courses served as subjects in the within-subjects design. Subjects, who ranged in age from 18 to 44, had a mean age of 19.74 years (n = 95, SD = 3.83). Subjects were recruited from the Psychology Department subject pool, and were given extra credit points for their participation. Subjects were also offered monetary bonuses, as described below. Subjects identified as being under the care of a physician for physical or mental health problems, suffering from a chronic health condition, or having taken a polygraph test in the past were excluded from the study. Also, only those subjects who reported normal hearing and corrected to normal vision were invited to participate in the study.

Apparatus

Physiological responses were monitored on a Lafayette field polygraph instrument (Model 761-65GA). Electrodermal activity (skin resistance) was measured on the volar surfaces of the medial phalanges of the right hand using silver-silver chloride electrodes. Respiration was transduced mechanically through pneumatic tubes placed around the abdomen and upper thoracic region. Cardiovascular activity was measured according to standard field polygraph practice through a cuff attached to the upper left arm. The Lafayette polygraph was interfaced with an Epson lap-top PC to allow for digitization of data. Digitized data were then stored on a separate floppy disk for each subject.

Computer Assisted Polygraph (CAPS, version 7.0; Kircher & Raskin, 1990a) served as the data collection software.

Procedure

Subjects participated in a two-phase experiment in the within-subjects design. The phases were separated by one week. During the first phase, subjects were fully informed about the experiment (with the exception of the purpose of the postevent narrative). They were told that they would view a videotaped crime which they were to think of themselves as having committed. They were also told that on a separate occasion (phase two) they would be given a polygraph test and a paper-and-pencil memory test concerning the crime. Subjects were informed that they had the opportunity to earn up to $20.00 for their participation: they would be rewarded with $10.00 if they passed the polygraph test and would be given 50 cents for each correct response on the 20-item memory test.

Monetary incentives to pass the polygraph test, a standard feature of laboratory studies on PDD, were included in an effort to enhance the external validity of the study. The possibility of earning additional money based on their memory of the crime was intended to encourage subjects to attend to the videotaped stimulus.

Phase One: Presentation of Crime Stimulus: Following informed consent (Appendix A), subjects viewed the videotaped crime. The video was approximately 12 minutes in length, and was recorded from a first person perspective. It portrayed an unidentified intruder breaking into a home, stealing several objects, and leaving the scene in a stolen car. This video was used in a previous study (Honts, Devitt, Winbush & Kircher, 1996) in which the effects of countermeasures on CKT performance were investigated. After viewing the crime, subjects were thanked for their time and reminded of their phase two appointment for the following week.

Phase Two: Presentation of Misinformation: During the second phase of the experiment subjects were met by the same research assistant who had shown them the videotape one week earlier. They were then exposed to the misinformation, which was presented in a summary of the original event for the purpose of "refreshing their memory." The summary was an accurate description of the videotaped crime with the exception of three details, which were presented inaccurately. Also, three other details chosen as control details were not explicitly named in the memory refresher. Appendix B contains the narrative used to misinform subjects, with misled details italicized and references to control details underlined. Subjects were asked to read the summary as they listened to a recorded version of it. Subjects therefore received the misinformation both visually and auditorally, utilizing the same sensory modalities as the videotaped crime stimulus.

As suggested above, six critical details from the original event were the source of the information manipulation. Three of the details served as controls--they were generically described in the summary. For example, although the intruder stole a computer monitor during the burglary, the narrative simply referred to the piece of electronic equipment which was stolen. The remaining three details were the source of misinformation--they were inaccurately described in the written summary. For example, subjects were told in the narrative that the burglar used a prybar to force entry into the residence, when in fact the intruder had used a screwdriver. A pilot investigation was conducted to aid in the selection of details to serve as the source of the information manipulation. Two groups of subjects were tested, one provided a measure of the memorability of the details of the crime and the other provided a measure of the transparency of the details.

The 41 undergraduate psychology students who served as subjects in the memorability group were shown the videotaped crime. Immediately following the crime, they were asked to respond to a 19-item recognition memory test. Each item inquired about a specific detail of the crime and had six alternatives (five foils and the key). Subjects were instructed to respond according to their memory of the videotaped crime. If subjects were uncertain, they were to provide their best guess. The results of this measure of the memorability of the crime details are provided in Table 1.

Forty undergraduate psychology students served as subjects in the transparency group. These subjects were told that the study was being conducted to assess people's thoughts regarding a hypothetical crime. Furthermore, they were told "You will be asked to complete a questionnaire that contains items describing a hypothetical crime in which you are the burglar." Subjects were instructed to provide their "best guess" about what they would do as a burglar. Subjects then responded to the questionnaire (the same questionnaire was used for both the memorability and transparency groups). The results of this measure of the transparency of the details of the crime are also provided in Table 1.

The results from this pilot investigation were used to determine the six critical details--three control and three misled--that were used as the source of the information manipulation. Details which were high in memorability, yet low in transparency were chosen (see Table 1). The first control detail chosen pertained to how the burglar entered the duplex (Item 2, Table 1). One hundred percent of the subjects in the memorability condition of the pilot study correctly chose the sliding glass door, whereas less than one-quarter of the subjects (22.5%) in the transparency condition chose this alternative.

Table 1
Memorability and Transparency of Details of the Crime

Alternatives	Percent of Respondents Endorsing Memorability[a]	Transparency[b]
1. What did the burglar carry the stolen merchandise in?		
red backpack	0.0	2.5
gray suitcase	0.0	2.5
white laundry sack	0.0	5.0
blue daypack	2.4	2.5
black gym bag	4.9	82.5
green duffle bag*	92.7	5.0
2. How did the burglar enter the residence?		
front door	0.0	7.5
second floor deck door	0.0	2.5
second floor window	0.0	5.0
basement window	0.0	37.5
sliding glass door*	100.0	22.5
through the garage	0.0	25.0
3. What kind of tool was used to force entry?		
hammer	0.0	5.0
pry bar	0.0	42.5
crow bar	0.0	35.0
screw driver*	100.0	12.5
tire tool	0.0	0.0
drill	0.0	5.0
4. What was one of the stolen items?		
CD player	0.0	70.0
Sony Walkman	0.0	5.0
cellular phone*	95.1	25.0
shortwave radio	0.0	0.0
microwave oven	0.0	0.0
tape deck	4.9	0.0
5. What did the note that was left by the family say?		
gone to the movies	2.4	60.0
gone for a short walk*	95.1	0.0
gone to the doctor	0.0	0.0
gone to the grocery store	0.0	10.0
gone to church	2.4	2.5
gone to a ball game	0.0	27.5

Table 1, Continued

Alternatives	Percent of Respondents Endorsing Memorability[a]	Transparency[b]
6. What did the burglar eat while in the residence?		
ice cream	0.0	5.0
cookie*	97.5	45.0
ham sandwich	0.0	7.5
chicken leg	0.0	15.0
candy	2.4	22.5
piece of pie	0.0	5.0
7. What did the burglar knock over while in the duplex?		
vase of flowers	4.9	25.0
pot of soup	0.0	0.0
glass*	92.6	20.0
lamp	2.4	47.5
chair	0.0	7.5
table	0.0	0.0
8. What musical instrument was stolen?		
piano	0.0	0.0
violin	0.0	30.0
cello	0.0	0.0
flute*	100.0	35.0
saxophone	0.0	25.0
trumpet	0.0	10.0
9. What kind of liquor did the burglar steal?		
whiskey	7.3	47.5
scotch	7.3	17.5
vodka	0.0	27.5
gin*	78.0	2.5
aqua vit	7.3	2.5
uzo	0.0	2.5
10. What was one of the stolen items?		
slide projector	0.0	0.0
silver tray	0.0	10.0
microscope	2.4	0.0
crystal vase	0.0	10.0
camera*	97.5	12.5
camcorder	0.0	67.5

Table 1, Continued

Alternatives	Percent of Respondents Endorsing Memorability[a]	Transparency[b]
11. What type of musical recordings were stolen?		
45 rpm records	0.0	0.0
LP records	0.0	0.0
reel to reel tapes	0.0	0.0
8-track tapes	0.0	0.0
CDs	4.9	97.5
cassette tapes*	95.1	2.5
12. How many musical recordings were stolen?		
one	12.2	0.0
two*	78.0	0.0
three	4.9	2.5
four	4.9	12.5
five	0.0	22.5
six	0.0	62.5
13. What piece of jewelry was stolen?		
necklace	0.0	7.5
pair of earrings	2.4	5.0
diamond ring	0.0	65.0
woman's watch	17.0	0.0
man's watch*	80.5	12.5
wedding ring	0.0	10.0
14. What type of electronic equipment was stolen?		
calculator	0.0	2.5
radar detector*	85.3	22.5
stereo amp	0.0	7.5
turntable	0.0	0.0
laptop computer	12.2	62.5
boom box	2.4	5.0
15. What did the burglar break?		
glass	0.0	30.0
lamp	0.0	37.5
chair	0.0	2.5
vase*	100.0	27.5
flower pot	0.0	2.5
mirror	0.0	0.0

Table 1, Continued

Alternatives	Percent of Respondents Endorsing Memorability[a]	Transparency[b]
16. What type of electronic equipment was also stolen?		
television	0.0	7.5
VCR	0.0	42.5
laser disk player	0.0	37.5
computer	2.4	7.5
computer monitor*	97.5	0.0
printer	0.0	5.0
17. What item of clothing was stolen?		
pair of leather pants	0.0	0.0
fur coat	2.4	42.5
leather coat*	90.2	47.5
designer dress	0.0	5.0
pair of shoes	2.4	2.5
man's suit	4.9	2.5
18. What type of vehicle was stolen?		
minivan	2.4	7.5
station wagon*	7.3	0.0
four-door car	82.9	10.0
two-door car	4.9	2.5
sports car	2.4	65.0
pickup truck	0.0	15.0
19. What was the make of the stolen vehicle?		
Chevy	2.4	30.0
Ford	2.4	22.5
Olds	9.7	0.0
Nissan*	78.0	15.0
Honda	4.9	17.5
Toyota	2.4	15.0

Note. An asterisk denotes the correct alternative

[a] Subjects viewed the videotaped crime and then responded to the recognition memory test (N = 41).

[b] Subjects provided their "best guess" concerning details of a hypothetical crime (N = 40).

*Indicates the item/event depicted in the videotape.

The second control detail, which pertained to the contents of a note left by the occupants of the residence (Item 5, Table 1), was correctly identified by 95.1% of the subjects in the memorability condition while not being chosen by any of the subjects in the transparency condition. The final control detail chosen (Item 16, Table 1), regarding the theft of the computer monitor, was similarly remembered by 97.5% of the subjects in the memorability condition yet guessed by 0% of the subjects in the transparency condition.

Subjects were exposed to misinformation concerning the following three details: (a) The color of the bag used to carry the stolen merchandise in (Item 1, Table 1), which was remembered as green by 92.7% of the subjects in the memorability condition and guessed by only 5% of the subjects in the transparency condition; (b) the type of tool used to force entry, correctly recalled as a screwdriver by all of the memorability subjects and guessed by 12.5% of the memorability subjects (Item 3, Table 1); and (c) a camera that was stolen during the burglary, correctly recalled by 97.5% of the subjects in the memorability condition while being guessed by 12.5% of the subjects in the transparency condition (Item 10, Table 1).

The results from the transparency condition of the pilot study were further utilized in selecting the misinformation that subjects were exposed to. In an attempt to enhance the misinformation effects, incorrect response alternatives which were chosen most frequently by subjects in the transparency group served as the misinformation for the three misled details. For example, subjects were misinformed when the alleged memory refresher stated that a black gym bag (chosen by 82.5% of subjects in the transparency condition) was used to carry the stolen merchandise. Regarding the type of tool used to force entry, subjects were incorrectly informed that it was a prybar (chosen by 42.5% of the subjects in the transparency condition). Finally, subjects were misled when informed that a camcorder (chosen by 67.5% of the transparency subjects), rather than a camera, had been stolen.

Phase Two: Concealed Knowledge Test. Following exposure to the misinformation in the narrative alleged to be a memory refresher, subjects were escorted to the lab of the polygraph examiner. Procedures for conducting the CKT were consistent with those used by Honts et al. (1996). Upon arrival, subjects were asked to read typewritten instructions for taking the CKT while simultaneously listening to an audiotaped version of the instructions. The CKT instructions (Appendix C) were consistent with those used in the field. All questions that subjects had following these standardized instructions were answered consistently with the contents of the standardized instructions. Questions that could not be answered based upon the standardized set of instructions were answered with: "You need not worry about that right now."

Prior to the beginning of the CKT, all subjects were shown to the restroom where they were instructed to wash their hands and use the facilities if necessary. Hand washing was requested to ensure that electrode placement sites would be clean (Venables & Christie, 1973). Subjects were asked to use the facilities so that the CKT could proceed without interruption.

Autonomic reactivity to control and misinformed items was assessed using the CKT paradigm. First, the transducers were placed on the subject. The experimenter then adjusted the equipment (i.e., pen centering, gain adjustments) to ensure quality recordings. Next, subjects were presented with the audiotaped CKT questions. Although the presentation of the CKT items was standardized, the experimenter continuously monitored the equipment, noting stimulus presentation and answer points on the chart and computer.

Subjects where asked six multiple choice questions concerning the details of the crime (Appendix E). Each question series had six multiple choice test alternatives. Three of the question series served as controls and contained only the original information from the videotaped crime as a key. As described above, none of the keys to these series had been reviewed in the narrative. Hence, subjects were only exposed to this information once. The remaining three series contained two potential keys, the original information as provided in the videotape and the misinformation as provided in the narrative. Although there was a potential confounding of time of exposure to the information (given that the misinformation is always presented in the more recent past), this was necessary to ensure the maximal effects of the misinformation manipulation. This procedure, consistent with many empirical studies of this phenomenon, was also representative of the field conditions which were being modeled.

The key(s) was randomly placed within each series of six questions with the exception that it never occupied the first serial position. The foil which occupied the first position was discarded prior to all analyses, consistent with field CKT methods. Furthermore, presentation of the six series was standardized so that only two forms of the questions existed (location of the key(s) was random within each version). This was done to allow an audiotaped presentation of the CKT stimuli in an effort to strengthen control over the presentation and timing of the CKT questions. In sum, all subjects responded to one of two standardized presentations of the CKT stimuli. The only differences between the two versions were in the placement of the key(s) among the alternatives.

All subjects who passed the polygraph test were given a $10.00 bonus. Decisions regarding pass/fail were made following data collection based upon a posteriori probability of truthfulness calculated by the CAPS program (see Kircher & Raskin, 1988; 1990a; or Honts et al., 1996 for a discussion of

the rationale and methods utilized in the CAPS classification procedure). Subjects who scored above .30 a posteriori probability of truthfulness (calculated using all six series/charts) were given the monetary bonus.

Phase Two: Memory Test. Following the CKT, subjects were asked to respond to a paper-and-pencil test (Appendix D) of their memory for the original event. This 20-item multiple choice test was similar to that used in the pilot investigation. Six of the 20 items were replications of the six series assessed on the CKT. Subjects were instructed to respond based upon their memory of the original event, and were offered a reward of 50 cents for every correct item. A perfect score therefore resulted in a $10.00 reward.

Phase Two: Debriefing. After scoring the memory test, subjects were given a brief explanation of the rationale behind the CKT and its determination of the probability of truthfulness. Subjects were then informed of the results of the CKT test. Monetary bonuses were calculated and paid to the subject at this time. Also, subjects were given the documentation necessary to receive extra-credit for their participation. Subjects were completely debriefed and any questions they had were answered. Possible use of countermeasures was assessed during debriefing through the following question: "Did you do anything or attempt anything during the polygraph examination that you were hoping might help you to appear innocent?". Although almost all of the subjects reported the desire to maintain a relaxed state during the exam, none reported the use of sophisticated countermeasure techniques. The possibility of between-subject contamination was also assessed during debriefing. None of the subjects reported having heard anything about the experiment prior to their participation or between phase one and two that would be considered contamination. Subjects only reported hearing from classmates things such as "the experiment was fun and interesting to participate in," and that people received varying amounts of payment. Finally, subjects were urged not to discuss the specifics of the experiment with anyone until the following semester.

Results

The software program ARCHIVE (Kircher & Raskin, 1990b) was used to extract the physiological features from the digitized waveforms for each item (6 series X 5 alternatives per series, or 30 items) after they were edited for artifact. A psychophysiologist, who was also an experienced polygraph examiner, smoothed artifacts and removed baseline centering adjustments during the editing process. The dependent measures extracted included skin resistance amplitude, skin resistance half recovery time, relative blood pressure amplitude, relative blood pressure half recovery time, abdominal respiration line length, and thoracic respiration line length. In sum, 180 data points existed for each subject (6 series X 5 alternatives per series X 6 dependent measures). All extracted features were

transformed to reflect a percent of response range measure before analysis. Transformations, made by the software program ARCHIVE (Kircher & Raskin, 1990b), were calculated within each chart and were based upon observed responses.

Effects of Misinformation on CKT

To determine the effects of misinformation on CKT performance, skin resistance amplitude data were scored using the procedures described by Lykken (1959). Response amplitude was defined as the peak amplitude of any response or complex of responses that began within 5 seconds of the point of answer. According to Lykken's (1959) scoring procedure, a score of 2 was assigned to the largest amplitude response within a given series. A score of 1 was assigned to the next largest response and a score of 0 was assigned to the remaining three alternatives within the series (the first alternative in a series was not scored due to the increased reactivity associated with the start of a series). To determine truthfulness or deception according to the Lykken (1959) procedure, only scores associated with the correct alternative are retained. Utilizing this criteria, Lykken scores ranged from 0 to 12 across the six charts. The mean Lykken score across all six charts was 6.09 (SD = 2.61, n = 92).

According to the Lykken (1959) procedure, if the sum of the scores to the key items is equal to or greater than N + 1, the subject is classified as deceptive. Thus, subjects who had scores of 7 or greater were classified as deceptive. This procedure resulted in the correct classification of 41.7% (40 of 92) of the subjects. A majority of subjects (54.2%, or 52 of 92 subjects) would have been incorrectly classified as truthful utilizing Lykken's scoring procedures.

Retaining only the scores associated with the correct alternative (i.e., the key), summed scores on the three misled series were compared to summed scores on the three non-misled series with a paired-samples t-test (n = 92). Differences between the summed scores were found [t (91) = -4.80, p < .000], with scores on the non-misinformed charts (M = 3.57, SD = 1.65) significantly larger than scores on the misinformed charts (M = 2.52, SD = 1.71).

Next, the sum of the Lykken scores associated with the key items on the three misinformed charts was compared to the sum of the Lykken scores associated with the misinformation on the same charts (i.e., the Lykken scoring method was applied to the misinformation, treating the misinformed alternatives as though they were the key). No significant difference existed between scores associated with the key (M = 2.53, SD = 1.71) and scores associated with the misinformation (M = 2.46, SD = 1.54) on the three misled charts, t(93) = .24, p = .813. Restating this finding in other words, there was no difference between the scores associated with responses to the keys and scores

associated with responses to the misinformation on the three misinformed charts.

Effects of Misinformation as Measured on the Memory Test

The mean score on the memory test was 15.02 (SD = 2.08, min = 10, max = 19, n = 96) out of a possible score of 20. When responding to the control item (i.e., non-misled item) regarding where the burglar entered the duplex, 99% of the subjects (95 of 96) chose the correct alternative (sliding glass door). Similarly, 96.9% of the subjects (93 of 96) correctly identified the contents of the note that was read by the burglar. The final control item, regarding the theft of the computer monitor, was answered correctly by 93.8% of the subjects (90 of 96).

Results from memory-test questions inquiring about misled details revealed the results of the misinformation effect. A majority of subjects correctly identified the screwdriver as the item that had been used to force entry (62.5%, 60 of 96), although 37.5% (36 of 96) chose the misinformation (prybar) provided regarding this detail of the crime. On the item which inquired about the type of bag used to carry the stolen merchandise, 58.3% of the subjects (56 of 96) incorrectly chose the misinformation (black gym bag). Approximately one-third of the subjects (34 of 96) correctly chose the green duffel bag on this test item. On the final misled item, slightly more than half of the subjects (51 of 96) correctly identified that a camera had been stolen, whereas 43.7% of the subjects chose the misinformation (camcorder).

Effects of Misinformation as Revealed through Psychophysiological Measures

To determine the effects of misinformation through the psychophysiological measures, type of CKT item (key, misinformation, or foil) was treated as a between subject variable. This allowed a comparison of responses to the key, misinformation, and foil items for subjects who displayed differential misinformation effects across the three misled charts. Results from the memory test were coded to reveal the results from the information manipulation (chart type). Three levels of chart type were considered: non-misinformed, unsuccessfully misinformed (the correct alternative on the misinformed charts was chosen on the memory test), and successfully misinformed (the misinformation was chosen on the memory test). This 3 (item type) X 3 (chart types) design led to a potential for 9 cells. However, due to the absence of a misled item type in the non-misled charts, eight cells existed. In sum, analyses were conducted on the dependent measures examining eight cells (2 item types X 1 chart type for non-misinformed charts, 3 item types X 2 chart types for misinformed charts).

A MANOVA revealed a significant interaction between chart type and item type across the six extracted physiological features [Wilks $F(18, 3946) = 5.36$, $p = .000$], with univariate

F-tests revealing significant effects in skin resistance amplitude [F(3, 1400) = 20.37, p = .000], skin resistance half-recovery time [F(3, 1400) = 8.45, p = .000] and abdominal respiration [F(3, 1400) = 5.44, p =.001]. The physiological features that were found to be significant in the MANOVA were included in follow-up analyses.

Planned comparisons were conducted on the significant dependent measures using an alpha level of .01. These comparisons were conducted to test the hypotheses concerning the mechanism(s) underlying the misinformation effect.

Table 2 lists the descriptive statistics associated with each of the cells on the skin resistance amplitude measure. Significant differences were found between the key and foil on the non-misinformed charts [t(573) = 9.33, p = .000] and the unsuccessfully misinformed charts [t(288) = 6.17, p = .000]. No significant differences in skin resistance amplitude existed between the key and the foil on the successfully misinformed charts [t(264) = .56, p = .573]. Furthermore, no significant differences in skin resistance amplitude were found between the misinformation and foils on the unsuccessfully misinformed charts [t(288) = 1.10, p = .272], while responses to the key and misinformation were significantly different on the successfully misinformed charts [t(263) = -4.33, p =.000].

Table 2
Skin Resistance Amplitude: Percent of Response Range

	Item Type		
Chart Type	Key	Misinfo.	Foil
Non-Misinformed (n)	287		288
Mean	45.20		23.52
SD	34.50		19.09
Successfully Misinformed (n)	133	132	133
Mean	22.83	38.97	21.18
SD	27.50	32.00	19.38
Unsuccessfully Misinformed (n)	145	145	145
Mean	41.04	23.26	20.21
SD	35.65	27.06	19.60

Table 3 lists the descriptive statistics associated with the skin resistance half-recovery time within each cell. Again, significant differences existed between the key and foil on the non-misinformed charts [t(573) = 6.34, p = .000] and the unsuccessfully misinformed charts [t(288) = 5.39, p = .000]. No significant differences in skin resistance half-recovery time were found between the key and the foil on the successfully misinformed charts [t(264) = 1.75, p = .081]. Furthermore, no significant differences in skin resistance half-recovery time

were found between the misinformation and foils on the unsuccessfully misinformed charts [$t(288) = 1.45$, $p = .127$], while responses to the key and misinformation were significantly different on the successfully misinformed charts [$t(263) = -2.66$, $p = .008$].

Table 3
Skin Resistance Half-Recovery Time: Percent of Response Range

	Item Type		
Chart Type	Key	Misinfo.	Foil
Non-Misinformed (n)	287		288
Mean	40.02		27.35
SD	28.98		17.58
Successfully Misinformed (n)	133	132	133
Mean	28.97	38.54	23.64
SD	30.31	28.20	17.69
Unsuccessfully Misinformed (n)	145	145	145
Mean	40.43	28.01	23.47
SD	32.60	30.05	19.25

Table 4 lists the descriptive statistics associated with the abdominal respiration measures within each cell. No significant differences were found between the key and foil on the non-misinformed charts [$t(573) = -.75$, $p = .455$], the successfully misinformed charts [$t(264) = -2.14$, $p = .033$], and the unsuccessfully misinformed charts [$t(288) = -2.05$, $p = .041$]. Furthermore, significant differences in abdominal respiration were found between the misinformation and key on the successfully misinformed charts [$t(263) = -4.33$, $p = .000$].

Table 4
Abdominal Respiration: Percent of Response Range

	Item Type		
Chart Type	Key	Misinfo.	Foil
Non-Misinformed (n)	287		288
Mean	40.69		42.22
SD	27.97		20.49
Successfully Misinformed (n)	133	132	133
Mean	31.23	26.43	36.15
SD	20.25	21.42	17.07
Unsuccessfully Misinformed (n)	145	145	145
Mean	27.44	34.12	39.23
SD	21.29	21.60	20.82

Discussion

Misinformation's Effect on the CKT

Differences between non-misled and misled series were compared to determine if the introduction of misinformation affected the Lykken (1959) CKT scoring method. The Lykken scoring method assigns higher scores to responses with a higher skin resistance amplitude. Lykken scores associated with the key were significantly different on the non-misled and misled series, suggesting that the introduction of misinformation lowers response amplitude on the key. This effect existed regardless of the success of the misinformation manipulation. Furthermore, key and misinformation scores within the misled series did not differ, suggesting that the inclusion of misinformation as an alternative on a CKT series would lead to similar response amplitudes. The misinformed alternative would be considered a foil, which implies that response amplitude between the key and foils (since any misinformation would be considered a foil) is similar on misled series.

Lower scores on the keys are associated with a higher probability of being classified as truthful according to the Lykken criteria for classification. Therefore, these findings suggest that the introduction of misinformation would lead to a higher rate of false negative errors, or the increased likelihood that deceptive individuals would be classified as truthful. Again, the mere introduction of misinformation rather than the effect of the misinformation led to lowered Lykken scores. These findings should lead one to question the utility of the CKT in real-world situations due to the many possible sources of misinformation that a guilty individual may be exposed to.

The utility of other PDD tests could also be jeopardized by these findings. For example, the control question test (CQT) has been shown to be susceptible to both physical (Honts, Hodes, & Raskin, 1985; Honts, Raskin, & Kircher, 1987, 1994) and mental (Honts et al., 1996) countermeasures, although it is the most commonly used PDD test in real world applications (Honts, 1991; Raskin, 1989). Honts et al. (1996) suggested that the effects of countermeasures are psychological--they affect information processing when used successfully. The introduction of misinformation may similarly lead to increased error rates on the CQT.

Another method of detecting deception through psychophysiological methods that has recently been suggested utilizes evoked potentials in a CKT-like paradigm (e.g., Farwell & Donchin, 1991; Rosenfeld, Cantwell, Nasman, Wojdac, Ivanov, & Mazzeri, 1988; Rosenfeld, Nasman, Whalen, Cantwell, & Mazzeri, 1987). These studies suggest that using electroencephalographic measures such as P300 latency result in low false positive and false negative error rates. However, the use of evoked potentials for detecting deception could be just as susceptible

to the introduction of misinformation as are more typical PDD methods.

Despite the demonstrated impact of misinformation on the CKT and the potential impact of misinformation on other PDD methods, some cautions are necessary when attempting to generalize these findings to situations outside of the laboratory. First and foremost, this design utilized six series on the CKT--three non-misled and three misled. Although it is quite plausible that misinformation may be introduced to guilty suspects, the amount of misinformation introduced may not be as large. In other words, the misinformation effect may have been exaggerated in this study due to the introduction of misinformation on half of the CKT series.

The number of CKT series used in the field varies depending upon the ability to develop the items. While Iacono, Boisvenu, and Fleming (1984) have reported that the optimal number of CKT items is five, others have suggested that developing even that many items is very difficult in real cases (e.g., Elaad, 1990; Elaad et al., 1992; Podlesny, 1993). Obviously, the effects of any introduced misinformation would have a greater impact on CKTs that consist of only a few series as compared to those that contain many series.

In sum, although this study may have had artificially strong misinformation effects, the impact of misinformation may vary depending upon the number of CKT series used. For example, one misinformed item would not influence the total score associated with five series as much as it would influence the total score calculated from a CKT using only three series. Therefore, at the very least, this study demonstrates the potential for misinformation effects. One way to lessen any potential effects may be to increase the number of series used. However, one could never be certain of the amount of misinformation that has been introduced. Future research is needed to further understand the potential interaction between number of CKT series and misinformation on the Lykken classification system.

A second feature of this study that could potentially limit the generalizability of these findings is the method of guilt induction. This study utilized a videotaped burglary to create "guilty" subjects. Although this method of inducing guilt is similar to other PDD laboratory investigations (e.g., Iacono, Boisvenu, & Fleming 1984) and utilized the same stimulus material as the study conducted by Honts et al. (1996), misinformation may not have the same effect in the field. At issue here are differences between memory for a simulated event and memory for an experienced event. Many factors could contribute to differential memories between experienced and simulated events including environmental factors, emotional factors, or consequential context (Yuille, 1993).

Environmental factors that may lead to different effects in the field include the richness, strength, or complexity of the experience. For example, Bradley and Rettinger (1992) suggest that a richer and more complex memory would be associated with an experienced event. The use of a 12-minute videotaped burglary probably doesn't replicate the experience of a burglar who plans and commits a crime. However, the results of the memory test and the pilot study suggest that subjects attended to the stimulus and had very good memories for the details of interest (i.e., the three misled and three non-misled details). Also, an experienced event contains many more potential stimuli to attend to, which may lessen the attention to some of the details which are later included in the CKT. Therefore, the effects of misinformation may actually be greater in the field than demonstrated in this study.

Consequential and emotional factors such as the motivational level of subjects or the type of emotion experienced by subjects during the presentation of the crime stimulus and later during the CKT are also different than the motivation and emotion that may be experienced outside of the laboratory. Although a monetary bonus was used to induce motivation, the effects of the monetary reward may be very different from the motivational level found in field situations. Subjects knew that they were participating in a study, so the consequences were limited to the potential to earn $10.00. Emotion has been investigated numerous times in terms of selectivity of attention, which in turn would affect memory (e.g., Christianson & Loftus, 1987, 1991; Clifford & Scott, 1978). Because the CKT is a knowledge-based test, a brief discussion of how emotion may influence knowledge is required.

Generally, the results from studies that have investigated emotional variables in relation to memory for details have found improved memory for central details and poorer memory for peripheral details when events are emotional rather than neutral. This would imply that in the field, the use of central details of the crime should be used on the CKT to increase the likelihood that they were attended to. However, "emotional" has been operationally defined differently across the studies. Typically, the emotional event has involved witnessing injury (e.g., Christianson, 1984; Christianson & Loftus, 1987, 1991), violence (e.g., Clifford & Scott, 1978; Loftus & Burns, 1982), or stressful events (e.g., Cutler, Penrod, & Martens, 1987; Loftus, Loftus, & Messo, 1987; Maass & Kohnken, 1989). These studies have typically investigated the effects of negative emotion on attention and memory. Those who commit a crime may, in reality, experience a "high" or positive emotional experience.

Future research investigating the effects of positive emotion (for example, exhilaration) are necessary. Despite the need for future research, the results of the memory test from this study suggest that subjects did attend to the stimulus.

Heightened emotion, according to the Easterbrook Hypothesis (Easterbrook, 1959) leads to narrowing of attention. Regardless of the direction of the emotion, this implies that fewer details are processed. With this in mind, the effects of misinformation on the CKT and other PDD techniques may actually be more severe in the field, due to the increase in emotion experienced.

In sum, the use of lab simulations to investigate the reliability and validity of field PDD tests has been controversial (Kircher, Horowitz, & Raskin, 1988). Despite this controversy, the fact remains that it would be impossible to investigate the effects of misinformation in the field. Although the situation may be artificial, it has demonstrated that the introduction of misinformation influences CKT performance. The effects may be different in the field, including the potential for more severe effects. This alone warrants consideration by field examiners. Future research utilizing a richer guilt induction method such as a mock crime in which subjects are made to believe that severe consequences could exist if they are caught is essential to further understand the implications of this study for field PDD use.

Effects of Misinformation as Revealed through Psychophysiological Measures

Hypotheses concerning the effects of misinformation were examined by comparing responses elicited to non-misinformed detail, unsuccessfully misinformed details, and successfully misinformed details. The six extracted physiological features from the key, misinformation, and foils were compared across these conditions to reveal a significant interaction between the success of the information manipulation (chart type) and item type (key, foil, or misinformation). The results of this interaction revealed significant differences in skin resistance amplitude, skin resistance half-recovery time, and abdominal respiration across the conditions.

Non-misled Details. As expected according to the rationale for the CKT, skin resistance amplitude and half-recovery time responses to the key were significantly larger than were responses to foils. This finding supports the use of the CKT paradigm in this study to elucidate the mechanism(s) underlying misinformation effects. If this finding had not emerged, the methodology of the study would have been questionable.

Unsuccessfully Misled Details. Unsuccessfully misinformed details were operationally defined as those details in which the subject (a) received misinformation regarding the detail; and (b) correctly chose the key detail on the memory test (i.e., they did not "fall for" the misinformation). Psychophysiological responses that were found to be significant on the MANOVA were included in follow-up analyses.

Skin resistance amplitude and half-recovery time were significantly larger in response to the key than to the

misinformation or foil on the unsuccessfully misled charts. Furthermore, responses to the misinformation and foils did not differ. Analyses of abdominal respiration length revealed no significant differences between the key, misinformation, and foils on the unsuccessfully misinformed charts.

These findings are also supportive of the rationale underlying the CKT. For subjects who correctly remembered the detail of inquiry, the unsuccessfully introduced misinformation was responded to no differently than the other foils. Responses to the key were larger than the others (for skin resistance amplitude and half-recovery time), as would be predicted. The lack of significant differences on abdominal respiration length is not surprising--despite the measurement of numerous channels on the CKT, the skin measurements are typically the most useful.

Successfully Misled Details. Successfully misinformed details were operationally defined as those details that subjects (a) received misinformation regarding the detail; and (b) incorrectly chose the misinformation rather than the key on the memory test (i.e., they "fell for" the misinformation). Again, the three psychophysiological measures (skin resistance amplitude and half recovery time, and abdominal respiration length) that were found to be significant were examined in the follow-up analyses.

Skin resistance amplitude and half recovery time in response to the misinformation were found to be significantly larger than responses to both the key and the foils on the successfully misled series. Furthermore, responses to the key and foils did not differ. Abdominal respiration length demonstrated the same findings, only decreased in response to the misinformation (as would be expected). The results from the successfully misled series are essential to understanding the mechanism(s) underlying the misinformation effect. Therefore, a more thorough discussion of the ramifications of these findings will follow.

Mechanism(s) Underlying the Misinformation Effect

It was hypothesized that if misinformation does not impair the original memory, one of two outcomes was possible. The first outcome that would have been supportive of non-impairment theories would have been demonstrated if misled subjects' psychophysiological responses to the original/key detail were similar to responses elicited from the misinformation. Similar reactivity would have implied that two separate memory traces exist (one for the original detail and another for the misinformation) and that some response selection process was responsible for reporting the misinformation on the memory test.

Secondly, the non-impairment hypotheses would have been supported if misled subjects had stronger responses to the original details when compared to the misinformation. Although reporting the misinformation on the memory test, their autonomic reactions would indicate that the original memory trace was

retained. Furthermore, this outcome would have demonstrated that subjects were able to discriminate between the original detail and the misinformation.

Neither of these findings, which would have been supportive of non-impairment hypotheses, were demonstrated in the current study. Responses to the original detail from misled subjects were not larger than or equal to responses to the misinformation. Therefore, the current study found no support for the non-impairment hypotheses.

It was hypothesized that support for the impairment hypotheses would exist if misled subjects' responses to misinformation were greater than their reactivity to original details. Furthermore, it was hypothesized that the strongest support for the impairment hypotheses would occur if subjects' responses to misinformation are (a) stronger than responses to the original detail; and (b) responses to the original detail are not distinguishable from responses to the neutral foils. The results of this study, which demonstrated significantly stronger responses to the misinformation and no differences between responses to the original detail and the neutral foils, show strong support for the impairment hypotheses. However, this support is contingent upon whether misled subjects initially encoded the original detail.

As described earlier, it has been suggested that misinformation effects could merely be the result of subjects who did not attend to the original detail (e.g., McCloskey & Zaragoza, 1985; Zaragoza, McCloskey & Jamis, 1987). If a subject did not attend to the original detail, memory impairment would not occur due to the absence of a memory to impair! Similar to findings summarized by Loftus and Loftus (1980), when no misleading information was provided to the pilot subjects the correct detail was remembered by over 90% of the individuals. This finding suggests that at least some of the misled subjects actually did store the original information, thereby discrediting the suggestion that misinformation effects are due to the absence of the original memory.

Although this study provides strong support for the impairment hypotheses, one other concern must be addressed. Non-detection of the original information does not necessarily imply its non-existence. Perhaps, for whatever reason, the original memory remains but is currently inaccessible. What pattern of results would be expected if this were the case? Although this cannot be tested directly, Bauer's (1984) findings may provide a rationale for a hypothesis. Bauer (1984) found that covert recognition of correct name/face pairings existed despite the inability of his prosopagnosiac subject to overtly recognize the correct pairings. These findings suggest that information that is not retrievable is still detectable through psychophysiological responses. In terms of the current study, if the original

memory did coexist with the misinformation one would have expected to see stronger responses to that information.

The results of this study, taken together with the work of others who investigated similar questions regarding mechanisms responsible for the misinformation effect, provide very strong support for impairment hypotheses. Impairment hypotheses concerning the misinformation effect are also relevant to the discussion of memory's permanence.

The Permanence of Memory, Revisited

Once again, the ultimate issue regarding the permanence of memory has been challenged. Perhaps Schwartz and Reisberg (1991), who felt that no evidence existed which adequately challenged the assumption that memories are permanent, were correct. That is, they may have been correct when stating "...we are willing to believe that some future data may force us to include something like decay in our theorizing." (p. 533). The results of this and future studies utilizing this paradigm may prove to be quite useful to those who question the permanence of memory in the future.

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Appendix A

Consent Form

This is a study of the physiological detection of deception. You will be asked to watch a videotape of a staged burglary, while imagining that you have committed it (hence, you will be "guilty" of the burglary). The videotape is approximately 15 minutes in length. One week after watching the videotape you will be given a polygraph test to determine if you have guilty knowledge of the burglary. During the polygraph test sensors will be placed on your body, but none of them will hurt you in any manner. Sensors will be placed on your fingers, a blood pressure cuff will be placed around your arm, and two tubes will be placed around your ribs (on top of your clothing). Prior to their placement on your body, the sensors will all be shown to you and their use will be explained. The sensors will be used to measure your physiological responses while you are asked questions about what happened during the burglary. No personal or embarrassing questions will be asked at any time.

You can earn $10.00 if you pass the polygraph test. The polygraph examiner will not know whether or not you have seen the videotape, and judgments of truthfulness will be based on an analysis of the physiological responses you give during the polygraph test. Some scientists believe that the lie detector does not work very well, so don't give up just because you are in the Guilty Condition. You can still earn the money if you pass the polygraph test. Subjects who do not pass the polygraph will not receive money.

Following the polygraph test, you will be asked to complete a questionnaire assessing your memory of the crime. You should answer this questionnaire honestly, based on your memory of the videotaped crime. You will be paid 50 cents for every correct answer you provide on the 20-item questionnaire. A total of $10.00 may be earned for a perfect score of 20.

If you agree to participate in this study, all of your responses would be held confidential and treated in a professional manner. Your name would not be associated with any of the data. Data collected during the course of this study will be used by the investigators for research and publication purposes.

You will be given 2-3 hours of extra credit upon completion of the experiment (depending upon the amount of time it takes to complete the study). Also, you can earn up to $20.00 for passing the polygraph and performing well on the memory questionnaire.

You may withdraw from the experiment at any time without negative consequences. Extra credit hours will be given based on the amount of time that you participated prior to your withdrawal

from the experiment. TO EARN ANY MONEY, YOU MUST COMPLETE THE EXPERIMENT! Therefore, early withdrawal will result in a forfeiture of any money earned.

The only known risks for your participation may be an uncomfortable feeling for having to lie to pass the polygraph or an uncomfortable feeling when imagining yourself as having committed the burglary. Please keep in mind your right to withdraw at any time if you should become too uncomfortable. Any questions that you may have can be answered now, or in the future by contacting the researchers.

Please direct any questions you may have to Susan Henderson OR Dr. Joseph Plaud in the psychology department (777-3451).

I have read and understand the above information and agree to participate in this study of the detection of deception. I understand that I may withdraw from the study at any time without penalty, with the exception of forfeiting any money earned. All of my questions have been answered and I am encouraged to ask any questions that I may have concerning this study in the future.

_____ _____

Subject's Signature Date

A copy of this consent form is available upon request.

Thank you for your participation!

Appendix B

Narrative To Refresh Memory Concerning Crime Video

You exit your vehicle, taking your black gym bag. You walk through the yard, pass a birdhouse,. and look into the window. Using a pry bar, you **break into the house**. You see and take the cellular phone from a living room table. You also take the car keys that are lying there. You walk into the kitchen, and **read a note that is on the table**. You see cookies in a can on a counter and help yourself to one. You walk toward the sink and knock over a glass that is sitting on the counter. It falls into the sink. Next, you look in the china cabinet. You open a door and find a flute. You put the flute in your bag. You open the hall closet door, finding a camcorder on the top shelf that you put into your bag. You enter the living room again and head toward the entertainment center. You grab some cassette tapes and put them in your bag. You walk to the stairs and climb to the second story. You enter the master bedroom and look at the jewelry lying in a decorative bowl on the dresser. You grab a piece that you think is nice. You then enter the office and notice **a piece of electronic equipment**. You note that you will return to get it. You go down the stairs, into the kitchen, and notice an exit to the garage. You wonder if the keys you took earlier will fit the car in the garage. You unlock the door to the car. You become excited about the radar detector in the car, and put it into your bag. You look around the garage. You notice a vase on the workbench. You say "that's the ugliest vase I have ever seen", and promptly throw it on the floor. It breaks and you note "Took care of that one". You say you will return inside and see if there's anything else you can grab. You put the bag in the passenger side of the car. Then you return inside the house. You walk through the kitchen, up the stairs, to the office and grab the electronic equipment you had spotted earlier. You look out the window at the top of the stairs and remark that you "better get out of here." You descend the steps, go to the hall closet and take a leather jacket. You walk through the kitchen and return to the garage. While looking through the garage door window, you notice neighbors. you open the rear passenger side door and put the stuff inside the car. You go to the driver's side and enter the car. You say, "With my luck the thing won't start." You start the car. The radio begins playing. You say, "all right, good tunes." Then you remark that the car can probably be sold in Manitoba. You back out of the garage, and speed away down the road in the car.

Appendix C

Instructions For The Polygraph Examination

You are going to be given a polygraph examination concerning a breaking and entering of a duplex in Grand Forks, North Dakota. You will be asked a series of questions about things that happened during the breaking and entering. If you were involved in the burglary, then you will know the correct answers to these questions. If you are innocent you will not know which answer is the correct one.

During the examination the questions will take the form of multiple choice questions. The issue will be stated and then you will be presented with a series of six possible alternatives, with about 20 seconds between the alternatives. When you are asked about those alternatives you will answer "No" to all of them. One of those alternatives will be the correct one. If you were involved in the burglary you will recognize the correct alternative, and when you answer "No" you will be telling a lie. When we tell lies certain physiological changes take place and those changes will be recorded on the polygraph chart. The changes recorded on the polygraph are controlled by the autonomic nervous system, and you don't have direct control over them, but they will change when you tell a lie. If you were not involved in the burglary, then you won't know which of the alternatives is the correct choice. Since you don't know the correct answer none of your "no" answers will be lies, and you will not show a consistent pattern of responding to the correct alternative.

The examiner is now going to place some sensors on your person. They will not hurt or harm you in any way. If any of them become uncomfortable at any time please tell the examiner so that she can adjust them. The sensors are as follows:

- **Two tubes will be placed around your chest.** These sensors tell us how tense you are and measure your breathing.

- **Two sensors will be placed on your fingers.** These sensors measure sweating in the hands.

- **A blood pressure cuff will be placed around your arm.** This will provide a measure of changes in blood pressure.

Again, if any of the sensors ever become uncomfortable, you should tell the examiner. Furthermore, note that these sensors measure things that you cannot control. You can't stop your heart from beating or make you hands sweat, can you? However, these things will change when you tell lies!

After the examiner places the sensor on you, you will be asked the questions over the cassette recorder. **It is very important the you sit as still as possible while the questions are being asked.** The instrumentation is very sensitive and will pick up movement. Movement will not make it look like you are telling the truth or lying. However, if the examiner thinks that you are not cooperating, she will decide that you are probably lying. If you have any questions about the test, or the procedures, please ask the examiner at this time.

Appendix D

Memory Test

According to your memory of the videotaped crime, please circle the letter of the correct response to each question. If you are not certain of the correct response, please give us your best guess. You will receive 50 cents for every question that you get correct.

1. If you are the burglar, you would know what the burglar passed while walking through the yard of the duplex. Did the burglar walk past:

A. a garden
B. a doghouse
C. a dog
D. a birdhouse
E. a birdbath

2. If you are the burglar, you would know what the burglar carried some of the stolen merchandise in. Did the burglar carry the stolen merchandise:

A. in a red backpack
B. in a gray suitcase
C. in a white laundry sack
D. in a blue daypack
E. in a black gym bag
F. in a green duffelbag

3. If you are the burglar, you would know how the burglar entered the duplex. Did the burglar enter the duplex:

A. through the front door
B. through a second floor deck door
C. through a second floor window
D. through a basement window
E. through a sliding glass door
F. through the garage

4. If you are the burglar, you would know what kind of tool was used to force entry. Was the tool:

A. a hammer
B. a pry bar
C. a metal file
D. a screw driver
E. a tire tool
F. a drill

5. If your are the burglar, you would know what was stolen from the duplex. Was one of the items stolen:

A. a CD player
B. a Sony Walkman
C. a cellular phone
D. a short-wave radio
E. a microwave oven
F. a tape deck

6. The family left a note saying why they were out. If you were the burglar you would know what that note said. Did the note say:

A. they had gone to the movies
B. they had gone for a short walk
C. they had gone to the doctor
D. they had gone to the grocery store
E. they had gone to church
F. they had gone to a ball game

7. While there, the burglar ate something. If you are the burglar you would know what was eaten. Did the burglar eat:

A. some ice cream
B. a cookie
C. a ham sandwich
D. a chicken leg
E. some candy
F. a piece of pie

8. The burglar knocked something over while in the duplex. If you are the burglar you would know what was knocked over. Did the burglar knock over:

A. a vase of flowers
B. a pot of soup
C. a glass
D. a lamp
E. a chair
F. a table

9. The burglar stole a musical instrument, was the stolen instrument:

A. a piano
B. a violin
C. a cello
D. a flute
E. a saxophone
F. a trumpet

10. The burglar stole a bottle of liquor. Did the burglar steal:

A. a bottle of whiskey
B. a bottle of scotch
C. a bottle of vodka
D. a bottle of gin
E. a bottle of aqua vit
F. a bottle of ouzo

11. If you are the burglar, you would know what was stolen from the duplex. Was one of the items stolen:

A. a slide projector
B. a silver tray
C. a microscope
D. a crystal vase
E. a camera
F. a camcorder

12. Some musical recordings were stolen from the duplex. Were they on:

A. 45 rpm records
B. LP records
C. reel to reel tapes
D. 8-track tapes
E. CDs
F. cassette tapes

13. How many musical recordings were stolen:

A. 1
B. 2
C. 3
D. 4
E. 5
F. 6

14. A piece of jewelry was stolen. Was it:

A. a necklace
B. a pair of earrings
C. a diamond ring
D. a women's watch
E. a man's watch
F. a wedding ring

15. A piece of electronic equipment was stolen. Was it:

A. a calculator
B. a radar detector
C. a stereo amp
D. a turntable
E. a laptop computer
F. a boom box

16. The burglar broke something while at the duplex. Was the item broken:

A. a glass
B. a lamp
C. a chair
D. a vase
E. a flower pot
F. a mirror

17. Another piece of electronic equipment was stolen. Was the stolen item:

A. a television
B. a VCR
C. a laser disk player
D. a computer
E. a computer monitor
F. a printer

18. An item of clothing was stolen from the duplex. Was the stolen item:

A. a pair of leather pants
B. a fur coat
C. a leather coat
D. a designer dress
E. a pair of shoes
F. a man's suit

19. A vehicle was stolen. Was the stolen vehicle:

A. a minivan
B. a station wagon
C. a four door car
D. a tow door car
E. a sports car
F. a pickup truck

20. The burglar would know the make of the stolen vehicle. Was the stolen vehicle:

A. a Chevy
B. a Ford
C. a Olds
D. a Nissan
E. a Honda
F. a Toyota

Appendix E

Questions Used During Testing

1. If you are the burglar, you would know what the burglar carried some of the stolen merchandise in. Did the burglar carry the stolen merchandise:
   - in a red backpack?
   - in a gray suitcase?
   - in a white laundry sack?
   - in a blue daypack?
   - in a black gym bag? (misinformation)
   - in a green duffelbag? (correct)

2. If you are the burglar, you would know what kind of tool was used to force entry. Was the tool:
   - a hammer
   - a pry bar (misinformation)
   - a metal file
   - a screw driver (correct)
   - a tire tool
   - a drill

3. The family left a note saying why they were out. If you were the burglar, you would know what that note said. Did the note say:
   - they had gone to the movies
   - they had gone for a short walk (correct)
   - they had gone to the doctor
   - they had gone to the grocery store
   - they had gone to a ball game

4. If you are the burglar, you would know how the burglar entered the duplex. Did the burglar enter the duplex:
   - through the front door
   - through a second floor deck door
   - through a second floor window
   - through a basement window
   - through a sliding glass door (correct)
   - through the garage

5. If you are the burglar, you would know what was stolen from the duplex. Was one of the items stolen:
   - a slide projector
   - a silver tray
   - a microscope
   - a crystal vase
   - a camera (correct)
   - a camcorder (misinformation)

6. If you are the burglar, you would know that a piece of electronic equipment was stolen. Was the stolen item:

a television
a VCR
a laser disk player
a computer
a computer monitor (correct)
a printer