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EFFECTS OF MISLEADING QUESTIONS AND HYPNOTIC MEMORY SUGGESTION ON MEMORY REPORTS: A Signal-Detection Analysis

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Abstract: In 2002, the first author and colleagues reported data indicating that both hypnosis and misleading questions decreased the accuracy of memory reports and decreased “don’t know” response rates, that the effects of misleading questions were significantly greater than those of hypnosis, and that the two effects were additive. Using a sample of 194 undergraduate students, the present study replicated the findings that misleading questions reduce accuracy and “don’t know” responding but failed to replicate the negative effect of hypnosis on memory reports. Signal detection analysis indicated that misleading questioning produced decreased sensitivity accompanied by higher response bias, though affecting sensitivity more than producing a criterion shift.

Since its inception, hypnosis has been purported to enhance cognitive abilities such as memory for past events (Ellenberger, 1970). Forensic practitioners in France during the 1920s considered the use of hypnosis to refresh memory for witnessed events, an idea which was not pursued further at the time due to concerns that hypnosis might negatively impact memory (Laurence & Perry, 1988). In the 1960s and 1970s, hypnosis was widely used for investigative purposes in the United States and, largely due to anecdotal accounts, was widely believed to be effective in enhancing witness memory (see Brown, Schefflin, & Hammond, 1998, Chap. 18, for a history and review of the legal status of hypnosis in the United States).

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Due to concerns that hypnotically refreshed testimony was unreliable and might unduly influence juries (for a review, see Scheflin, Brown, Frischolz, & Caploe, 2002), posthypnotic testimony was subjected to a per se exclusion in a substantial minority of the U.S. courts (Scheflin, Speigel, & Speigel, 1999). This rule, which varies in specifics from jurisdiction to jurisdiction, generally states that once a witness has been hypnotized with the intention of memory recovery or enhancement, their testimony is no longer considered valid because accuracy of memory is questionable, and confidence in memory may have become elevated due to the hypnotic procedures. In other words, individuals hypnotized for the purpose of providing recall for past events are deemed no longer capable of providing reliable testimony.

Proponents of the per se exclusion have argued that hypnosis brings too great a level of uncertainty regarding the credibility of hypnotically influenced testimony and therefore should not be introduced into evidence (Ruffra, 1983). Karlin and Orne (1997) argue that testimony influenced by hypnosis “tends to be believable, vivid, and misleading” (p. 172) and therefore should be automatically excluded from admission in virtually all circumstances. A review of such criticisms of the use of hypnosis may be found in Scheflin et al. (2002).

Critics of the per se rule make a number of further observations. First, Scheflin et al. (2002) note that in a significant number of court cases, hypnosis did not lead to any change in recall from prehypnotic levels, thus hypnosis cannot be argued to have harmed memory in such instances. Scheflin (1997) notes that any number of other mind altering procedures (e.g., intoxication, organic brain damage) do not lead to an exclusion of testimony; therefore, competently administered hypnosis should not as well. Scheflin (1994) observes that leading questions, which are known to negatively impact memory, are inadmissible and are subject to cross-examination but do not lead to an exclusion of testimony. Lynn and Kirsch (1996) observe that hypnosis does not appear to result in a greater number of false memories than occur due to nonhypnotic suggestive procedures, bringing into question the assumption of undue risk for hypnosis in the creation of false memories. Finally, there are numerous factors that impact the quality of information that a defendant or witness divulges in the context of legal investigations. For example, interrogative procedures used by investigators are at times characterized by interviewer bias and social pressure (Gudjonsson, 2003). Factors such as confirmatory bias in interviewers and coercive and deceptive interviewing procedures have been associated with providing false confessions, a problem of considerable importance to the legal system (Kassin & Gudjonsson, 2004). Confessions are therefore handled carefully by the courts in determining their admissibility, and it seems a strong statement to assert that hypnosis leads to significantly greater problems and therefore should not be permitted similar review.
Initial studies supported the memory-enhancing qualities of hypnosis (Stager & Lundy, 1985; Timm, 1981). However, these studies were not well controlled, and as more rigorous scrutiny was brought to the issue, it was convincingly demonstrated that hypnosis as typically practiced has no unique memory-enhancing effect beyond that of normal hypermnesia (the ability to recall more information with multiple recall trials). In fact, Erdelyi (1996) observed that when carefully controlled, the hypermnescic effects of hypnosis are no greater than normal nonhypnotic hypermnesia and that hypnotized individuals appeared to remember more material due to increased verbal output. Once response output was controlled, any apparent memory-enhancing benefit of hypnosis was eliminated. A related line of evidence suggests that hypnosis is no more beneficial than motivation to try to remember, indicating that effort and not hypnotic induction produces increases in memory accuracy (Lynn, Lock, Myers, & Payne, 1997).

Other research has demonstrated that hypnotic procedures result in increased error rates and enhanced subjective confidence for all recalled material (for reviews, see Erdelyi, 1994; Kebbell & Wagstaff, 1998; Orne, Whitehouse, Dinges, & Orne, 1988). However, these effects may not be due to the induction of hypnosis. Burgess and Kirsch (1999), for example, manipulated expectations that hypnosis accompanied with a hypermnesia suggestion would improve memory for the recall of line drawings. They found that participants given memory-enhancement expectancy information made more confident errors and retained these erroneous memories after hypnosis; whereas, for participants who were warned that hypnosis can lead to memory distortion, errors in recall were eliminated following hypnosis. These data suggest that it may be expectations about the effectiveness of hypnosis for memory enhancement that drive increased errors in recall.

Scoboria, Mazzoni, Kirsch, and Milling (2002) observed that few studies have attempted to compare hypnotic memory refreshment with other procedures known to distort memory. One study (Spanos, Quigley, & Gwynn, 1991) compared the effects of hypnotic age regression with standard witness-preparation procedures and found that memory distortion was much greater for individuals in the witness-preparation group. Several studies have combined hypnotic induction and/or hypnotic responsiveness with exposure to postevent information or misleading questioning. These studies have yielded mixed results. Compared to people high in hypnotic suggestibility, low suggestible participants yielded to fewer misleading questions in three studies (Linton & Sheehan, 1994; Sheehan, Garnett, & Robertson, 1993; Sheehan & Linton, 1993) but not in a fourth (Register & Kihlstrom, 1988). Greater responsiveness to leading questions while hypnotized was observed in two early studies (Putnam, 1979; Zelig & Beidleman, 1981), but hypnosis did not impact responses to misleading questions.
in three studies, which had stronger experimental designs (Linton & Sheehan; Sheehan et al.; Sheehan & Linton). Interactions between hypnotic suggestibility and the effects of hypnosis on responses to misleading questions have not been reported in any study, a finding that suggests that misinformation effects and hypnotic memory effects are likely driven by differing mechanisms.

Scoboria et al. (2002) compared the memory distorting effects of hypnosis with the effects of misleading questioning. It has been well established that misleading questioning (i.e., asking questions in which an incorrect response is suggested in the question) in interrogative situations is linked with significant increases in errors upon later recall (for recent reviews of this literature, see Gudjonsson, 2003; Loftus, 2003). Responses to misleading questions may be objected to in court, but unlike witnesses who have been hypnotized for the purpose of memory enhancement, witnesses are not precluded from subsequently testifying because they have previously been asked misleading questions. However, Scoboria et al. found that people exposed to misleading questions during hypnosis had the lowest rates in accuracy and in “don’t know” responses, whereas the control group showed the highest accuracy rates and highest rate of “don’t know” responding. Hypnosis alone and misleading questions alone produced intermediate rates of accuracy and of “don’t know” responding. However, misleading questions were significantly more detrimental to memory than hypnosis. The authors interpreted this finding as suggesting that either misleading questioning should also become subject to a per se exclusion from subsequent testimony or that the per se exclusion of testimony may be an excessive measure to protect testimony from errors.

The purpose of the present study was to elucidate the mechanisms by which misleading questions and hypnotic suggestions alter memory reports. Based upon the pattern of responding across groups, Scoboria et al. (2002) proposed that changes associated with hypnosis may have been due to shifts in report criterion, such that hypnotized participants were more willing to report ambiguous material from memory in response to questions. In contrast, changes due to misleading questions may have been due to distortion of the original signal, as the misleading cues in questions might interfere with (replacing or competing with) recall of the original material.

Analyses based upon signal detection theory allow for independent assessment of factors related to memory and factors related to response strategy. The signal-detection measure, \( d' \), can be used to estimate a participant’s ability to discriminate between information present in the stimulus and distracting information (which may include information suggested by misleading questions) independently of bias in responding. Bias is measured with the statistic \( B \) and
provides a measure of a participant’s willingness to adopt an acquiescent (yea-saying) or negative (nay-saying) response set.

The nature of the questions used in Scoboria et al.’s (2002) study made it impossible to conduct a signal-detection analysis that could address these hypotheses. The present investigation was designed to allow the application of signal-detection methods in testing the mechanisms that produce the errors in memory created by hypnosis and misleading questions.

To this aim, a series of forced-choice questions appropriate for signal-detection analysis were designed to administer at the end of the experimental procedures. These questions referred both to the information presented in the narrative and to the questions asked during the experiment, allowing assessment of the role of sensitivity and criterion shifts in the impact of hypnosis and misleading questioning for material subjected and not subjected to questioning during the interview.

In summary, this study was designed to replicate previous findings (Scoboria et al., 2002) and include signal detection methods that would allow for the testing of signal discrimination versus response bias accounts of the effects of both procedures. Our predictions were that misleading questioning would lead to a significant decrease in discrimination of the original narrative, indicating a decrease in the participant’s ability to access original material and/or accurately distinguish original material from the narrative amidst distracting material; an assertion which is consistent with theoretical accounts regarding the effects of misinformation (see Ayers & Reder, 1998, for a review of related accounts of misinformation effects). Based upon observations regarding decreases in response bias observed in hypnotic suggestions targeting perception (Jones & Spanos, 1982; Naish, 1985; Reed, Kirsch, Wickless, Moffitt, & Taren, 1996; Spanos, Burgess, Cross, & MacLeod, 1992) and memory (Dinges, Whitehouse, Orne, & Powell, 1992; Murray, Cross, & Whipple, 1992), hypnosis was predicted to produce a decrease in response bias, thus leading to a more liberal response criterion.

METHOD

Participants

Study participants were 194 undergraduate students in psychology courses at the University of Connecticut (117 female, 77 male; mean age 18.63, age range 17 to 31), who took part through a psychology-department-sponsored participant pool for course credit. Participants signed up to participate in one of 20 group sessions conducted over a 2-week period. The groups of 8 to 12 participants were randomized to experimental conditions, which were counterbalanced for day of week and time of day.
Materials

Participants were provided with a response packet consisting of informed consent, immediate and delayed recall, a distractor task (the IPIP personality inventory, International Personality Item Pool, 2001), Time 1 and Time 2 response sheets, and finally the forced-choice signal-detection questionnaire. We used the same audiotaped narrative employed in Scoboria et al. (2002), played at a volume that was predetermined to be clearly discernable throughout the room in which the experiment was conducted.

Procedures

The procedures were similar to those used in Scoboria et al. (2002), with minor adaptations for group administration. As no relationship was found between hypnotic responsiveness and any of the dependent variables in the original study, participants in the current study were not screened for responsiveness to hypnotic suggestion.

Participants agreed to participate in a group session entitled “Memory for Events” and were informed that they would listen to a story and then answer questions about what they remembered. No details as to the type or number of questions or the number of times they would respond to questions were provided at this point. Participants were not aware that the study involved hypnosis. Participants took part in groups of 8 to 12. Participants arrived at the experimental session and were placed in assigned seats that were positioned so that individuals could not view one another’s work. Participants were asked to provide informed consent. Those who had been randomized to hypnotic conditions were informed that hypnosis was involved and that hypnosis was a safe procedure routinely used in research and treatment; participants in nonhypnotic conditions did not learn that hypnosis was involved until debriefing. All participants then listened to the audiotaped narrative. They provided free recall about the narrative immediately after hearing it and again 40 minutes later. Between recall periods, they completed the distractor task.

Participants were then given instructions on writing responses to questions. They were asked to write a single answer to all questions and were given two examples (to answering two questions); one of the sample answers was “don’t know.” Half of the participants were then hypnotized and given the suggestion for memory enhancement used in Scoboria et al. (2002). Half of the hypnotized and half of the nonhypnotized participants were then asked misleading questions about the narrative, and the remaining participants were asked objective questions (Time 1). Hypnotized participants were then deinducted. Following a 10-minute waiting period, all participants were asked the series of objective questions (Time 2). The content of these Time 1 and Time 2 questions are reported in Scoboria et al. (2002). Finally, participants were
asked to answer a series of forced-choice (true/false) statements about the narrative. These statements are described in the section below.

Throughout the procedures, the experimenters reviewed written responses to determine that they had been completed correctly. The experimenters removed each portion of the response packet after completion throughout the experiment, so that participants could not look back at prior responses.

**Measures**

The Time 1 and Time 2 questions and scoring procedures were the same as those used in Scoboria et al. (2002). The measure of recall was derived from Register and Kihlstrom’s (1988) modification of the Guðjónsson Suggestibility Scale (GSS; Guðjónsson & Clark, 1986). The GSS assesses individual differences in susceptibility to suggestive questioning and the tendency to change answers as a result of social pressure. Two sets of questions were used, one which consisted of 18 misleading and 6 objective questions, and the second which consisted of 24 objective questions. Responses to questions were scored as correct, error, or don’t know (DK), and responses to misleading questions were also scored as yield (acceptance of the misleading cue in the question, which is a subset of errors). Accuracy rates were calculated as the ratio of correct to correct plus error responses. As in Scoboria et al., the focus was upon misleading questioning, and therefore the negative feedback component of the GSS was not employed.

**Signal-detection measure.** Signal-detection procedures typically require participants to state whether stimuli represent “targets” or “noise” (nontarget distractors of any type). Approximately equal numbers of queries for targets and distractors are given, and the ratio of instances in which targets and distractors are endorsed are compared to calculate the $d'$ and $B$ statistics. In the present study, targets consisted of information that was present in the narrative, and distractors consisted of information not present in the narrative (including information embedded in misleading questions). Targets and distractors were queried in forced-alternative (true/false) questions. For example, the narrative mentioned that there were three assailants. A response of “true” to the signal-detection question, “In the story, there were three assailants,” would therefore be categorized as a “hit”—stating that a piece of information was in the story when it actually was; a response of “false” to this question is termed an “incorrect rejection.” In a second example, the narrative does not mention that the woman had children. A response of “true” to the signal detection question, “In the story, it was mentioned that the woman had children,” is categorized as a “false alarm”—stating that a piece of information was in the story when it in fact was not; a response of “false” to this question is termed a “correct rejection.” “Hits” and “correct rejections” represent instances in which
the narrative is correctly recalled (true information is endorsed, and distractors are rejected); “false alarms” and “incorrect rejections” represent instances in which the narrative is incorrectly recalled (distractors are endorsed, and true information is rejected). As ratios of hits and incorrect rejections sum to 1, and ratios of false alarms and correct rejections sum to 1, signal detection statistics could be calculated either combining hits and false alarms or incorrect rejections and correct rejections; the results would be identical. Hits and false alarms are what are typically utilized.

For the present study, four additional sets of statements (true/false) were prepared to test for the effect on memory of hypnosis, misleading questioning, and simple questioning upon \( d' \) and \( B \). Two groups consisted of questions that probed for “hits” (stating information was present in the video when it was) and two which probed for “false alarms” (stating information was present in the video when it was not). Within each of these groups of questions, half of the questions probed for recognition of information that was asked about in the interview questions (via objective or misleading questioning), while the other half probed for information that was not asked about in the interview questions. This is an important distinction, as the act of objectively inquiring (e.g., “Did the robbers have any weapons?”) may alter the ability to accurately recall the original event. Whether this is the case or whether such distortion would equal that of misleading questioning (e.g., “Did the robbers have a knife or a gun?”) remains an open question. Analyses of the effect of asking questions versus not asking questions upon detection and bias in responding are possible using this method. A second question that can be tested is whether the effects of hypnosis and/or misleading question extend to information from the narrative about which individuals were not questioned. Third, probing for unquestioned information also serves as a partial control for changes in detectability and bias that are due to normal memory processes, which are unrelated to the manipulations to which questioned information are subjected. The questioned/not questioned distinction was included in the present study primarily for control purposes; therefore, we made no specific predictions regarding the outcome of analyses.

Statements in Set 1 referred to information that was present in the narrative (correct information) and about which participants had already been questioned (in narrative and questioned). An example of this type of statement is “In the story, the attack took place in the morning. True/False,” where the story mentions the attack taking place in the morning. In the misleading-question condition, participants had been asked whether the attack took place in the afternoon or evening. In the neutral-questions condition, they had been asked, “At what time of day did the attack take place?”
Statements in Set 2 referred to information that was not in the original narrative (misleading information) and was questioned (not in narrative and questioned). An example of this type of statement is, “The story said that the woman had children. True/False”; where the story does not mention the woman having or not having children, the misleading question had been, “Did the woman have one or two children?” and the neutral question had been, “Did the woman have any children?” Statements in Sets 1 and 2 were utilized to calculate detectability and bias scores for information that had been subjected to questioning during the interview.

Statements in Set 3 referred to information that was in the narrative but for which no previous question was asked (in narrative and not questioned). An example is: “In the story, the woman’s purse was found six days after the incident,” which actually was in the story and is therefore a true statement. Set 4 statements referred to information that was not in the narrative and was not questioned (not in narrative and not questioned) and are therefore false. For example, “In the story the age of the woman was mentioned.” Sets 3 and 4 were combined to calculate detectibility and bias scores for information that had not been subjected to questioning during the interview.

Response rates to all of the forced-choice questions were analyzed, and any question that was answered correctly or incorrectly by 95% or more of the sample was eliminated from analysis, as they represent questions that were either too easy or too difficult for inclusion in analyses due to instability related to ceiling or floor effects. Three of the 51 questions were eliminated due to high rates of correctly rejecting distracting information, all from the true distractor group (not questioned, not in the narrative), bringing total number of questions to 48, 10 in narrative/questioned, 14 in not in narrative/questioned, 12 in narrative/not questioned, and 12 in not in narrative/not questioned. The full set of forced-choice statements is presented in Appendix A.

Answers to the forced-choice questions were summed and transformed into hit and false alarm ratios for each participant. In the case of proportions of 0 (100% false responses) and 1 (100% true responses), values of $1/2n$ and $1–1/2n$ ($n$ being the total number of questions in the condition) were substituted respectively (per recommendations made by Wickens, 2001). This was necessary, as the formulae cannot accommodate cases of 100% perfect or 100% erroneous responding due to the resulting division by zero. These ratios were utilized to calculate discriminability ($d'$) and bias ($B$) estimates for information subject to questioning and information not subject to questioning, using the nonparametric formulae discussed by Repp, Frost, and Zsiga (1992). The indices were calculated for each participant and were then subjected to parametric analyses.
RESULTS

Immediate Effects

Means and standard deviations for treatment groups at Time 1 and Time 2 are presented in Table 1. Main effects for misleading questions were found for correct responses, $F(1, 190) = 6.91, p < .01$, error responses, $F(1, 190) = 35.04, p < .01$, and accuracy rates, $F(1, 190) = 34.44, p < .01$; no significant effect of hypnosis or significant interaction was found for any of these dependent variables. Group means indicated that misled participants made fewer correct responses ($d = .38$), a greater number of errors ($d = .86$) and had lower accuracy rates ($d = .86$) than did nonmisled participants. No significant differences in DK response rates were found. The number of instances in which misleading cues were yielded to in the two misled groups was compared using an independent samples $t$ test, and no significant difference in the rates of responding was observed. Thus, hypnosis did not significantly affect the tendency to yield to misleading questions.

Delayed Effects

Main effects of misleading questioning were found for DK response rates, $F(1, 190) = 8.22, p < .01$, errors, $F(1, 190) = 19.40, p < .01$, and accuracy rates, $F(1, 190) = 13.78, p < .01$. No significant effects of hypnosis or significant interactions were found. Misled participants made fewer DK responses ($d = -.41$), more errors ($d = .64$), and had lower accuracy rates ($d = -.55$) than did nonmisled participants. No differences in correct responding were found.

Table 1
Mean Rates of Correct, DK, Error and Accuracy at Times 1 and 2

<table>
<thead>
<tr>
<th></th>
<th>Treatment Group</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Combined Misleading</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Correct</td>
<td>12.91</td>
<td>2.99</td>
<td>12.64</td>
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<td>2.21</td>
<td>6.94</td>
<td>3.23</td>
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<td>Accuracy</td>
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<td>0.13</td>
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<td>Accuracy</td>
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<td>0.82</td>
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<td>0.83</td>
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Note: Accuracy rates were calculated as the ratio of correct to correct plus error responses.
Signal-Detection Analyses

Means and standard deviations for the signal-detection analyses are presented in Table 2. Detectability and bias measures were analyzed utilizing $2 \times 2 \times 2$ mixed ANOVAs (mislead and hypnosis between subjects; question status, questioned/not questioned, within subjects).

Detectability. A main effect of misleading questions was observed, $F(1, 190) = 4.51, p < .05$, which was qualified by the misleading by question interaction, $F(1, 190) = 10.95, p < .01$. The main effect of hypnosis and remaining interactions did not approach significance. Examination of the interaction with simple comparisons (following methods for randomized mixed ANOVA designs recommended by Keppel, 1991) demonstrated that participants in misleading question groups had significantly lower $d'$ scores, $F(1, 97) = 64.48, p < .01$, for questioned material (.80, $SD = 0.77$) than they did for un questioned material and lower $d'$ scores than the nonmisled groups for questioned material, $F(1, 192) = 20.05, p < .01$, and unquestioned, $F(1, 97) = 33.98, p < .01$.

Bias. A main effect of misleading questions was observed, $F(1, 190) = 9.81, p < .01$, which was qualified by the misleading by questioning interaction, $F(1, 190) = 26.94, p < .01$. The main effect of hypnosis and remaining interactions did not approach significance. Examination of the interaction with simple comparisons (Keppel, 1991) demonstrated that participants in misleading question groups had significantly more conservative (higher) $B$ scores, $F(1, 97) = 18.03, p < .01$, for questioned material than they did for un questioned material, and than the nonmisled groups for questioned, $F(1, 192) = 10.55, p < .01$, and unquestioned material, $F(1, 97) = 10.80, p < .01$. Misled participants were therefore less likely to endorse a statement as having happened in the story, regardless of whether it had actually been in the story or not.

Table 2
Average Detectability ($d'$) and Bias ($B$) Statistics by Treatment Group and Question Material Status (Questioned during Procedures / Not Questioned during Procedures)

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Combined</th>
<th>Misleading</th>
<th>Hypnosis</th>
<th>Control</th>
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<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
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<tr>
<td>$d'$ Questioned</td>
<td>.80</td>
<td>.68</td>
<td>.80</td>
<td>.86</td>
</tr>
<tr>
<td>Not questioned</td>
<td>1.41</td>
<td>.53</td>
<td>1.40</td>
<td>.61</td>
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<tr>
<td>$B$ Questioned</td>
<td>.20</td>
<td>.77</td>
<td>-.02</td>
<td>.85</td>
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<tr>
<td>Not questioned</td>
<td>-.26</td>
<td>.62</td>
<td>-.29</td>
<td>.64</td>
</tr>
</tbody>
</table>
DISCUSSION

The findings of Scoboria et al. (2002) regarding misleading questions were largely upheld in the present study, although with some variations. Replicating the original study were immediate and delayed effects of misleading questioning, such that misled participants demonstrated higher error and lower accuracy rates. Misled participants also made fewer DK responses at delayed questioning. Absent in the present study were immediate changes in DK responding that were found in the Scoboria et al. (2002) study. The immediate decrease in correct responding for mislead groups in the present study was not found in the original study, but this effect was also of small to moderate size.

Significant effects of hypnosis upon any of the dependent variables were absent in the present study. This is a marked departure from the original study, which found immediate and delayed effects of hypnosis upon errors and accuracy rates, immediate effects of hypnosis upon DK responding, and that the effects of misleading questioning and hypnosis were additive. It is possible that the effects of hypnosis are statistically weak and therefore did not emerge in the present study. Alternatively, the differences in outcome may have been due to differences in procedure.

One possible contributing factor is that in the original study all DK responses were unsolicited; however, in the present study an example response was provided that included “I don’t know” as a response. This may have made participants more aware that DK was an acceptable response. DK response rates were much higher in experimental groups in the present study, and this was especially true among participants in the hypnosis groups (see Figure 1). This is important particularly if the effects of hypnosis upon memory are driven by enhancing confidence in recalled material; perhaps hypnotized individuals are therefore less likely to select DK as a response, unless it is provided as a response option. Other differences from the original study include the writing of answers (as opposed to transcribed verbal responses), which may have impacted the encoding of responses, leading to higher overall accuracy. It is also important to note that hypnosis for forensic purposes is not typically administered in groups, marking one point of departure that this study has from real-world practice. Further, individual differences in hypnotizability were not assessed in the present study, as they were not found to be related to outcomes in Scoboria et al. (2002), but may still have been related to outcome in the present work.

Whatever the source of the difference in findings involving hypnosis, the current data is consistent with our previous finding that misleading questioning had a greater impact than hypnosis on memory in
both investigations. This provides further empirical evidence that in the absence of a *per se* exclusion of testimony from witnesses who have been asked leading questions, a *per se* exclusion of posthypnotic testimony is not supported by the empirical data. However, consistent with our prior research as well as that of others, improvements in the amount and accuracy of information recalled as a result of hypnosis were not observed, whereas those data indicate that hypnotic suggestions for memory enhancement can decrease the accuracy of memory reports (for reviews, see Erdelyi, 1994; Kebbell & Wagstaff, 1998; Orne, Whitehouse, Dinges, & Orne, 1988). Thus, consistent with the results of prior research, no support was found for the use of hypnosis as an effective memory-enhancement technique.

Our hypotheses regarding underlying mechanisms were partially upheld in the present study. We predicted that misleading questioning would lead to a decrease in the detectability of the material subjected to misleading questioning, whereas hypnosis would lead to a more liberal response overall. Misleading questioning did lead to the predicted decrease in detectability for questioned but not for unquestioned material from the narrative, but interestingly was accompanied by a more conservative response bias. The conservative response bias may be due to the presence of conflicting information in memory. The presence of both pieces of information may lower certainty about either, thereby decreasing the likelihood of affirming that they were true. Another

![Figure 1. Comparison of Don’t Know (DK) responding at delayed questioning, in Scoboria et al. (2002) and the present study.](image-url)
possible explanation is that individuals in misled groups may have been aware that their memory was negatively impacted or that they were otherwise at risk of making errors of commission and therefore adopted less of a “yea-saying” approach to avoid inaccurate statements. This does not appear to have been protective, however, as discrimination was considerably lower in these groups.

It is interesting to consider that misled participants demonstrated these changes in discrimination and response bias only for information for which they had received misleading questioning. The same participants performed as well as other treatment groups when responding regarding material from the narrative that had not been subject to questioning. This indicates these participants were able to produce equally effective recall of material that had not been subjected to misleading questioning. This suggests that the effects of misleading questions upon recall are specific to material subjected to misleading questioning. Participants appeared to have rejected new information about the story if it had not presented in a misleading form previously. It is as if two sources of information for different portions of the same event exist within the same individual; one source distorted through misleading questioning, whereas another source, not having been subjected to questioning, remains comparatively intact. This is potentially important, as it suggests that knowledge of what someone has been mislead regarding in the past may aid in determining what information from their subsequent report remains reliable.

One caveat to these findings is that all groups were questioned; therefore, the objective questions asked in the nonmisled groups may have served to aid participants in rehearsing accurate information. A true comparison of the effects of misleading questions upon detectibility and response bias requires an “unquestioned” control group, which provides responses to the signal-detection questions without intervening questioning.

The absence of any hypnosis effects in the signal-detection analyses is not particularly surprising, considering the lack of hypnotic effects in the preceding portions of the study. The effects of hypnosis upon recall obtained in the Scoboria et al. (2002) study might have been in part due to the dyadic interaction used in that experiment, in which implicit social pressures may be more likely to develop due to the matching between one interviewer and one interviewee. The effects of the hypnotic interview may have been further reduced, in that participants in the present study wrote their responses, further reducing the effects of cues provided by interviewers and perhaps leading to firmer traces in memory for prior responses as compared with providing verbal responses.

Future studies should expand the use of methods of discriminating the effects of memory-distorting procedures. A more rigorous application of signal-detection procedures would involve the development of question sets and by counterbalancing what information from a stimulus
is subjected to misleading questioning, objective questioning, and no questioning at all. This would better control for differences in item difficulty. Future studies might also choose to use more elaborate stimuli, such as videotaped or witnessed scenes and include emotionally and/or autobiographically relevant material more analogous to traumatic experience to increase the ecological validity of the design.

It is also interesting to note that participants who were asked misleading questions were less likely to respond with some form of “I don’t know” at Time 2 questioning, which replicates our initial study. DK responding is an understudied response in the context of interviews, however, it is a naturalistic manner by which individuals respond to questions. It would therefore be worthwhile to explore further the processes involved in judgments leading to stating DK and the mechanisms by which misleading questioning change the likelihood of such responses. Furthermore, the relationship between hypnotic interviewing, confidence, and DK responding is another potentially fruitful area of investigation.

Regarding the forensic use of hypnosis, these data suggest that either a per se exclusion of postmisinformation testimony is warranted or that another rule be used to evaluate the admissibility of posthypnotic testimony. We note that there are many manners in which testimony might be affected by pretrial procedures, which include the use of misleading questioning and coercive interviewing to name but two. To single out any procedure as so pernicious that it is barred from subsequent admission is an extreme position and would seem best applied to procedures for which data conclusively indicate that irreparable harm to the ability to provide reliable testimony results. In the case of hypnosis, this present research indicates that the risks are not as strong as originally thought, however neither is there evidence to support the use of forensic hypnosis.

In summary, this study provides further evidence that the effects of misleading questioning are more pernicious than those of hypnosis when used for refreshing memory. These results provide support for the notion that it is important to examine the relative effects of memory-distorting procedures prior to advocating such measures as a per se exclusion from further testimony. On the other hand, these data do not provide any support for the use of hypnosis as a memory-enhancing procedure. Although hypnotic suggestion did not increase memory distortion, neither did it result in memory enhancement.

REFERENCES


**APPENDIX A**

**Signal Detection Questions**

All questions began with “In the story,” and were anchored, True / False.

Set 1: In Story, Questioned
- the woman’s name was Sarah Marlett
- the police helped the woman following the interview
- the police found one of the woman’s possessions
- the attack too place in the morning
- the police took the woman to the nearest police station
the woman kicked one of the assailants
it was indicated that one of assailants was Asian
the officer suggested that the woman contact the American Embassy
the woman fought off the assailants
three men were charged with the crime

Set 2: Not in Story, Questioned
the woman’s screams frightened the assailants
the assailant’s were arrested 6 weeks after the incident
at least one of the assailants was either black or white
the assailants directed verbal communication at the woman
the assailant’s clothing was described
the woman’s purse was damaged during the struggle
the height of the assailants was mentioned
the condition of the woman’s clothing following the attack
the assailants had at least one weapon
the woman wore glasses
the police gave woman a ride back to hotel
the woman had children
the woman’s husband was present at police interview
the color of woman’s purse was mentioned

Set 3: In Story, Not Questioned
the woman’s purse was found six days after the incident
a police car arrived at the scene of the incident
two of the assailants were convicted and received prison sentences
the woman’s travelers checks were taken
the woman returned home with two friends
the interviewing officer was sympathetic
the assailants were slim
the woman remained frightened of being out alone
one of the assailants had a prior criminal record for similar offenses
the approximate ages of assailants was mentioned
the woman’s passport was taken
the woman was held up outside her hotel

Set 4: Not in Story, Not Questioned
the woman had traveled to the same location in the past
the assailants got away in a car
it was indicated how long the woman had to wait before being interviewed
the age of the woman was mentioned
the number of police officers who arrived at the scene of the incident
the woman’s wrist was bruised during the incident
there were witnesses to the assault
it was indicated where woman’s husband was when she was assaulted
the woman’s husband was on vacation with her
one of the assailants did not speak English
the woman returned home on a plane
the woman was on her way to do some shopping when held up

Die Auswirkungen irreführender Fragen und hypnotischer
Erinnerungssuggestion auf Gedächtnisleistungen: Eine
Signalentdeckungs-Analyse

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Les effets de questions induisant en erreur et de la suggestion hypnotique de souvenirs sur le souvenir rapporté: Une analyse de la détection du signal

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Résumé: En 2002, le premier des auteurs et des collègues ont communiqué des données indiquant que l’hypnose aussi bien que les questions induisant en erreur diminuaient l’exactitude de souvenirs rapportés et diminuaient la part des réponses «je ne sais pas», que les effets de questions induisant en erreur étaient plus importants, de manière significative, que ceux de l’hypnose, et que les deux effets s’additionnaient. En utilisant un échantillon de 164 étudiants de premier cycle, la présente étude réplice les résultats quant à la réduction de l’exactitude et des réponses «je ne sais pas», mais échoue à répliquer l’effet négatif de l’hypnose sur les souvenirs rapportés. L’analyse de la détection du signal indiquait que des questions induisant en erreur produisaient une diminution de la sensibilité, accompagnée d’un biais de réponse plus élevé, affectant toutefois la sensibilité plutôt que de créer un changement de critère.

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Los efectos de las preguntas capciosas y sugestiones hipnóticas de memoria en informes de memoria: Un análisis de detección de señal

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Resumen: En el 2002, el primer autor y sus colegas presentaron datos que indicaban que tanto la hipnosis como las preguntas capciosas disminuyen la precisión de los informes de memoria y disminuyen las respuestas “no sé,” que los efectos de las preguntas capciosas eran apreciablemente mayores que los de la hipnosis, y que los dos efectos eran aditivos. Utilizando una muestra de 164 estudiantes de licenciatura, este estudio replicó las conclusiones de que las preguntas engañosas reducen la precisión y las respuestas “no sé,” pero no replicó el efecto negativo de la hipnosis en las respuestas. El análisis de detección de señal indicó que las preguntas capciosas disminuyen la sensibilidad y aumentan las respuestas tendenciosas, con un mayor efecto en la sensibilidad que en los cambios de criterios de evaluación.

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