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Misleading Suggestions Can Alter Later Memory Reports Even Following a Cognitive Interview

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Abstract
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Keywords
Cognitive Interview, investigative interviewing, misinformation effect, eyewitness memory, retrieval-enhanced suggestibility

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Comments
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Abstract (142 words)

Taking an immediate recall test prior to misinformation exposure can increase eyewitness suggestibility—a finding termed retrieval-enhanced suggestibility (RES). Here we examined whether RES would occur when participants were administered an immediate Cognitive Interview (CI). The CI is an investigative interviewing technique that consistently elicits more correct details in memory reports than other standard interviews. In this study, participants watched a video of a crime and then completed a distractor task (control condition), a free recall test, or the CI. They then heard misinformation presented in a narrative. Participants produced more accurate memory details in the CI than in free recall despite spending equal time on both tasks. However, the CI also increased the later report of misinformation relative to the control condition. These results show that initial retrieval can increase subsequent suggestibility even when such retrieval occurs under relatively ideal conditions.

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Misleading Suggestions Can Alter Later Memory Reports Even Following a Cognitive Interview

In 1999, the National Institute of Justice formed a technical working group of researchers, law enforcement officials, and legal practitioners to create a guide to collect and preserve eyewitness evidence (Technical Working Group for Eyewitness Evidence, 1999). This guide describes a best practice procedure for interviewing witnesses that is similar to the Cognitive Interview (CI). Much research has demonstrated the efficacy of the CI at eliciting accurate memory reports from witnesses relative to many alternative interviewing techniques (Memon, Meissner, & Fraser, 2010). However, its effect on other aspects of eyewitness memory is less clear.

Little research has addressed situations in which a witness encounters misleading information after they have completed a CI. This is an important question because the extensive literature on the misinformation effect shows that witnesses who have been exposed to misinformation may recall these misleading details during later testimony (for a review, see Loftus, 2005). Because many eyewitnesses are interviewed soon after the occurrence of a crime (e.g., talking to a 9-1-1 operator) but do not provide their final testimony until much later (e.g., at a police station, in a courtroom), they are prone to be exposed to misinformation. Past research has indicated that taking an initial memory test can enhance one's retention of the learned material (i.e., the testing effect; Roediger & Karpicke, 2006). Surprisingly, taking an initial recall test can sometimes exacerbate witnesses' susceptibility to subsequently presented misinformation (Chan, Thomas, & Bulevich, 2009). In the current study, we examined the effect of completing an early CI on later eyewitness suggestibility.

Retrieval-Enhanced Suggestibility

Chan et al. (2009) investigated the effects of recalling details of an event on eyewitness suggestibility. They postulated that initial testing would enhance memory for the original event (i.e., a testing effect), thereby reducing people's susceptibility to subsequently presented misinformation. In a series of experiments, participants watched an episode of the Fox television program *24*. Half the participants were then given an immediate cued recall test, and the other participants completed an unrelated distractor activity. Following a short delay, participants listened to an audio narrative that contained some misinformation about the video and then took a final cued recall test. Surprisingly, instead of reducing suggestibility, Chan et al. found that testing made participants recall *more* misinformation. They termed this finding retrieval-enhanced suggestibility (RES).

Since its discovery, the RES effect has been shown with various delays (Chan & Langley, 2011; Chan & LaPaglia, 2011), repeated initial tests (Chan & LaPaglia, 2011), and various final test formats (Chan & LaPaglia, 2013; Chan, Wilford, & Hughes, 2012; Wilford, Chan, & Tuhn, 2013). A critical question is how to counteract this RES effect. Thomas, Bulevich, and Chan (2010) found that the detrimental RES effect can be minimized if participants are warned specifically about possible inaccuracies in the misinformation narrative just before the final test. However, providing such specific warnings (so that participants can selectively discount one source of information) is nearly impossible in actual criminal investigations because investigators are unaware of what, if any, misinformation to which witnesses have been exposed. Consequently, continued research into potentially applicable methods of reducing RES is imperative. In the present experiment, we examined whether the Cognitive Interview, a strongly

supported method for eliciting accurate and detailed memory descriptions from witnesses, can reduce the RES effect.

The Cognitive Interview

Fisher and Geiselman (1992) devised the CI as a method of interviewing cooperative adult witnesses. The CI draws from principles of cognitive and social psychology to facilitate communication and maximize eyewitness recall. Relative to other investigative interviews, the defining characteristics of the CI are: 1) establishing rapport with the witness, 2) minimizing interruptions and distractions caused by the interviewer, and 3) encouraging the witness to freely report all details without guessing. In addition, the original CI engages the witness in repeated and varied retrieval by reinstating the context of the event and recalling the event in a different way (e.g. drawing a sketch).

The efficacy of the CI in eliciting accurate memory reports is well documented (Memon et al., 2010a). The CI has been shown to reliably enhance witness recollection of relevant crime details without sacrificing accuracy relative to other methods of recall, including the standard police interview (e.g., Fisher, Geiselman, & Amador, 1989), structured interview (e.g., Akehurst, Milne, & Kohnken, 2003), and free recall (e.g., Gabbert, Hope, & Fisher, 2009) These studies represent both controlled laboratory experiments and field studies with victims and witnesses of real-world crimes (e.g., Fisher et al., 1989). In short, the CI can increase recall of accurate details and can, under some circumstances, reduce false recall. For instance, Geiselman, Fisher, Cohen, Holland, and Surtes (1986) found that the original CI can reduce the effects of later misinformation presented via misleading questions. Likewise, Gabbert, Hope, Fisher, and Jamieson (2013) reported that a Self-Administered Interview (a written interview protocol similar to the CI) soon after viewing a witnessed event can help people counter later presented

misinformation. Holliday (2003) and Roos af Hjelmsäter, Strömwall, and Granhag (2012), on the other hand, found that children's reports of misinformation were unaffected by an initial CI and SAI, respectively. Given these conflicting findings, it remains unclear whether a CI could protect memory from later misinformation.

The Current Study

In the present experiment, participants watched a video of a burglary and were then administered a CI, a free recall test, or an unrelated verbal distractor task (control condition). The amount of time spent on these three activities was equated across participants. This is an especially important aspect of the present study because time-on-task has not been controlled in many previous CI studies (e.g., Akehurst et al., 2003; Granhag, Jonsson, & Allwood, 2004; Memon, Wark, Holley, Bull, & Köhnken, 1997; Stein & Memon, 2006; to name a few). The difference in time-on-task makes it difficult to separate benefits of the CI from the general benefits of extra recall time. By equating time across conditions, we can more easily conclude that any memorial benefits that emerge are primarily driven by the recall activity rather than extra recall time. The free recall test was typed whereas the CI was spoken recall (by necessity). We opted for this difference in response modality for multiple reasons. First, we wanted to keep the procedures in the free recall condition as similar to previous research as possible (i.e., a typed recall test; Chan et al., 2009; Wilford et al., 2013) such that we can better compare our results with existing findings in the literature. Second, we opted to use a type-written test for free recall because it would be extremely difficult to ensure that participants would use the entire 30 min allotted to them in spoken free recall (because the CI took, on average, 30 min to complete). We suspect that in a spoken free recall task, participants would stop recalling the witnessed event once they felt that they had exerted enough effort, which would likely leave much of the 30 min

task "empty." From a logistical standpoint, it would be unrealistic, and perhaps very awkward, to conduct a spoken free recall test that lasted 30 min. Lastly, the primary comparison of interest was between the CI and the no-test control condition. Following the initial recall or control phase, participants listened to an audio narrative that included misinformation. They then took a final cued recall test over the witnessed event.

We hypothesized that participants who engaged in a CI would recall the misinformation at a higher rate than those in the control condition (i.e., those who received a CI would exhibit an RES effect). Chan and LaPaglia (2011) found that taking multiple early memory tests exacerbates the RES effect. Specifically, participants who recalled details from the witnessed event five times were more suggestible than participants who recalled those details only once prior to misinformation exposure (who in turn were more suggestible than participants who took no initial recall test). The CI involves numerous recall attempts (albeit in different formats), which might also exacerbate the RES effect. Furthermore, RES has been found when participants complete the initial test in a free recall format (Wilford et al., 2013), which is similar to the initial phase of the CI sans the (potentially important) social elements (e.g., rapport, social dynamic, etc.).

A competing, and equally intriguing, hypothesis is that completing an initial CI (but not free recall) may reduce false recall relative to the no-test control condition. The CI uses many techniques that improve recall performance—most of which have not been examined in previous RES research. It is possible that rapport building, stating the investigative needs, and context reinstatement work to produce stronger event memories that are more resistant to misinformation. In particular, establishing rapport with a witness may be essential to reducing suggestibility (Carter, Bottoms, & Levine, 1996; Kieckhaefer, Vallano, & Compo, 2013; Vallano

& Compo, 2011). Research has shown that the magnitude of the misinformation effect is highly sensitive to the perceived authority or credibility of the agent providing the misinformation (e.g., Ceci, Ross, & Toglia, 1987; Echterhoff, Hirst, & Hussy, 2005; Henkel & Mattson, 2011; Hoffman, Granhag, Kwong, & Loftus, 2001; Scoboria, Wysman, & Otgaar, 2012; Underwood & Pezdek, 1998), and building rapport may help participants reject misinformation by reducing the perceived authority of the experimenter (as the purpose of rapport building is to transfer control from the interviewer to the interviewee). Thus, it remains possible that the constellation of CI techniques (i.e., context reinstatement, rapport building, etc.), presented as a whole, will work to inoculate participants against RES. Note that our purpose was not to examine whether individual elements of the CI were effective at reducing eyewitness suggestibility (aside from that such an aim would be beyond the scope of any single study). Rather, we wanted to examine whether the CI, with all of its memory enhancing techniques in place, can reduce people's susceptibility to later misinformation. Indeed, the CI was designed to be used as a holistic method and the individual elements were meant to complement each other to produce better recall performance from eyewitnesses.

Method

Participants and Design

This experiment was conducted at two sites – a university in the Midwest and a university in the Southeast. A total of 102 undergraduate students (47 female) participated in this study for course research credit, with 72 students from the Midwestern university and the remaining 30 from the Southeastern university. The participants had a mean age of 20.5 (*SD* = 5.0). Among the participants, 66 were non-Hispanic Caucasian, 22 were Hispanic, and the remaining were African American, Asian, or unspecified.

The experiment used a 3 (Test Condition: control, free recall, Cognitive Interview) X 2 (Postevent Item Type: misinformation, neutral) mixed design. Test condition was manipulated between subjects and postevent item type was manipulated within subjects. Thirty-four participants were included in each test condition—24 from the Midwestern university and 10 from the Southeastern university.

Materials and Procedure

CI Training. Six female experimenters were trained for a minimum of ten hours on the administration of the CI. Training included at least four practice CIs, reading the CI manual (Fisher & Geiselman, 1992), and watching and critiquing four sample CIs (both good and bad).

Critical event video. Participants were tested in groups of up to seven in the control and free recall conditions, and individually (as a necessity) in the CI condition. They began by watching the critical event video on individual computers. The video was a 9-min excerpt from the movie *Return of the Pink Panther*, which depicted a robber breaking into a museum and stealing a diamond. All participants were told that their memory would be tested later.

Initial recall. Immediately following the video, participants were randomly assigned to one of the three test conditions. Participants in the control condition engaged in a distractor activity, which involved typing out a description of a childhood story (e.g., Sleeping Beauty). Participants in the free recall condition were provided instructions to type out a detailed summary of the robbery video. Participants in both the control and free recall conditions typed out their description into a blank Microsoft Word document. Prior to recall, participants in the control and free recall conditions read a sample story demonstrating the level of detail desired in their description. This story served instructional purposes only and was not related to the witnessed event. These instructions explained the nature of the task and requested that

participants recall as much detail as possible including the actions, scenery, decorations, and props. During recall, participants were asked to insert a line on the page at every 5 min interval, which enabled us to examine whether information was recalled during each 5 min period. All participants wrote something following each line, which indicated that they did indeed spend the entire 30 min completing their descriptions. Participants took an average of 30.51 min (*SD* = 7.92) to complete the CI. Therefore, time spent on the free recall and CI tasks were equated.

CIs were audio recorded for later data coding purposes. The experimenter began by establishing rapport with the participant. Once rapport had been established, participants were asked to provide an open-ended description of the details they could recall from the video event. This open-ended recall was uninterrupted by the experimenter. Participants were told to "report everything" and be as detailed as possible. The experimenter made it clear that the participant was to do most of the talking and not wait for questions to be asked by the experimenter. Participants were also asked to not report anything inaccurate and were reminded that they would not be expected to report details for which they were unsure.

Following the open-ended recall portion of the CI, the experimenters asked participants to close their eyes and recreate the context of several components (or idea packets) of their narratives (e.g., when the robber breaks into the museum, when the robber steals the diamond, when the robber escapes the guards). Next, participants were asked to draw a sketch of the robber stealing the diamond. This task allowed participants to further visualize the event and sketch out any difficult-to-describe information not provided during the previous recall attempts. Participants were encouraged to provide a narrative that described their drawing. The sketch was used to elicit more details from participants who spent less than 25 min on the free recall and questioning phase. Although sketches have recently become a more regular addition to the CI

protocol, most CI research has omitted this procedure (Gabbert et al., 2009; Holliday et al., 2012; Stein & Memon, 2006; to name a few). The sketch was skipped for five participants who took more than 25 min on the first two recall phases.[1] We opted to truncate the CI for these participants in favor of equating time-on-task between the no-test, free recall, and CI conditions. Further, participants who were not asked to complete a sketch had already provided extremely detailed narratives and did not require any additional recall tools. After all the components of the studied event had been exhausted, the experimenter reviewed a summary of the information gathered with the participant. Participants were encouraged to interrupt during this time with any additional information or corrections.

Post-event information. Following the initial recall/control phase, participants watched a distractor video (22 min clip of the show *Spooks*, which depicted a fictional case involving the British intelligence agency). They then listened to an audio narrative via headphones (~6 min) and were told that the narrative recapped the events of the video, but there was no mention of its accuracy. There were two versions of the narrative that were counterbalanced across participants. The narratives differed in their mentioning of 12 critical details—six misinformation and six neutral items. The misinformation items presented details in the video inaccurately whereas the neutral items were omitted from the narrative. For example, one critical detail dealt with the number of guards shooting at the burglar (correct answer: three). In one version of the narrative, participants heard that there were *four* guards (a misinformation item). In the other version of the narrative, the number of guards was not specified (a neutral item).

[1] Including or omitting these five participants made no difference in the patterns observed in the final test.

Final memory test. After the narrative, participants completed a working memory task (Reading Span; Unsworth, Heitz, Schrock, & Engle, 2005) and played a videogame for a combined 25 min. Following this retention interval, participants took a final cued recall memory test. Twelve questions were asked in this test (e.g., "At the end of the video, how many guards shot at the burglar as he was trying to escape?"), with each addressing a critical detail (i.e., six neutral and six misinformation; see Appendix). Instructions requested that participants respond based on their memory of the critical event video and did not mention the audio narrative. No feedback was provided during the test and participants were not required to answer each question. Following each question, participants were asked to rate their confidence in their response from 1 (I guessed) to 5 (I am very sure). All participants then completed a brief demographic questionnaire and were asked whether they had seen any of the videos from the experiment before. One participant was replaced because he/she claimed to have seen the critical event video within the last two years. No other participants claimed to have seen either the critical event or the distractor videos used in the experiment.

Results

Five experimenters transcribed the CIs for coding purposes (only one had been involved in data collection). Two experimenters identified as many recallable details from the video as possible. This resulted in a total of 484 details. Each detail from the free recall and CI transcriptions was coded as either correct, matching the misinformation provided later (i.e., spontaneous misinformation generation), or as an incorrect response that did not match the misinformation (i.e., an *other* response). The free recall tests and CIs were coded by the same five individuals. One coder was also an administrator of the CIs, and this coder did not code any CIs that she had administered. Each coder scored four of the same randomly chosen CIs and free

recall tests. There was substantial agreement among raters (free-marginal kappa = .90, percentage of overall agreement = 93%; Randolph, 2008). All final cued recall tests were coded by a single experimenter. Each response was coded as either: *correct*, *misinformation*, *no recall* ("I don't know" or blank responses), or *other* responses. Data acquired at the universities produced similar results; including location as a variable did not change any of the effects reported here. Thus, we collapsed the data across the two sites and this variable will not be discussed further. Partial eta squared (η_p^2) indicates effect size for analysis of variance (ANOVA) and Cohen's *d* indicates effect size for t-tests.

Results from the Initial Free Recall and CI Test

The mean number of correct, incorrect, and misinformation details recalled in the free recall and CIs are presented in Table 1. Consistent with results from the extant literature, the CI elicited far more correct details ($M = 109.94$) than did free recall ($M = 73.97$), $t(66) = 4.94$, $p < .001$, $d = 1.20$, and this CI superiority cannot be attributed to differences in time on task between CI and free recall. The CI group also recalled slightly more incorrect details ($M = 4.29$) and misinformation ($M = .29$) than did the free recall group ($M = 3.41$ for incorrect recall and $M = .12$ for misinformation recall)—but these differences were only marginally significant, ts > 1.71, ps < .09, ds > .41. Note that this finding is consistent with several other CI studies (Memon, et al., 2010a). Perhaps the most impressive result here is that output bound accuracy (i.e., Correct / Total in the top portion of Table 1) did not differ between participants who completed the CI (.96) and free recall (.95), despite the CI having elicited much more event details in recall. Table 1 also displays the proportion of critical details recalled on the initial test. Unsurprisingly, participants who completed a CI recalled more of the critical details correctly ($M = .35$) than those who took a free recall initial test ($M = .20$), $t(66) = 3.94$, $p < .001$, $d = .93$.

Results from the Final Cued Recall Test

Correct Recall. Correct, misinformation, no recall, and incorrect recall probabilities are presented in Table 2. A 3 (Test Condition: control, free recall, Cognitive Interview) X 2 (Postevent Item Type: misinformation, neutral) ANOVA revealed a significant main effect of postevent item type, $F(1, 99) = 29.81$, $p < .001$, $\eta_p^2 = .23$. As expected, misinformation reduced correct recall, such that performance was higher for the neutral items ($M = .65$) than the misinformation items ($M = .50$). Neither the main effect of test condition nor the interaction were significant, Fs < 1, ps > .38. That is, no testing effect emerged in the current experiment. This is not uncommon given the short retention interval (25 min) employed in the present experiment (Chan et al., 2009; Chan & LaPaglia, 2011).

Misinformation Recall. A 3 (Test Condition) X 2 (Postevent Item Type) ANOVA revealed a significant misinformation effect, with participants reporting more misinformation for the misleading items ($M = .34$) than the neutral items ($M = .10$), $F(1, 99) = 85.70$, $p < .001$, $\eta_p^2 = .46$. The effect of test condition was marginally significant, $F(2, 99) = 2.70$, $p = .07$, $\eta_p^2 = .05$. There was also a significant interaction, $F(2, 99) = 5.50$, $p = .005$, $\eta_p^2 = .10$. Planned comparisons showed that the initial free recall test increased recall probability of the misinformation ($M = .35$) relative to the control condition ($M = .25$), $t(66) = 1.81$, $p = .07$, $d = .44$ – a marginally significant RES effect.[2] Most important for present purposes, however, was that participants who took the initial CI reported more misinformation ($M = .43$) than the control

[2] This effect may have been only marginally significant due to insufficient statistical power (observed power = .56). Whereas Wilford et al. (2013; who report a significant RES effect with free recall) included 60 participants per condition, we included about half that many ($N = 34$). Moreover, although the difference did not reach conventional level of significance, the effect size ($d = .44$) is considered a medium sized effect (Morris & Fritz, 2013). Further data collection did not seem necessary since the primary comparison of interest was between the CI and the no initial test condition.

participants, $t(66) = 3.03$, $p = .003$, $d = .73$. Note that the magnitude of the RES effect is numerically greater in the CI condition than the free recall condition, though the difference was not statistically significant, $t(66) = 1.46$, $p = .15$, $d = .35$, observed power = .41.

To further explore the influence of initial recall on later suggestibility, we examined misinformation recall probability on the final test as a function of the amount of accurate details recalled during the initial test. We identified high performing ($M = 98$ and 133 for the free recall and CI initial tests, respectively) and low performing ($M = 49$ and 86) individuals with a median split analysis based on the initial test data. Intriguingly, participants who recalled more correct details in the free recall initial test were more suggestible ($M = .42$) than those who recalled fewer details ($M = .28$), $t(32) = 2.14$, $p = .04$, $d = .74$. But this pattern did not occur for participants in the CI condition. In fact, participants who recalled more details in the CI tended to be *less* suggestible ($M = .37$) than those who recalled fewer details ($M = .47$), though the difference failed to reach significance, $t < 1$, $p = .38$. Note, though, even participants who reported the most correct details in the initial CI produced more misinformation on the final test than participants in the control condition ($M = .25$). Given that the CI tends to elicit more details from eyewitnesses, a poor performance on a CI may be an indication of poor memory for the event, thus greater suggestibility. Recalling fewer details on a free recall test, however, may be indicative of a host of factors other than retention, such as a lack of motivation, ineffective retrieval strategy, or anxiety towards the free recall tasks.

To further investigate the effects of an initial CI or free recall test on subsequent misinformation recall, we examined the probability of misinformation recall depending on initial test accuracy (i.e., whether a critical item was recalled correctly or not during the initial test). Not surprisingly, participants were less likely to report a piece of misinformation if they had

recalled that item correctly during the initial test (M = .20 for free recall and M = .38 for CI) than if they had not (M = .35 for free recall and M = .45 for CI). The difference was significant for participants who completed free recall, $t(26) = 2.30$, $p = .03$, but not for participants who completed the CI, $t < 1$, $p = .41$. But more importantly, misinformation recall probability was still greater (numerically, but not significantly) for items in which participants were initially correct in the CI (M = .38) compared to the overall misinformation recall probability for the control participants (M = .25); $t(60) = 1.58$, $p = .12$, $d = .39$ (observed power = .45). This finding is particularly remarkable because the comparison is confounded by item selection artifacts (i.e., items that were recalled correctly during the initial test were necessarily easier to remember). Indeed, this conditional analysis revealed that even items that could be recalled correctly during the initial CI are not immune to the influence of later misinformation.

Discussion

The advantages of the CI in investigative interviewing are well established. Across numerous studies, the CI has been shown to elicit more correct details than the standard police interview and structured interview (Memon et al., 2010a). To lend further credence to the superiority of the CI, we too found its benefits in the intervening test relative to free recall—even after controlling for recall time. The more novel finding here is that the CI exacerbated the misinformation effect relative to the control condition. This finding is notable because it suggests that retrieval can increase subsequent eyewitness suggestibility even when initial recall occurs under relatively ideal conditions.

What could have caused the RES effect with an initial CI? Chan et al. (2009) postulated that initial testing might inadvertently draw participants' attention to the misinformation presented in the narrative. For example, being asked a question about the number of guards

shooting at the burglar may heighten the perceived importance of this event detail, and when (mis)information about this detail is presented in the subsequent narrative, participants pay particular attention to this detail, thus facilitating learning of this detail (relative to no-test control). Consistent with this notion, Gordon and Thomas (2013) found that initial testing causes participants to spend more time encoding sentences containing misinformation. This logic can apply to the present data as well, including results from the CI condition. Because the CI was designed to extract the maximal amount of remembered information from a witness, participants were more likely to mention the critical (to-be-misled) details during the CI (M = .47) than during free recall (M = .30), $t(66) = 3.31$, $p < .01$, d = .81. Because participants in the CI condition had attempted to recall more critical details on the initial test than those in the no-test control condition (and to some extent those in the free recall condition), they would likely attend to more of the misinformation in the narrative, thus enhancing the encoding of the misinformation.

How can initial free recall of CI increase encoding of the subsequent misinformation? One possibility is that completing the initial free recall test provided participants with a chance to assess what they could and could not recall during the initial test (Padilla-Walker & Poole, 2002; Thompson, Wenger, and Bartling, 1978). When participants hear the misleading narrative following recall, they might focus on what was not recalled initially (Battig, Allen, & Jensen, 1965), thus resulting in RES. For example, in a multi-trial learning paradigm, participants spend more time encoding information that they had missed on a previous recall test (Son & Kornell, 2008). In the CI, a similar mechanism was employed because of the initial open-ended recall, but the CI also included cued recall (questions posed by the interviewer based on the open-ended description generated by the participant), which may further boost the learning of the

misinformation. Moreover, highly confident errors are more easily corrected by feedback than errors accompanied by lower confidence (Butterfield & Metcalfe, 2001). In the present scenario, if participants assumed that the information presented in the narrative was correct, it may have served as corrective feedback (Loftus & Hoffman, 1989). Therefore, because the CI tends to increase confidence (Granhag et al., 2004; Gwyer & Clifford, 1997), these highly confident "errors" may have been more likely to be "corrected."

Although results of the present experiment appear to contradict three previous studies (Gabbert, Hope, Fisher, & Jamieson, 2012; Geiselman et al., 1986; Memon, Zaragoza, Clifford, & Kidd, 2010), these inconsistencies are perhaps more apparent than real. Indeed, major methodological differences between our experiment and these studies likely contributed to the opposite findings. Geiselman et al. found that an initial CI reduced the effects of suggestion from leading and misleading questions. The RES effect, however, has recently been shown to be eliminated (and even reversed) when misinformation is presented in questions instead of a narrative (LaPaglia & Chan, 2013). When misinformation is presented in a narrative, it is often placed in a stream of information that recaps the original sequence of events, including event details that occurred prior to and following the misinformation. Such contextual details are often absent when misinformation is presented via questions. Preliminary data collected in our lab suggest that the amount of contextual information that accompanies the misinformation may play a critical role in whether testing protects against or exacerbates suggestibility (LaPaglia, 2013). We believe that initial recall alters the way in which participants encode subsequent prose materials. Whereas it may increase participants ability to "pick out" important details in a stream of information in a narrative (thereby producing RES), it may allow participants to critically evaluate the veracity of the information if the materials have already "highlighted" the

important details for the participants (as when misinformation is presented in a question with few contextual details). Therefore, how misinformation is presented likely has a profound influence on whether initial retrieval increases or decreases suggestibility. Likewise, Memon et al. found that a CI reduced suggestibility for self-generated misinformation compared to a free recall group. However, self-generated misinformation differs substantially from the narrative-based misinformation presented in the current study. Unlike our externally provided misinformation (via an audio narrative), which was described as a summary of the critical event, participants who were told to fabricate misinformation were fully aware of its falsehood. This knowledge provides participants with unique information that they do not have in the current study. In fact, the knowledge that this fabricated misinformation is false could be considered similar to a warning regarding the veracity of misinformation, which has been previously shown to eliminate RES (Thomas et al., 2010).

Gabbert et al. (2012) found that the Self-Administered Interview (SAI; a written derivation of the CI) decreased later eyewitness suggestibility to externally presented misinformation compared to a no-test control group. We believe that two primary differences between their experimental design and ours might help to explain the disparate results. First, most of the misinformation presented in the present study involved contradictions regarding peripheral details whereas Gabbert et al. presented misinformation regarding central details (e.g., the facial appearance of the perpetrator, the presence of a weapon). Critically, LaPaglia and Chan (2012) found no RES effect when dealing with facial details of the perpetrator, and Saunders (2009) found that weapons are not susceptible to influence by misinformation (possibly due to weapon focus). Therefore, RES may be dependent on the type of misinformation presented. Further, Roos af Hjelmsater et al. (2012) found that children who were administered

an initial SAI were no less susceptible to later misinformation than those who did not complete an initial SAI. Far from simply obtaining conflicting results, we believe that an examination of the differences between our experiment and these studies is informative and can highlight the complex nature of and dynamic relationship between retrieval and eyewitness suggestibility.

Although we cannot account for every difference between the CI and free recall conditions, attempts were made to make the groups as comparable as possible. For instance, we controlled for time on task and provided both groups with instructions to be as detailed in their descriptions as possible. One potential limitation, however, is that participants performed their free recall test by typing whereas participants completed their CI verbally. We opted to use this procedure because we modeled the free recall procedure after former attempts that demonstrated RES (e.g., Chan et al., 2009), which always used a written recall task, whereas the interactive nature of the CI necessitates verbal responses. Related to this methodological discrepancy, Sauerland and Sporer (2011) found that spoken descriptions of a crime elicited more details than typed descriptions. Therefore, had we used a verbal free recall initial test, it might have produced a greater RES effect than written free recall, thus reducing the (nonsignificant) discrepancy in false recall between the CI and free recall conditions. In addition, Gabbert et al. (2009) found similar memorial effects for a CI relative to a Self-Administered Interview, which they describe as a written form of the CI. More importantly, the primary aim of the present experiment was to examine whether completing an initial CI would increase or decrease subsequent eyewitness suggestibility relative to not taking any initial memory test.[3] Regarding this question, the answer is clear - an initial CI can, under the present circumstances, increase the

[3] The verbal distractor task for the no-test condition made no difference in final test misinformation recall; their performance was comparable to former studies using Tetris as a distractor activity (Chan et al., 2009; Chan & LaPaglia, 2011).

influence of misinformation on memory performance. Future research may examine whether completing an initial CI can produce different effects on suggestibility depending on whether the retention interval is short (e.g., minutes to hours) or long (e.g., days to weeks). The question of delay is particularly interesting because variations in retention intervals can have a major impact on the testing effect (Carpenter, Pashler, Wixted, & Vul, 2008), whereas its influence on RES may be more limited (Chan & Langley, 2011; Chan & LaPaglia, 2011).

The CI is currently one of the most recommended procedures to local and national precincts for use in eyewitness cases. Despite the results of the present experiment, we believe that the CI is still one of the best available techniques for interviewing cooperative witnesses, and should be used as a means for eliciting more details from eyewitnesses and reducing misleading questioning from police interviewers (which is different from witnesses encountering misinformation on their own from less controllable sources, such as other witnesses, news reports, etc.). Because repeated questioning of witnesses is nearly inevitable in criminal investigations, one possible way to mitigate the negative effects of RES on eyewitness evidence is to have witnesses describe the event using a CI soon after the witnessed event (and possibly prior to any misinformation exposure). Any inconsistencies between information recalled in the CI and in later recounting of the event can then be called into question.

One important implication of our results is that perhaps little can be done to eliminate the RES effect by variations of the initial test format (e.g., RES can occur following initial cued recall, initial free recall, and even initial CI), given that the CI provides nearly ideal parameters under which a witness should be interviewed. Indeed, consistent with previous findings, our results during the initial recall phase clearly show the typical superiority of the CI over free recall. Despite this, in a criminal investigation, eliciting crime-relevant details from

eyewitnesses early in the investigation is critical to generating leads and, ultimately, to the success of the investigation. The idea that the process of conducting an effective initial interview increases eyewitnesses' sensitivity to post-interview misinformation is an unfortunate byproduct, but this should not deter criminal investigators from conducting the most effective initial interview possible. Indeed, if an effective initial interview is conducted, much of the forensically relevant information will have already been gathered before a witness' memory might be contaminated by outside sources. Moreover, armed with this recorded testimony, investigators should be more likely to notice any changes in an eyewitness' account (potentially due to later exposure to misinformation) and thus be able to weigh the credibility of those changes accordingly.

As we have mentioned, the CI represents one of the best structured interview techniques available for criminal investigations. However, our data highlight that no technique, no matter how meticulously devised and carefully executed, is immune to memory distortions for the simple reason that human memory itself is unreliable. Indeed, an interesting pattern that has emerged over the past decade is that procedures that enhance accurate remembering also tend to increase false remembering (Chan, McDermott, Watson, & Gallo, 2005), whereas procedures designed to reduce false memories can sometimes decrease accurate ones (Echterhoff, Groll, & Hirst, 2007; Memon & Gabbert, 2003; Steblay, Dysart, Fulero, & Lindsay, 2001). These results are consistent with the idea that much of the cognitive and neurobiological processes that produce accurate retrieval also underlie false memory creations (Schacter, Reiman, Curran, Yun, Bandy, McDermott, & Roediger, 1996). Because of these shared processes between accurate and false recall/recognition, there may simply be no magic bullet.

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Table 1

Mean Number and Critical Detail Mean Proportions of (and Standard Deviations) of Correct, Misinformation, Incorrect, and Total Details Recalled on the Initial Tests

Mean Number of Details Recalled

	Correct	Misinformation	Incorrect	Total
Free Recall	73.97 (30.50)	.12 (.33)	3.41 (2.08)	77.50 (31.52)
Cognitive Interview	109.94 (29.55)	.29 (.46)	4.29 (2.17)	114.82 (31.13)

Mean Proportion of *Critical* Details Recalled

	Correct	Misinformation	Incorrect	Total
Free Recall	.20 (.14)	.01 (.02)	.05 (.07)	.26 (.15)
Cognitive Interview	.35 (.18)	.02 (.04)	.07 (.06)	.43 (.20)

Table 2

Mean Probabilities (and Standard Deviations) of Correct, Misinformation, No Recall and Incorrect Recall on the Final Test as a Function of Test Condition and Postevent Item Type

	Correct Recall	
	Neutral	Misleading
Control	.66 (.25)	.54 (.24)
Free Recall	.62 (.21)	.50 (.21)
Cognitive Interview	.67 (.21)	.47 (.22)
	Misinformation Recall	
	Neutral	Misleading
Control	.12 (.15)	.25 (.24)
Free Recall	.10 (.12)	.35 (.21)
Cognitive Interview	.09 (.10)	.43 (.25)
	No Recall	
	Neutral	Misleading
Control	.02 (.05)	.01 (.06)
Free Recall	.02 (.07)	.04 (.09)
Cognitive Interview	.01 (.04)	.03 (.06)
	Incorrect Recall	
	Neutral	Misleading
Control	.21 (.17)	.20 (.19)
Free Recall	.24 (.21)	.13 (.14)
Cognitive Interview	.24 (.19)	.08 (.12)

Appendix

1. In the video, when the burglar entered the roof of the museum, the entrance was of a particular shape. What shape was it? [Correct Answer: Octagon; Misinformation: Square]

2. The burglar entered the museum via the window. How did he do it (describe in a few words or a short sentence)? [Correct Answer: Lowered crossbow and climbed down rope; Misinformation: Jumped down with crossbow]

3. When the burglar is using the aerosol to detect any security beams from the alarm system, what color did the beams appear? [Correct Answer: Blue; Misinformation: Red]

4. In the video, when the museum guards are shown, they are standing in front of what appears to be a stained glass window. Please describe the design of this window as specifically as possible (e.g., colors, patterns, etc.). [Correct Answer: Color blocked/simple shapes; Misinformation: Holy figure]

5. The guards are also shown standing next to two statues. What were the statues made of? [Correct Answer: Marble or stone; Misinformation: Bronze]

6. Describe the small stand holding the diamond in the big room in the video. [Correct Answer: Glass; Misinformation: Marble]

7. In the video, the burglar pierces an arrow through a piece of artwork in the big room (where the burglar stole the diamond). Describe what the artwork looked like and be as specific as possible (e.g., what patterns were present in the artwork, etc.). [Correct Answer: Brown, wooden shield; Misinformation: Painting of two knights]

8. The video cuts to a single guard standing in a hallway. What is this guard doing? [Correct Answer: Smoking a cigarette; Misinformation: Drinking out of a flask]

9. The burglar uses two metal devices to steal the diamond. How many prongs does each device have? [Correct Answer: One had two prongs, the other had three; Misinformation: Both had three prongs]

10. After a guard realizes the diamond has been stolen, how is the alarm triggered? [Correct Answer: Guard accidentally sets it off; Misinformation: The robber hits an alarm button]

11. What color were the museum guards' hats in the video? [Correct Answer: Dark green; Misinformation: Tan]

12. At the end of the video, how many guards shot at the burglar as he was trying to escape? [Correct Answer: Three; Misinformation: Four]