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Testing can enhance or reduce suggestibility: The importance of contextual detail during misinformation exposure

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Testing can enhance or reduce suggestibility: The importance of contextual detail

during misinformation exposure

by

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ABSTRACT

Witnesses are likely to describe an event to a police investigator or 911 operator soon after the event and prior to any exposure to misinformation. Recent studies have found that recalling an event can increase people's suggestibility (e.g., Chan, Thomas, & Bulevich, 2009) while other studies have reported that retrieval can reduce subsequent eyewitness suggestibility (e.g., Pansky & Tenenboim, 2011). In this dissertation, I examined whether differences in the way misinformation is presented can modulate the effects of testing on suggestibility. Participants watched a video of a robbery and some were questioned about the event immediately afterwards. Later, participants were exposed to misinformation in a narrative (Experiment 1a) or in questions (Experiment 1b). Consistent with previous studies, testing increased suggestibility when misinformation was presented via a narrative; however, when misinformation was presented in questions, testing decreased suggestibility. In Experiments 2 and 3, I sought to uncover why the retrieval-enhanced suggestibility (RES) effect was eliminated when misinformation was presented in questions. Experiment 2 was designed to address whether differences in the presentation duration of misinformation can account for the opposite patterns of results in Experiment 1 – they cannot. In Experiment 3, I manipulated whether a) misinformation was presented in questions or a narrative and b) the amount of contextual detail presented with the misinformation. I found that an RES effect was present only when misinformation was embedded in rich contextual details, regardless of whether misinformation was presented in questions or a narrative. Consistent with these data, previous studies that have found an RES effect have used misinformation narratives that included many additional contextual details (e.g., Chan &

LaPaglia, 2011), whereas work showing a testing benefit has consistently presented misinformation in relative isolation (e.g., LaPaglia & Chan, 2012). These results suggest that the way in which misinformation is presented determines whether initial testing enhances or reduces suggestibility. The main findings are discussed within the context of discourse comprehension and narrative persuasion.

CHAPTER 1. INTRODUCTION

Eyewitness memory is far from perfect. This idea was emphasized in a recent landmark New Jersey ruling to revise current juror instructions (*Henderson v. New Jersey,* 2011).   These new instructions educate jurors on findings from decades of research demonstrating the fallibility of eyewitness memory in an attempt to reduce wrongful convictions based on faulty eyewitness testimony. The instructions state that jurors should keep in mind that witnesses may have been exposed to misleading information (e.g., from other witness descriptions or newspaper accounts) which may influence their memory for the event (i.e., the misinformation effect; for a review see Loftus, 2005). However, prior to any misinformation exposure, a witness is likely to recount details of the event to a 911 operator or a police investigator. There are mixed findings in the literature as to whether describing an event increases or decreases eyewitness suggestibility (e.g., Chan, Thomas, & Bulevich, 2009; Pansky & Tenenboim, 2011). In this dissertation, I examined some factors that may contribute to these mixed findings.

Chan, Thomas, and Bulevich (2009) sought to reduce the harmful effects of misinformation on eyewitness memory by having participants recall details of the witnessed event prior to misinformation exposure. The logic was that because testing enhances memory retention of the original event (Roediger & Karpicke, 2006a), taking a memory test prior to misinformation exposure may reduce suggestibility. In their study, participants watched a video and some received an initial test over several details presented in the video. Following a short delay, participants listened to a narrative containing misinformation and then took a final test over the video. Instead of reducing

suggestibility, initial testing increased it (an effect termed retrieval-enhanced suggestibility, or RES). Since its publication, several works have reported similar results (e.g., Chan & Langley, 2011; Chan & LaPaglia, 2011; Thomas, Bulevich, & Chan, 2009; Wilford, Chan, & Tuhn, 2013), but other studies have reported that testing can protect against suggestibility (e.g., Gabbert, Hope, Fisher, & Jamieson, 2012; LaPaglia & Chan, 2012; Memon, Zaragoza, Clifford, & Kidd, 2010; Pansky & Tenenboim, 2011). In this dissertation, I sought to understand under what conditions retrieval enhances or reduces suggestibility. Previous studies have examined the effect of different types of intervening tests on suggestibility and have found that initial retrieval in the form of cued recall (Chan et al., 2009), free recall (Wilford et al., 2013) and a Cognitive Interview (LaPaglia, Wilford, Rivard, Chan, & Fisher, 2013) can increase suggestibility. In studies that have found initial testing to inoculate participants from misleading suggestions, the misinformation was often presented in misleading questions (e.g., Pansky & Tenenboim, 2011; Saunders & MacLeod, 2002), whereas studies that have demonstrated RES always presented misinformation in a narrative format. In this dissertation, I conducted three experiments to examine whether (and why) variations in how misinformation is delivered (namely, via questions or via a narrative) alter the influence of testing on eyewitness suggestibility.

In Experiment 1a, I established retrieval-enhanced suggestibility with a new set of materials (i.e., a new stimulus video). In Experiment 1b, I examined whether a similar effect occurs when the misinformation is presented in misleading questions instead of a narrative. To preview, I found that initial testing rendered participants less suggestible when the misinformation was embedded in questions. In Experiments 2 and 3, I

attempted to uncover methodological differences between the narrative and misleading

questions that may contribute to the contrasting pattern in Experiments 1a and 1b. In

Experiment 2, I manipulated the duration with which misinformation was presented. In

Experiment 3, I manipulated the amount of contextual information presented during the

misinformation phase as well as whether a retrieval component was included during the

misinformation phase. In the following literature review, I first describe how

misinformation can alter memory reports. I then describe the costs and benefits of test

taking on memory performance. Lastly, I provide an overview of studies that have

examined differences in eyewitness suggestibility between misinformation presented in a

narrative and in questions.

The Misinformation Effect

The misinformation effect has been studied extensively over the past three

decades (see Loftus, 2005 for a review). In a typical misinformation experiment,

participants witness an event (e.g., a man using a *screwdriver*) and are later presented

with misleading information in a narrative (e.g., the man pulled a *wrench* out of his

toolbox) or in misleading questions that inquired about other details in the witnessed

event (e.g., What object did the man steal after he pulled a *wrench* out of his toolbox?).

The typical finding is that being exposed to misinformation impairs subsequent memory

performance by reducing accurate recall (of the original detail) and increasing false recall

(of the misleading detail). The misinformation effect has been found with both

contradictory misinformation (i.e., replacing the original detail with a new one; e.g.,

Loftus, Miller, & Burns, 1978) and additive misinformation (i.e., telling participants that

something occurred or was present that was not; e.g., Zaragoza & Mitchell, 1996).

Additive misinformation has been associated with more "remember" judgments (i.e., conscious recollection as opposed to familiarity) than contradictory misinformation after long delays, perhaps because no contradiction with the original learning is detected at the time of misinformation exposure or at retrieval (Frost, 2000). Simply changing how witnesses are questioned can also lead to memory illusions. For instance, Loftus and Palmer (1974) had participants watch a video of a car accident. Some participants were then asked, "About how fast were the cars going when they *contacted* each other?" Whereas others were asked, "About how fast were the cars going when they *smashed* each other?" The greater the severity implied by the word, the faster the speed judgments provided by participants. Furthermore, on a later test, participants were more likely to falsely recall having seen broken glass if they had read "smashed" than if they had read "contacted" in the original question. These data indicate that even a subtle manipulation can drastically alter memory reports.

Since its discovery, several hypotheses have emerged regarding the underlying mechanisms of the misinformation effect. Loftus et al. (1978) postulated that the misinformation effect may be the result of participants incorporating the misinformation into their memory for the witnessed event, thereby replacing the original memory. This memory impairment hypothesis was the subject of much debate (McCloskey & Zaragoza, 1985; Zaragoza, McCloskey, & Jamis, 1987). McCloskey and Zaragoza found that misinformation had no effect on memory when performance was assessed in a forced choice recognition test that included the correct answer and a new item (but not the misinformation). Based on this finding, McCloskey and Zaragoza suggested that memory for the original detail is not impaired by misinformation; rather, misinformation

alters memory performance based on misinformation acceptance, demand characteristics, and failures in source monitoring.

It is likely that the misinformation effect results from a combination of factors. Misinformation acceptance (i.e., people assuming the misinformation to be true regardless of whether they encoded the original information, Belli, 1989) and, indeed, under some circumstances, memory impairment or interference can play a role in the misinformation effect (Loftus & Hoffman, 1989). Source misattribution is also a contributor to the misinformation effect. According to Johnson, Hashtroudi, and Lindsay (1993), the misinformation effect can occur because people sometimes misattribute the misinformation to the original event. Consistent with this idea, asking people to make source judgments (i.e., identifying where they learned the information) can reduce the misinformation effect (relative to recall and recognition). For example, Lindsay and Johnson (1989) found that making source judgments following a yes/no recognition task results in an elimination of the misinformation effect (see also Zaragoza & Koshmider, 1989). They explained that forcing participants to consider the source of each detail reduced the effects of misinformation because participants were more likely to base their judgments on the recollection of perceptual details as opposed to a general sense of familiarity (which is often employed in recognition). Zaragoza and Lane (1994) examined the effect of misleading post-event suggestion (embedded in both questions and a narrative) on source judgments. Intriguingly, source errors were more common when the misinformation was embedded in questions than when it was presented in a narrative. They explained that misleading questions led participants to create a new memory of the event by forcing them to reconstruct the witnessed event during retrieval.

Reconstructing the witnessed event increases the likelihood that the misinformation would be embedded in the newly formed memory. Consistent with this idea, when participants were asked to put a narrative (which contained misinformation) into a temporal order in a second experiment, similar levels of source confusion were found compared to when misinformation was presented in questions.

Regardless of the exact mechanism underlying the misinformation effect, the fact remains that misinformation can alter memory reports. And although the Loftus three-phase design (i.e., witnessed event, misinformation, test) has provided a general paradigm with which investigators can examine important questions regarding eyewitness suggestibility, this design lacks a key component in a real-life situation—namely, an immediate recall test following the event. A witness may talk to a 911 operator or police officer immediately following the event and prior to any misinformation. Research has shown that taking an initial memory test, as opposed to additional studying, can enhance one's retention of that information (Roediger & Karpicke, 2006a). Furthermore, taking multiple initial memory tests can increase retention of that information even more than one initial test (Wheeler & Roediger, 1992). This finding is important in the field of eyewitness memory because witnesses may be asked to recall an event multiple times prior to providing testimony. What are the implications of taking an initial memory test on eyewitness suggestibility? Before reviewing this (more specialized) literature, I first provide a review of the more general literature on the effects of taking an initial memory test on later retention.

The Testing Effect

Testing following initial learning has been shown to produce better performance on a subsequent memory test relative to not receiving the initial test (Spitzer, 1939). This *testing effect* is quite robust, even when initial testing is compared to an equivalent additional study period (for a review, see Roediger & Karpicke, 2006b). The testing effect has been observed in a variety of stimuli including word lists (e.g., Szpunar, McDermott, & Roediger, 2007), fact learning (e.g., Carpenter, Pashler, & Cepeda, 2009), and visuospatial information (e.g., Carpenter & Pashler, 2007), to name a few.

Several theories have been proposed to explain why testing enhances memory retention. Some have suggested that processes that enhance performance on a later test closely match the processes involved in an intervening test (Roediger & Karpicke, 2006b). The retrieval effort account has gained increasing support as a viable explanation for the testing effect which states that testing improves memory because it involves more effortful, elaborative processing than restudying (e.g., Kang, McDermott, & Roediger, 2007). Consistent with this hypothesis, Carpenter and Delosh (2006) found that providing fewer retrieval cues at the intervening test (e.g., *c _ _ _ _*) resulted in a greater testing effect than when more retrieval cues were provided (*c a b i _*, for the to-be-recalled word, *cabin*).

Because testing is a powerful memory enhancer, it might protect memory from later suggestion. Specifically, testing could increase the accessibility of the original event, thus making participants more likely to reject the misinformation. Consistent with this idea, better encoding of a witnessed event can reduce people's susceptibility to later misinformation (Lane, 2006; Pezdek & Roe, 1995). However, Chan et al. (2009) found

that testing increased, instead of decreased, the misinformation effect. In a series of experiments, participants watched an episode of the Fox television program *24* and then completed an initial memory test or a distractor task. Following a short delay, participants listened to an audio narrative that contained some misleading information and then they took a final memory test over the video. Based on findings from the testing effect literature, Chan et al. hypothesized that testing would reduce the misinformation effect. However, participants who took the initial recall test were *more* susceptible to misinformation than those who were not tested initially. Chan and colleagues termed this finding retrieval-enhanced suggestibility (RES).

Potential Mechanisms of Retrieval-Enhanced Suggestibility

Following its discovery, researchers have proposed two potential mechanisms for the RES effect. The *Reconsolidation Hypothesis* posits that a memory becomes particularly prone to interference shortly after its retrieval. Thus, when misinformation follows soon after retrieval of the original memory, it is more likely to interfere with subsequent access of that original memory. Conversely, the *Attention Capture Hypothesis* states that initial retrieval enhances learning of the misinformation by drawing people's attention to it. I elaborate on these hypotheses in the following paragraphs.

In a typical RES paradigm (see Figure 1), participants watch a critical event video (e.g., a robbery) and then either take a recall test over the video or perform a distractor activity. After a retention interval, participants listen to an audio narrative that purportedly recaps the video but includes several pieces of misinformation. Later, participants take a final memory test over the video. Chan et al. (2009) explained that the

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┌─────────────────┐
│  Critical Event │
│      Video      │
└─────────────────┘
         ⇩
┌──────────────┐   ┌──────────────┐
│  Memory Test │   │  Distractor  │
│  over Video  │   │   Activity   │
└──────────────┘   └──────────────┘
         ⇩
┌─────────────────┐
│  Misinformation │
│     Narrative   │
└─────────────────┘
         ⇩
┌─────────────────┐
│  Final Test over│
│      Video      │
└─────────────────┘
```
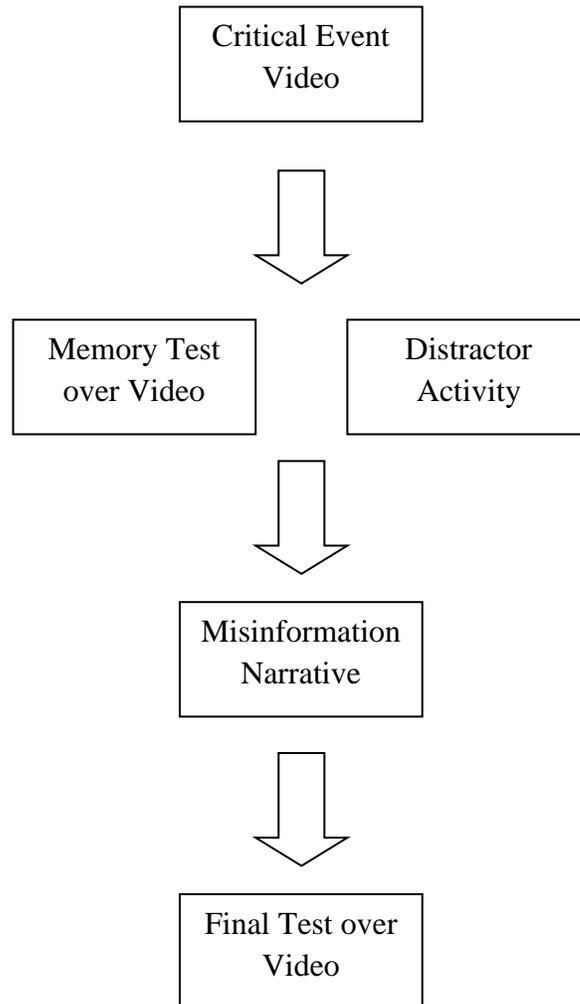
Figure 1. The Retrieval-Enhanced Suggestibility paradigm. The arrows indicate a retention interval which varied across previous RES experiments.

RES effect may be the result of source confusions. In a recent study, Chan et al. (2012) tested this idea by including a source discrimination task instead of the final cued recall test in the traditional RES paradigm. The source test asked whether the information was presented in the video, the audio narrative, both, or neither. Compared to nontested participants, tested participants were more likely to falsely attribute the misinformation as

having appeared in both the video and the audio (an RES effect). Chan et al. indicate that

these data are consistent with an interruption in reconsolidation hypothesis. That is,

when recall immediately preceded the misinformation, the original event memory was

partially updated with the misleading details (Hupbach, Gomez, & Nadel, 2009). Tested

participants, with their memory of the video partially updated with the misinformation,

were more likely to attribute the misinformation to both the video and narrative. This

lends support to the Reconsolidation Hypothesis as a potential mechanism for RES.

Once information has been encoded, the memory trace becomes progressively

more stable and resistant to disruption through a process of consolidation (McGaugh,

1999). However, recent research shows that a memory is destabilized upon retrieval and

must reconsolidate, during which it is again vulnerable to interference (see Hardt,

Einarsson, & Nader, 2010, for a review). Put into the current context, if misinformation

is presented during this reconsolidation process, it may produce greater interference than

if one had not recalled the event prior to misinformation encoding. Recently, Chan and

LaPaglia (2013) found evidence in support of this Reconsolidation Hypothesis. In a

series of experiments, they showed that presenting misinformation made the original

details less accessible in a later test, but only when the misinformation was presented

soon after a recall test. RES is a complex phenomenon and is likely the result of multiple

mechanisms. In addition to disruption of reconsolidation, RES may be the result of

increased attention or encoding of the misinformation (which I refer to as the Attention

Capture Hypothesis; Gordon & Thomas, 2013).

Taking the initial test may increase people's suggestibility by enhancing the

learning of the misinformation. Consistent with this notion, testing has been shown to

improve subsequent encoding (Szpunar, McDermott, & Roediger, 2008; Tulving & Watkins, 1974). Tulving and Watkins found that when participants learned paired associates (A-B) and were later asked to retrieve the target given its cue (A- __), subsequent learning of similar paired associates (A-D) was greater relative to participants who had not been initially tested. Applied to an eyewitness memory study, initial testing over the original event may increase the later learning of the related, but misleading, information. The initial recall test may draw attention to specific parts of the narrative, thus enhancing encoding of the misinformation presented in the narrative. For example, in Chan et al.'s (2009) experiments, participants were asked about the weapon used by the terrorist to knock out a flight attendant. Later, participants heard misleading information that the terrorist used a *chloroform rag* when the weapon was actually a *hypodermic syringe*. When participants were asked about the weapon in the initial memory test, it may have inadvertently drawn their attention to this relevant misleading detail in the narrative, thereby enhancing encoding of this misinformation and increasing misinformation recall on the final test. Consistent with the idea that enhanced learning of the misinformation would lead to a greater misinformation effect, when people are exposed to the same misinformation multiple times instead of once, they are more likely to report the misinformation on a later memory test (e.g., Zaragoza & Mitchell, 1996).

Gordon and Thomas (2013) tested this Attention Capture Hypothesis (i.e., initial testing enhances the learning of the misinformation) in their study. They used the same materials as Chan et al. (2009); however, the misinformation narrative was presented visually, one sentence at a time, as opposed to auditorily. This written narrative was self-paced so that participants could spend as much time reading each sentence as necessary.

Initial testing increased reading time of the sentences that included misinformation. This suggests that the initial test induced participants to pay more attention to the misinformation than they would have had otherwise.

In sum, both the reconsolidation hypothesis and the attention capture hypothesis have received empirical support, and it is likely that they both contribute to the RES effect. Overall, the RES effect has been found with different initial test formats (LaPaglia et al., 2013; Wilford et al., 2012), varying delays (Chan & Langley, 2011; Chan & LaPaglia, 2011), and different critical event videos (Chan et al., 2009; Chan et al., 2012). Several researchers, however, have examined the effects of initial testing on suggestibility and found recall to protect memory from misinformation.

When Does Retrieval *Reduce* Suggestibility?

Although the RES effect shows that testing can sometimes increase eyewitness suggestibility, several studies have found that testing can also reduce the misinformation effect (see Table 1 for a summary of studies that have both found RES and those that did not). LaPaglia and Chan (2012) discovered that when participants described the perpetrator immediately after witnessing the crime, they were less susceptible to misinformation about the perpetrator. In their study, participants watched a short video of a man stealing a laptop computer. Immediately following the video, participants either took a free and cued recall test over the video (with an emphasis on the appearance of the perpetrator) or performed a distractor activity. Following a short retention interval, participants listened to an audio narrative that either described the perpetrator as having

Table 1

Summary of previous studies that have examined the effect of initial retrieval on later suggestibility; the final column indicates whether an RES effect was found for each experiment

	Experiment	Initial Learning	Initial Test	Comparison Condition	New Learning (Misinformation)	Final Test	RES
Chan et al. (2009)	1, 2	Video	Cued Recall	No Test	Narrative	Cued Recall	Yes
Chan et al. (2012)	1	Video	Cued Recall	No Test	Narrative	Cued Recall	Yes
	2	Video	Cued Recall	No Test	Narrative	Free-choice Source Test	Yes
	3	Video	Cued Recall	No Test	Narrative	Forced-choice Source Test	No
Chan & Langley (2010)	1, 2	Video	Cued Recall	No Test	Narrative	Cued Recall	Yes
Chan & LaPaglia (2011)	1, 2, 3, 4	Video	Cued Recall	No Test	Narrative	Cued Recall	Yes
Chan & LaPaglia (2013)	1, 3, 4, 6	Video	Cued Recall	No Test	Narrative	Free-choice Recognition	Yes
Gabbert et al. (2012)	1	Video	Self-Administered Interview	No Test	Narrative	Free Recall	No
Geiselman et al. (1986)	1	Live Event	Cognitive Interview	No Test	Questions	Cued Recall	No
Gordon & Thomas (2013)	1	Video	Cued Recall	No Test	Narrative	Cued Recall	Yes
	2	Video	Cued Recall	No Test	Narrative	MMFR	Yes
Holliday (2003a)	1	Video	Cognitive Interview	Memorandum Interview	Narrative	Cued Recall	No
Holliday (2003b)	1	Video	Cognitive Interview	Structured Interview	Narrative/Self-Generated	Yes/No Recognition	No

Table 1 Continued.

Experiment	Initial Learning	Initial Test	Comparison Condition	New Learning (Misinformation)	Final Test	RES
Huff et al. (2011) 1, 2	Slide show	Cued Recall	No Test	Word List	Free Recall	No
3	Slide show	Cued Recall	No Test	Word List	Free-choice Source Test	No
Lane et al. (2001) 2	Video	Free Recall	No Test	Questions	Free-choice Source Test	No
LaPaglia & Chan (2012) 1	Video	Cued & Free Recall	No Test	Narrative	Cued & Free Recall	No
2	Video	Cued & Free Recall	No Test	Narrative	Recognition	No
LaPaglia et al. (2013) 1	Video	Free Recall & Cognitive Interview	No Test	Narrative	Cued Recall	Yes
Meluso (2011) 1	Video	Cued Recall	No Test	Narrative	Cued Recall	No
Memon et al. (2010) 1	Video	Cognitive Interview	Free Recall	Self-Generated	Recognition	No
Pansky & Tenenboim (2011) 1	Slide show	Cued Recall	No Test	Questions	Cued Recall	No
Saunders & MacLeod (2009) 1, 2	Narrative	Cued Recall	No Test	Questions	Forced-choice Recognition	No
Thomas et al. (2010) 1	Video	Cued Recall	No Test	Narrative	Cued Recall	Yes
2	Video	Cued Recall	No Test	Narrative	Recognition	Yes
Verkampt & Ginet (2010) 1, 2	Live Event	Cognitive Interview	Structured Interview	Questions	Free Recall	No
Weber (2012) 1	Word Pairs	Cued Recall	No Test	Word Pairs	Cued Recall	Yes
Wilford et al. (2013) 1	Video	Cued Recall	No Test	Narrative	Cued Recall	Yes
2	Video	Free Recall	No Test	Narrative	Cued Recall	Yes
3	Video	Free Recall	No Test	Narrative	Free Recall	Yes

facial hair (when he did not) or made no mention of facial hair. The final test was in the form of a free and cued recall test in Experiment 1 and a recognition test involving a target-present lineup (i.e., the perpetrator was included in a six-person photo array) in Experiment 2. Testing reduced the propensity for participants to recall the facial hair detail and to choose a lineup photo that included facial hair. It is unclear exactly why testing reduces suggestibility for a face and increases suggestibility for an event, but one possibility is that faces are processed holistically (i.e., faces are recognized based on the entire face as opposed to its individual features; Tanaka & Farah, 1993) whereas events (which are prone to produce RES) are processed sequentially (Kurby & Zacks, 2008). Describing a face is a difficult task that requires breaking up a face into component parts. Participants were told that the narrative was a professor's description of the perpetrator; however, because tested participants were quite aware of the difficulty in describing a face, they might have distrusted the memory of the professor providing the description of the perpetrator in the misinformation narrative. In previous RES studies, participants are simply told that the narrative recaps the video. If participants questioned the memory of the professor, then the RES effect would be eliminated—much like when a warning about the veracity of the narrative follows misinformation exposure can abolish the RES effect (Thomas et al., 2010).

In addition to the instructions given to participants about the misinformation phase, the initial test format might affect whether retrieval enhances or reduces suggestibility. Two studies have examined whether completing an initial Cognitive Interview or a Self-Administered Interview would reduce people's susceptibility to misinformation (Gabbert, Hope, Fisher, & Jamieson, 2012; Memon, Zaragoza, Clifford,

& Kidd, 2010). The Cognitive Interview is designed to elicit greater accurate recall and reduce suggestive questioning from the interviewer (Fisher & Geiselman, 1992). Across numerous studies, the Cognitive Interview has been shown to elicit more correct and sometimes more false details than the traditional police interview or structured interview (for meta-analyses, refer to Kohnken, Milne, Memon, & Bull, 1999; Memon, Meissner, & Fraser, 2010). The Self-Administered Interview is a written version of the Cognitive Interview that can elicit comparable levels of accurate recall relative to a standard Cognitive Interview (Gabbert, Hope, & Fisher, 2009). Memon et al. (2010) found that completing an initial Cognitive Interview reduced suggestibility compared to free recall and no initial test. However, unlike studies conducted by Chan and colleagues, participants in Memon et al.'s experiment were told to fabricate their own misinformation. A major difference between self-generated misinformation and misinformation provided by an experimenter is that participants know their fabricated misinformation is incorrect. Given that the RES effect can be removed by a warning, it is not surprising that testing can reduce the misinformation effect for self-fabricated misinformation.

Like Memon et al. (2010), Gabbert et al. (2012) found that an initial Self-Administered Interview (a Cognitive Interview modified for self-administration by the witness) reduced suggestibility compared to no initial test. These results, however, contradict a recent study by LaPaglia et al. (2013), who found that taking an initial Cognitive Interview enhanced later suggestibility. The type of misinformation presented in each of these studies may contribute to their contrasting findings. For example, Wilford et al. (2012) found that peripheral details, but not central details, are susceptible

to RES. Although Gabbert et al. did not report the centrality of the critical details used, it may have played a role. Of their three misinformation items, one was that the perpetrator had facial hair when he, in fact, did not. As described previously, LaPaglia and Chan (2012) found that recalling a perpetrator's appearance prior to misinformation exposure made participants more resistant to the misinformation that the perpetrator had facial hair. Another piece of misinformation used by Gabbert et al. was that a weapon was present where there had not been. Indeed, Saunders (2009) found no misinformation effect when the misinformation was about a weapon (possibly due to weapon focus; Steblay, 1992). If participants were able to detect the inaccuracies of these two pieces of misinformation, it is likely that they would be more skeptical about the rest of the misinformation narrative (Loftus, 1979), thus reducing the influence of misinformation.

Differences in methodology may contribute to whether initial testing can reduce or exacerbate the misinformation effect. In some cases, the misinformation phase instruction may lead participants to question the veracity of the information provided in the postevent narrative (for instance, that the source of the misinformation was based on another individual's memory; Huff, Davis, & Meade, 2013; LaPaglia & Chan, 2012). In other cases, the type of misinformation could change how initial testing affects suggestibility (Memon et al., 2010; Gabbert et al., 2012). However, two studies have examined the effect of initial retrieval on later suggestibility with few methodological differences in comparison to the original Chan et al. (2009) study (i.e., similar initial test format, no "warning" about the misinformation phase, etc.) and found testing to protect memory from later suggestion (Pansky & Teneboim, 2011; Saunders & MacLeod, 2002). One common feature of these studies was that the misinformation in these experiments

was embedded within questions as opposed to a story-like narrative. I elaborate on these studies in the following paragraphs.

Saunders and MacLeod (2002) found testing to reduce suggestibility in a retrieval-induced forgetting paradigm. Retrieval-induced forgetting is the phenomena whereby retrieving studied information makes related, but nontested information temporarily less accessible (Anderson, 2003). In their first experiment, Saunders and MacLeod had participants read two narratives describing two burglaries. Within the narratives, several objects were described as having been stolen. In the subsequent retrieval practice phase, half of the items from one of the described scenes were tested in a cued recall test and the other half were not tested. All items from the second scene (control items) were not tested during this initial retrieval phase. A free recall test was then given to establish retrieval-induced forgetting. Misinformation was either presented on only tested items, nontested items, or the control items via misleading *questions*. One critical detail was that the burglars stole a *necklace* that was next to the sink. During the misinformation phase, participants responded to the question, "When the burglars stole the *earrings* that were next to the sink in the kitchen, they knocked some items on the floor breaking them. What did they break?" Final test performance was measured in a forced-choice recognition test. Intriguingly, participants were less likely to recognize the misinformation if the item was tested ($M = .16$) than if the item was not tested ($M = .60$). Saunders and MacLeod claim that retrieving information in the initial test lead to forgetting of related information (which was later contradicted by misinformation), thus increasing the likelihood that one would accept the misinformation as correct.

Several key differences between their study and studies that found RES may clarify these contrasting findings. First, initial retrieval accuracy was far higher (~89% of questions were recalled correctly) in Saunders and MacLeod's study compared to what is typically observed in an RES study (~55% initial test accuracy). As mentioned previously, highly memorable details (e.g., central event details) are not susceptible to RES (Wilford et al., 2013). Second, Saunders and MacLeod included a free recall test for all participants after the initial retrieval and before the misinformation phase. Therefore, there was no true no-test control condition. Third, and most relevant to the current study, the misinformation was presented within misleading questions instead of a narrative. Retrieving information while being exposed to misinformation is different than passively listening to or reading misinformation presented in a narrative, and this may play a critical role in determining whether testing would increase or decrease subsequent suggestibility.

In Pansky and Tenenboim's (2011) study, participants viewed a slideshow as their critical event and then took a test over the information (tested and nontested items were manipulated within-subjects). Participants were asked to recall details at a general (or gist) level or at a more specific (or verbatim) level. For example, one question asked what the main character sat on (gist question; correct answer: chair). A verbatim version of the question asked what type of chair the main character sat on (correct answer: a *wooden* chair). The misinformation presented was always at the verbatim level (e.g., a *plastic* chair) and was embedded in misleading questions. One misleading question was "When Inbal came back home from the pub, was the book she was reading while sitting on the *plastic* chair written in Hebrew?" Testing with verbatim questions inoculated

participants from later misinformation presented in the questions. According to Pansky and Tenenboim, initial testing strengthened accessibility of the original detail as compared to the competing misleading item on the final test, thus reducing the misinformation effect. In an attempt to explain the inconsistencies between their results and those from Chan et al. (2009), Pansky and Tenenboim described several methodological differences (e.g., the length of the event video, initial testing manipulated within and between subjects, etc.). The difference of most relevance to the current study is that the misinformation was presented in misleading questions in Pansky and Tenenboim's study.

As is apparent from this brief review, initial testing can reduce or increase suggestibility, although the processes underlying the opposite patterns of results are unknown. I suspect that these discrepant findings are related to the way in which misinformation is delivered. Specifically, I examined whether the RES effect can generalize to misleading questions and attempted to uncover when retrieval helps or harms memory in the presence of misinformation.

Misinformation Narrative and Misleading Questions

In this dissertation, I investigated whether the RES effect generalizes to misleading questions. Participants watched a video and some took an initial test over the contents of the video. After a short delay, they either listened to a narrative containing misinformation (Experiment 1a) or responded to new questions containing misinformation (Experiment 1b). In both the narrative and the questions, the misinformation was presented as fact. Later, all participants completed a final recall test

over the video. Of interest is whether an RES effect will remain when misinformation is

presented via questions.

A few studies have examined the effects of different misinformation presentation

methods on eyewitness suggestibility. In one study, Zaragoza and Lane (1994) misled

their participants about the presence of a wristwatch in a witnessed event (when in fact

there was no wristwatch). If the misinformation was presented in a narrative, participants

read, "When the man looked at his wristwatch before opening the door, he appeared very

anxious." If the misinformation was presented in a question, participants read, "When

the man looked at his wristwatch before opening the door, did he appear anxious?" The

same misinformation was presented in each; however, a critical difference was that

participants needed to retrieve information in the misleading questions whereas no such

retrieval is required by the narrative.

There are mixed findings as to whether question or narrative presentation of

misinformation is more effective at inducing false memories. Zaragoza and Lane (1994)

found greater suggestibility for question-based misinformation than narrative-based

misinformation. Saunders (2009) also reported that misleading questions are more

effective at inducing false memories than a narrative—but only for central details and not

peripheral details (note that RES studies typically use peripheral details). In contrast, Lee

and Chen (2013) presented participants with questions that included false

presuppositions; for example, "I reached for the toothpaste beside the cleansing cream.

Was it Dove?" The misinformation here was that the cleansing cream was Dove when it

was actually Johnson. Somewhat surprisingly, this presentation format eliminated the

misinformation effect. The authors explained that this format made the misinformation

more salient; thus, when participants were told to discount the postevent information prior to the final test, these falsehoods were easily rejected. Based on these findings, it appears that question-based misinformation may be more effective at inducing false memories than narrative-based misinformation, though this effect does not always occur. It is unknown what effect prior testing will have on question-based misinformation recall.

In my first experiment, I examined whether testing enhances or reduces suggestibility when misinformation is presented in questions. There are reasons to expect that presenting misinformation in questions (rather than in a narrative) would increase or decrease the RES effect. Misleading questions have been previously shown to increase the misinformation effect compared to a narrative presentation. Zaragoza and Lane (1994) explained that questions may lead participants to reconstruct the event. The idea is that reconstructing the witnessed event provides an opportunity for the misinformation to be integrated into memory of the original event. If questioning in general leads to reconstruction of the event, then participants in the initial test group would essentially be reconstructing the event twice (once in the initial recall phase and once during misleading questioning) prior to the final recall test. If reconstructing the event multiple times leads to a greater integration of the misinformation into the original event memory, it may be that presenting misinformation in questions *increases* the RES effect.

Alternatively, presenting misinformation in questions may result in an elimination of the RES effect. Attempting to answer a question, as opposed to passively listening to a narrative, could encourage participants to engage in more effortful processing (Carpenter, 2009; Pyc & Rawson, 2009). In particular, participants may compare their memory of the event with the details in the questions, thus increasing the likelihood that they would

reject misinformation presented in questions, especially if their original event memory is strong. If this is the case, then taking an initial test would reduce suggestibility.

Another reason that testing might reduce suggestibility when misinformation is presented via questions is based on the idea that retrieving a subset of studied information can either impair (retrieval-induced forgetting; Anderson, 2003) or enhance (retrieval induced facilitation; Chan, McDermott, & Roediger, 2006) later recall of related information. Chan et al. explained that the integrative nature of the materials can determine whether retrieval-induced forgetting or facilitation occurs. Specifically, when study materials are highly integrated (such as a story), retrieval-induced facilitation is more likely to occur. In Chan et al.'s study, participants read prose material about toucans. Following the learning phase, participants retrieved some details about the prose (e.g., "Where do toucans sleep at night?" correct answer: tree holes; tested items). These questions were related to other information presented in the story (e.g. that the toucan is related to the woodpecker and that woodpeckers create the tree hole that toucans sleep in; nontested items). The authors found that initial testing, relative to restudying, facilitated later recall of related, but previously nontested information. Due to the coherent nature of the present study's materials, the misleading questions may lead participants to spontaneously retrieve the original correct detail, thus enhancing conflict detection between their memory and the misinformation. This would likely result in an elimination of the RES effect (and perhaps a testing effect).

Alternatively, reading event details during the initial test may lead to inhibition of related information (i.e., retrieval-induced forgetting). When participants take another test over the related (and perhaps inhibited) details, more cognitive resources would be

necessary to answer the misleading questions. This may result in impoverished encoding of the misinformation for tested participants, thus reducing the influence of RES (note that extant findings on the influence of dividing attention on false memories are mixed, Zaragoza & Lane, 1998; Dewhurst, Barry, Swannell, Holmes, & Bathurst, 2007; Perez-Mata, Read, & Diges, 2002; Seamon, Luo, & Gallo, 1998). In the present experiments, one critical detail is the number of warning shots fired by a bank robber. In the initial test, participants are asked, "How many warning shots did the robber fire?" While retrieving "three warning shots," details related to this item may be inhibited. In the later misleading questions, participants are asked, "What was the emergency with one of the employees before the robber fired two warning shots?" Because related details (such as the emergency that occurred prior to the warning shots) might be inhibited during initial retrieval, recalling these inhibited details would be particularly difficult for the tested participants. Difficulty recalling the inhibited details may result in reduced encoding of the critical detail; thus, tested participants would recall fewer misleading details on the initial test. Additionally, nontested participants may inhibit the critical details (e.g., the warning shots) during the misleading questions resulting in greater misinformation recall later on (Saunders & MacLeod, 2002).

To recap, initial testing might reduce eyewitness suggestibility if misinformation is presented via questions. Notably, one can arrive at this prediction regardless of whether retrieval enhances or impedes memory of the related details. Based on this reasoning, initial testing should reduce suggestibility when the misinformation is presented in questions (relative to in a narrative). Alternatively, if reconstructing an event via retrieval allows the misinformation to be better integrated into the event

memory (Morris et al., 1977), then an RES effect should occur with misleading

questions.

CHAPTER 2. EXPERIMENT 1A

Method

Participants and Design. Experiment 1a used a 2 (test, no-test) X 2 (postevent information: neutral, misled) mixed design. Initial testing was manipulated between subjects. Postevent information was manipulated within subjects. Forty-one undergraduate students from Iowa State University participated in this experiment for partial course credit. One participant was removed from analyses because of insufficient English proficiency. There were 20 participants in each between-subjects condition (23 male, 17 female). Their mean age was 19.50 ($SD = 1.18$).

Materials and Procedure. Participants began by watching a 25 min video clip from an episode of the television show *Flashpoint*, which showed a bank robbery. Participants were told to pay close attention to the video, including the actions and surrounding environment, because their memory would be tested later.

Following the video, no-test participants played the video game Tetris for 7 min as a distractor activity. The other participants, henceforth referred to as the tested group, took a cued recall test over their memory for the video. This test consisted of 14 open-ended questions; none of which included any misleading information (e.g., "How many warning shots did the robber fire?"; see Appendix A for a complete list of questions). Participants were given 30 sec to answer each question and the initial test phase lasted 7 min. They were told to be as accurate as possible and not to guess. No corrective feedback was given.

Once participants completed the initial test or Tetris, they were shown another video to fill a retention interval. The video was a clip from the BBC show *Spooks*. It

depicted a terrorist plot against abortion doctors and lasted approximately 20 min. Participants were told that they should pay close attention to the video, but they were not told whether their memory for the video would be tested later.

Following the distractor video, participants were presented with misinformation embedded in an audio narrative that purportedly recapped the video. The audio narrative lasted 5 min 45 sec and pacing of the narrative was approximately 187 words per min. Each of the 14 critical details that were queried during the initial test were included in the narrative. The critical details were either presented as misinformation or a neutral item. For example, one critical detail was the number of warning shots fired by the robber (the correct answer was three). If this detail was presented as misinformation, participants heard, "Inside the bank, Ruth expresses concern for a woman with asthma who needs her medication. This angers the robber so he grabs Ruth pointing a gun at her once again. He fires *two warning shots* into the ceiling." If this detail was presented as a neutral item, participants heard that the robber fired warning shots, but the number of shots fired was not specified. Whether a detail was presented as a misled or neutral detail was counterbalanced so that seven details were misled and seven were neutral.

Following a 25 min filled retention interval in which participants completed the Reading Span working memory task and played Tetris (Unsworth, Heitz, Schrock, & Engle, 2005), participants completed the final test (which was identical to the initial test). Participants were told to answer the questions based only on their memory for the video. Immediately after each question, participants were asked to rate their confidence in their response from 1 ("I guessed") to 5 ("I am very sure"). The final test was then followed

by a short demographic questionnaire and additional post-experiment questions (Appendix B).

Results and Discussion

Initial Test

Responses in the initial and final tests were classified as either *correct*, matching the misinformation presented later (spontaneous misinformation recall), *no answer* (blank response or "I don't know"), or an *other* response (any response that was incorrect, but did not match the misinformation). See Table 2 for performance on the initial test. Correct recall was similar to previous studies despite the new materials used here (Chan et al., 2009; $M = .64$) and spontaneous misinformation recall was low ($M = .07$).

Table 2

Mean Probabilities (and Standard Deviations) of Correct, Spontaneous Misinformation, No Answer, and Other Recall on the Initial Test in Experiments 1a, 1b, 2, 3a, and 3b

	Correct	Spontaneous Misinformation	No Answer	Other
Experiment 1a	.64 (.13)	.07 (.07)	.05 (.06)	.24 (.11)
Experiment 1b	.58 (.14)	.03 (.04)	.07 (.08)	.32 (.13)
Experiment 2	.60 (.16)	.03 (.04)	.06 (.07)	.32 (.14)
Experiment 3a	.57 (.16)	.03 (.04)	.05 (.06)	.34 (.14)
Experiment 3b	.59 (.14)	.02 (.04)	.05 (.06)	.34 (.15)

Final Test

Correct Recall. No answer and other responses for Experiments 1a and 1b are

presented in Table 3.

Table 3

*Mean Probabilities (and Standard Deviations) of No Answer and Other Recall in the
Final Test of Experiments 1a and 1b*

	Experiment 1a (Narrative)		Experiment 1b (Questions)	
	No-Test	Test	No-Test	Test
No Answer				
Neutral	.04 (.06)	.05 (.08)	.03 (.08)	.06 (.09)
Misled	.01 (.04)	.01 (.04)	.04 (.09)	.04 (.10)
Other Recall				
Neutral	.31 (.17)	.29 (.18)	.42 (.22)	.35 (.20)
Misled	.24 (.14)	.17 (.13)	.24 (.20)	.26 (.22)

Correct and misinformation recall probabilities are presented in Figure 2. A 2

(test, no-test) X 2 (postevent information: neutral, misled) ANOVA revealed a significant

interaction, $F(1, 38) = 4.14$, $p = .05$, $d = .66$. Specifically, the tested participants recalled

fewer correct details ($M = .35$) than the nontested participants ($M = .52$) for misled items,

$t(38) = 3.35$, $p < .01$, $d = .80$, but not for neutral items, $t < 1$, $p = .73$. There was also a

significant main effect of postevent information, $F(1, 38) = 10.51$, $p < .01$, $d = 1.05$.

Misinformation exposure reduced correct recall probabilities from .59 (neutral items) to .44 (misled items).
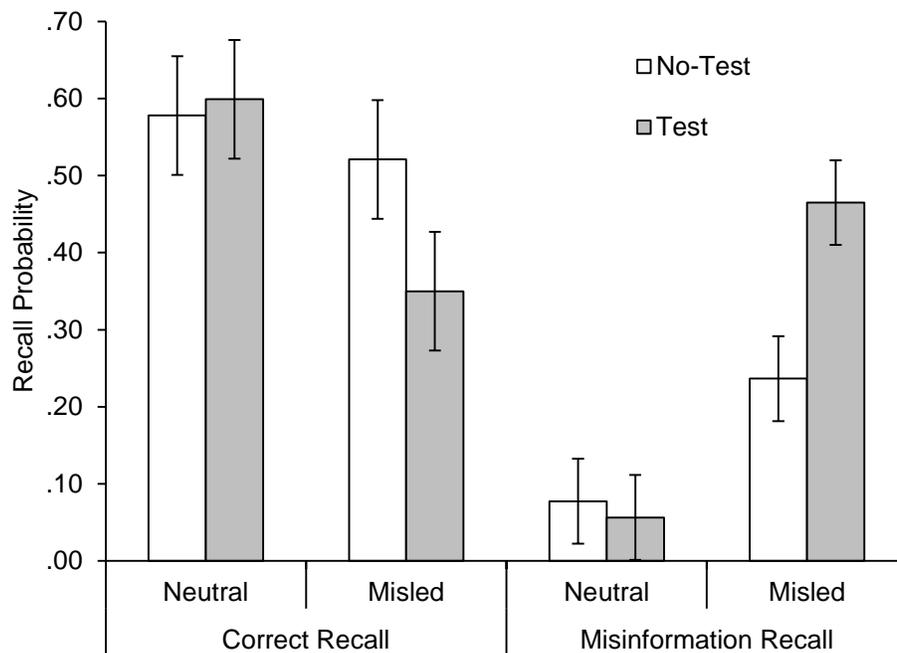
Figure 2. Experiment 1a final test data. Error bars indicate 95% confidence intervals.

Misinformation Recall. A 2 (test, no-test) X 2 (postevent information) ANOVA revealed a significant interaction, $F(1, 38) = 13.72, p < .01, d = 1.20$, such that testing doubled the misinformation recall probability for misled items, $t(38) = 3.35, p < .01, d = 1.05$ ($M = .47$ for test and $M = .24$ for no-test), but (as expected) not for neutral items, $t < 1, p = .44$. The main effect of testing was significant, $F(1, 38) = 6.93, p = .01, d = .85$; this main effect was driven by the large RES effect for the misled items. Not surprisingly, there was also a misinformation effect, with participants reporting more

misinformation for the misled items ($M = .35$) than the neutral items ($M = .07$), $F(1, 38) =$ 70.99, $p < .01$, $d = 2.73$.

During testimony, a witness may be prompted to only respond when they are highly confident. Using the confidence data collected in the final test phase, I examined misinformation recall probability for only highly confident responses (a confidence rating of 4 or 5—"I am sure" or "I am very sure"). Remarkably, even among these highly confident responses, the RES effect remained virtually unchanged ($M = .48$, $SD = .38$ for tested and $M = .25$, $SD = .20$ for nontested), $t(38) = 2.37$, $p = .02$, $d = .77$. This suggests that participants rarely reported misinformation unless they were highly confident about its occurrence.

To further investigate the effect of initial testing on later suggestibility, I performed a conditional analysis examining final test accuracy depending on whether the participant successfully recalled an item on the initial test (Table 4). Not surprisingly, participants were more likely to recall the misinformation if they could not provide the correct answer for a given item initially ($M = .56$) than otherwise ($M = .43$ for initially correct items), although the difference was not statistically significant, $t(19) = 1.29$, $p = .21$. However, more surprising is that being able to recall an item correctly during the initial test by no means protected one from the influence of RES, as the misinformation recall probability for these initially-correct items was still far greater than that in the no-test condition ($M = .24$), $t(38) = 3.76$, $p < .01$, $d = 1.19$. Later correct recall for initially *incorrect* items was not examined because performance was at floor. Misinformation had a powerful negative effect on retention of these initially-correct items, dropping correct

recall probability on the final test from .88 (neutral items) to .54 (misled items), $t(19) =$ 3.29, $p < .01$, $d = 1.02$.

Summary

In sum, Experiment 1a revealed that initial testing increased later susceptibility to misinformation embedded within a narrative, generalizing the RES effect to a new set of materials. In Experiment 1b, I examined whether an RES effect would occur when the misinformation was presented via questions as opposed to a narrative.

Table 4

Conditional Probabilities (and Standard Deviations) of Misinformation and Correct Recall on the Final Test Depending on Correct Recall on the Initial Test and Postevent Item Type for Experiments 1a, 1b, 2, 3a, and 3b

| | Misinformation Recall | | Correct Recall | |
	Initially Correct (Misled)	Initially Incorrect (Misled)	Initially Correct (Neutral)	Initially Correct (Misled)
Experiment 1a	.43 (.36)	.56 (.35)	.88 (.18)	.54 (.38)
Experiment 1b	.10 (.17)	.31 (.35)	.93 (.13)	.87 (.17)
Experiment 2				
Self-Paced	.40 (.40)	.53 (.40)	.90 (.20)	.58 (.40)
Experimenter-Paced	.41 (.37)	.58 (.42)	.91 (.14)	.58 (.35)
Experiment 3a				
Integrated	.43 (.37)	.67 (.29)	.91 (.14)	.52 (.38)
Isolated	.29 (.33)	.51 (.37)	.93 (.16)	.69 (.34)
Experiment 3b				
Integrated	.23 (.26)	.42 (.31)	.94 (.11)	.74 (.25)
Isolated	.10 (.17)	.31 (.34)	.94 (.12)	.83 (.18)

CHAPTER 3. EXPERIMENT 1B

Method

Participants. Experiment 1b used the same design as Experiment 1a. Forty-five participants completed this experiment. Five were removed from analyses because English was not their first language. Twenty participants were included in each between-subjects condition (25 male, 15 female). Their mean age was 19.65 ($SD = 2.09$).

Materials and Procedure. Experiment 1b followed the same procedure as Experiment 1a except that the misinformation was presented via misleading questions. The critical details were presented within questions (i.e., one detail per question for a total of 14 questions). Each question queried a noncritical detail in the video (e.g., "Just before the robber fires the *two* warning shots, what was the emergency with one of the employees?"; see Appendix C for a complete list of misinformation and neutral questions). Participants had 30 sec to answer each question. Whether a detail was presented as misled or neutral was counterbalanced so that seven of the details were misled and seven were neutral items.

Results and Discussion

Initial Test

Initial and final test data were coded in the same manner as described in Experiment 1a. See Table 2 for initial test recall probabilities. Not surprisingly, correct recall probability was similar to Experiment 1a ($M = .58$) and spontaneous misinformation recall probability was low ($M = .03$).

Misleading Questions

Responses from the misleading questions were coded as either *correct*, *no answer*, or *other* responses. Misinformation recall was not coded since misinformation was only presented on critical details and not the details queried in the misleading questions. Recall probabilities are presented in Table 5. Tested participants had fewer correct responses ($M = .76$) and more no answers ($M = .08$) than nontested participants ($M = .82$ and $M = .04$ for correct and no responses, respectively), but both differences were only marginally significant, both ts < 1.89, ps $< .09$. These data are consistent with idea that retrieving the critical detail during the initial test made related information less accessible, thus impairing their recall during the misleading questions phase. I examine this idea more thoroughly in the General Discussion.

Table 5

Mean Probabilities (and Standard Deviations) of Correct, No Answer, and Other Recall on the Misleading Questions Test in Experiments 1b

	Correct	No Answer	Other
No-Test	.82 (.07)	.04 (.05)	.14 (.09)
Test	.76 (.15)	.08 (.09)	.17 (.10)

Final Test

Correct Recall. Correct and misinformation recall probabilities are presented in Figure 3. No answer and other responses are presented in Table 3. A 2 (test, no-test) X 2 (postevent information) ANOVA showed no significant interaction or main effects of

testing and postevent information, Fs < 2.32, ps > .13. No simple main effects were significant, either, ts < 1.50, ps > .14. Although the testing effect was not significant, tested participants recalled numerically more correct details for both neutral and misled items.
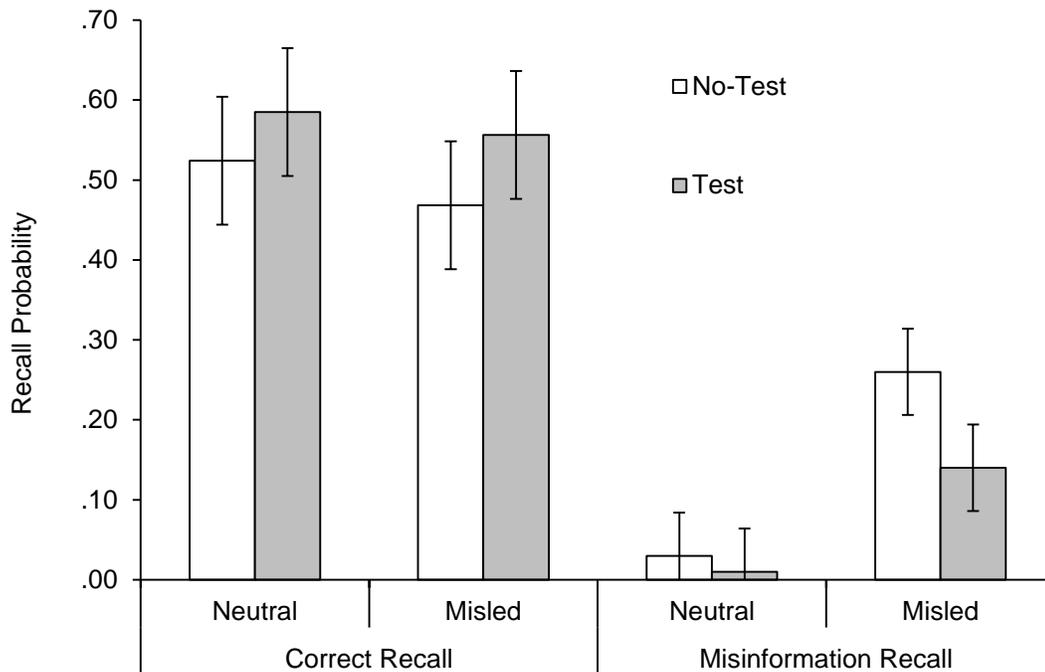
Figure 3. Experiment 1b final test data. Error bars indicate 95% confidence intervals.

Misinformation Recall. As expected, a 2 (test, no-test) X 2 (postevent information) ANOVA revealed a significant misinformation effect with participants reporting more misinformation for the misled items (M = .20) than for the neutral items (M = .02), $F(1, 38) = 44.26$, $p < .01$, $d = 2.16$. The effect of testing was also significant, $F(1, 38) = 8.92$, $p < .01$, $d = .97$, such that overall misinformation recall probability was

higher for nontested participants (M = .14) than for tested participants (M = .07). Most importantly, unlike the results in Experiment 1a, initial testing *reduced* suggestibility for the misled items (M = .14 for tested and M = .26 for nontested), $t(38)$ = 2.40, p = .02, d = .78.

Like Experiment 1a, I examined misinformation recall probabilities for the highly confident responses and again found a protective effect of testing for items contradicted by misinformation (M = .08 for tested participants and M = .26 for nontested participants; see Table 4), $t(37)$ = 2.41, p = .02, d = .78. I also performed a conditional analysis examining final test accuracy depending on initial test. Misinformation recall probability for misled items was very low (M = .10) for the initially correct items but remained quite high for the initially incorrect items (M = .31), $t(18)$ = 2.36, p = .03, d = .76. Moreover, unlike the result in Experiment 1a, presenting misinformation did not reduce final correct recall probability of the initially correct items (M = .93 for neutral and M = .87 for misled), $t(19)$ = 1.39, p = .18.

Summary

Consistent with previous studies (e.g., Chan et al., 2009), Experiment 1a showed that initial testing increased suggestibility when misinformation was presented in a narrative. In contrast, when misinformation was embedded within misleading questions (as in Experiment 1b), not only was the RES effect eliminated, but initial testing *reduced* suggestibility. In the following experiments, I attempted to uncover the factors driving the reversal of the RES effect with misleading questions.

CHAPTER 4. EXPERIMENT 2

To understand why an RES effect emerged with narrative-based misinformation but not with question-based misinformation, I began by identifying the differences between the two presentation methods. One difference that might be critical to suggestibility is the duration with which the misinformation is presented. Specifically, misinformation was presented briefly when it was embedded in an audio narrative (only as long as it took for the misleading detail to be spoken), but it was presented for a full 30 sec in questions (because participants needed time to answer the questions). Experiment 2 was designed to address whether variations in the presentation duration of misinformation affects suggestibility.

To effectively manipulate presentation duration of the misinformation, a *written* instead of an audio narrative was used in Experiment 2. The misinformation narrative was presented either self-paced or experimenter-paced. In the experimenter-paced condition, participants were shown each block of text in the narrative for 30 sec, which matched the duration of the misinformation in Experiment 1b. If the elimination of the RES effect in Experiment 1b was due to participants spending more time thinking about or reading the misinformation, then I expect a similar testing benefit in the experimenter-paced condition and an RES effect in the self-paced condition. When participants spend an extended period of time contemplating the information provided in the narrative or questions, they may engage in more elaborative processing. Indeed, there is evidence that the testing effect occurs because it involves more effortful and elaborative processing than encoding alone (Carpenter, 2009; Chan, 2009; Chan et al., 2006; Pyc & Rawson, 2009). With the extra time afforded by the 30 sec presentation duration, participants

might compare the information presented in the narrative with both what they retrieved in the initial test and what they remember from the video. If these pieces of information do not match, they may become more cognizant of the other information presented in the narrative and reject the misinformation.

Tousignant, Hall, and Loftus (1986) found that instructing participants to read a postevent narrative more slowly reduced the misinformation effect. The authors argued that longer reading times allowed participants to better scrutinize the information provided in the narrative and to detect inconsistencies between the narrative and their memory. Because tested participants likely have better retention of the event, they may be more likely to reject the misinformation in the experimenter-paced condition. Based on this logic, I hypothesized that an RES effect would be obtained in the self-paced condition, but not in the experimenter-paced condition. Alternatively, it is possible that increasing presentation duration of the misinformation could further increase the harmful effects of misinformation. Previous research has demonstrated that repeated exposure to misinformation can increase the misinformation effect (Foster, Huthwaite, Yesberg, Garry & Loftus, 2012; Zaragoza & Mitchell, 1996). Therefore, the RES effect may remain in the experimenter-paced condition; however, overall misinformation recall may be greater in the experimenter-paced condition.

Method

Participants and Design. Experiment 2 used a 2 (test, no-test) X 2 (narrative pacing: self-paced, experimenter-paced) X 2 (postevent information: neutral, misled) mixed design. Initial testing and narrative pacing was manipulated between subjects. Postevent information was manipulated within subjects. One hundred thirty three

participants were recruited for this experiment. Thirteen were excluded from analyses; 11 of whom were not proficient in English, one did not follow instructions, and one because of a computer error. Therefore, all analyses were based on the remaining 120 participants (64 female, 55 male, one chose not to respond). Thirty participants were included in each between-subjects condition. Their mean age was 19.96 ($SD = 3.85$).

Materials and Procedure. The materials and procedure for Experiment 2 were identical to Experiment 1 with the exception of the method in which misinformation was presented. Only a full written narrative was included in this experiment. An RES effect using a self-paced written narrative has been established in two previous studies using two different critical event videos (Gordon & Thomas, 2013; Chan, Wilford, & LaPaglia, unpublished data). The written narrative was identical to the audio narrative presented in Experiment 1a. The narrative was split into 26 blocks of information (Appendix D). The critical details were embedded in 14 of the 26 blocks with the remaining 12 blocks serving as filler information. The critical blocks included information that was provided in the misleading questioning phase in Experiment 1b. One of the misleading questions presented in Experiment 1b was "Just before the robber fires the *two* warning shots, what was the emergency with one of the employees?" In the written narrative of Experiment 2, participants read "Inside the bank, Ruth expresses concern for a woman with asthma who needs her medication. This angers the robber so he grabs Ruth pointing a gun at her once again. He fires *two* warning shots into the ceiling." The critical detail (i.e., the number of shots fired), therefore, was embedded in a block of information that includes the answer to the misleading question (i.e., that the emergency was an asthma attack). Each block was shown on the screen, one at a time. For some participants, this task was

self-paced. Specifically, they advanced to the next block of information by pressing the spacebar twice after they had read through everything on the screen. In the experimenter-paced condition, participants were shown each of the 26 blocks of information for 30 sec per block. This 30 sec time interval was designed to be the same amount of time given to participants to answer each question in Experiment 1b.

Note that the aim of the present experiment was not to equate the narrative with the questions in Experiment 1b; rather, it was to examine whether differences in exposure time of the misinformation can alter the magnitude of the RES effect. To this end, participants in both the self-paced and the experimenter-paced conditions read the same narrative, so the word length of the narrative was not confounded across conditions. Most important for current purposes is that the blocks that included misinformation were presented for longer in the experimenter-paced condition (30 sec) than in the self-paced condition (on average, 10.44 sec were spent reading each block containing misinformation). In addition, participants in the self-paced condition spent, on average, 9.11 and 11.84 sec reading neutral and filler blocks, respectively.

After the final test, participants were asked several follow-up questions (Appendix B). One question asked what strategy participants used during the narrative phase (e.g., simply reading the narrative, visualizing the information, comparing the information in the narrative to their memory of the video, etc.) and another question asked participants if they noticed any incorrect information presented in the narrative.

Results and Discussion

Of primary interest was the interaction between narrative pacing and initial testing for correct and misinformation recall probabilities. As in Experiments 1a and 1b,

planned conditional analyses (i.e., the probability of false recall given initial test accuracy) and analyses regarding only highly confident responses were examined. All analyses regarding the post-experiment questions were exploratory.

Initial Test

Responses were coded in the same manner as Experiment 1. Initial test data are presented in Table 2. Consistent with Experiment 1, spontaneous misinformation recall and blank responses were low ($M = .03$ and $M = .06$, respectively).

Final Test

Correct Recall. Correct recall probabilities are presented in Figure 4. No answer and other recall probabilities are presented in Table 6.
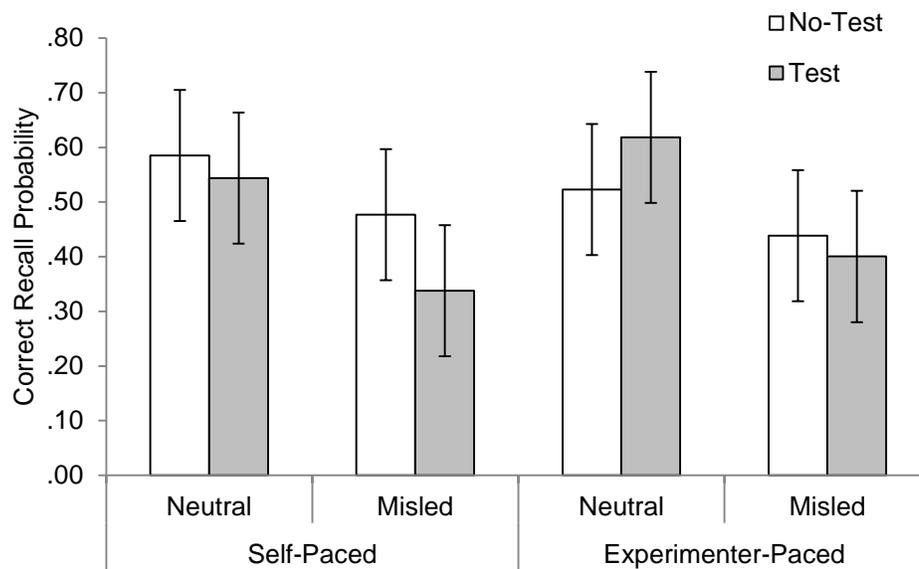
Figure 4. Correct recall probabilities in the final test of Experiment 2. Error bars indicate 95% confidence intervals.

A 2 (test, no-test) X 2 (narrative pacing) X 2 (postevent information) ANOVA revealed a marginally significant interaction between initial testing and narrative pacing, $F(1, 116) = 3.50$, $p = .06$, $d = .34$. That is, tested participants recalled fewer correct details ($M = .44$) than nontested participants ($M = .53$) in the self-paced condition, $t(58) = 2.26$, $p = .03$, $d = .57$, but not in the experimenter-paced condition ($M = .51$ and $M = .48$ for tested and nontested participants, respectively), $t < 1$, $p = .57$.

Table 6

Mean Probabilities (and Standard Deviations) of No Answer and Other Recall in the Final Test of Experiment 2

No Answer

	Self-Paced		Experimenter-Paced	
	No-Test	Test	No-Test	Test
Neutral	.04 (.07)	.04 (.06)	.01 (.04)	.02 (.05)
Misled	.04 (.08)	.02 (.07)	.01 (.04)	.00 (.00)

Other Recall

	Self-Paced		Experimenter-Paced	
	No-Test	Test	No-Test	Test
Neutral	.36 (.15)	.38 (.21)	.43 (.23)	.33 (.18)
Misled	.27 (.17)	.17 (.16)	.25 (.16)	.13 (.16)

There was also a significant interaction between postevent information and initial testing, $F(1, 116) = 4.72$, $p = .03$, $d = .40$, such that tested participants recalled fewer

correct details for the misled items (M = .37) than no-test participants (M = .46), $t(118)$ =

1.99, p = .05, d = .36. There was also a marginally significant testing effect for the

neutral items in the experimenter-paced condition (M = .62 and M = .52 for test and no-

test participants, respectively), $t(58)$ = 1.72, p = .09, d = .46. Overall, correct recall

probabilities were greater for neutral items (M = .57) than misled items (M = .41),

$F(1,116)$ = 33.68, p < .01, d = 1.07.

Misinformation Recall. Misinformation recall probabilities are presented in

Figure 5. A 2 (test, no-test) X 2 (narrative pacing) X 2 (postevent information) ANOVA

was conducted. Not surprisingly, participants reported more misinformation for the

misled items (M = .36) than for the neutral items (M = .03), $F(1, 116)$ = 177.41, p < .01, d

= 2.45. Across both pacing conditions, there was an interaction between initial testing

and postevent information, $F(1, 116)$ = 17.40, p < .01, d = .77; initial testing nearly

doubled misinformation recall probability for misled items (M = .47 for tested

participants and M = .26 for nontested), $t(118)$ = 4.28, p < .01, d = .76, but not for neutral

items, t < 1, p = .71. Although numerically different, there was no significant difference

in misinformation recall of misled items between the self-paced (M = .21) and

experimenter-paced conditions (M = .30) for nontested participants, $t(58)$ = 1.63, p = .11.

As expected, there was an RES effect in the self-paced condition (M = .47 for

tested participants and M = .21 for nontested participants), $t(58)$ = 3.81, p < .01, d = 1.01.

Most importantly for present purposes, an RES effect was also found in the experimenter-

paced condition (M = .47 for tested; M = .30 for nontested), $t(58)$ = 2.31, p = .02, d = .61.

Therefore, longer misinformation presentation duration did not eliminate the RES effect.
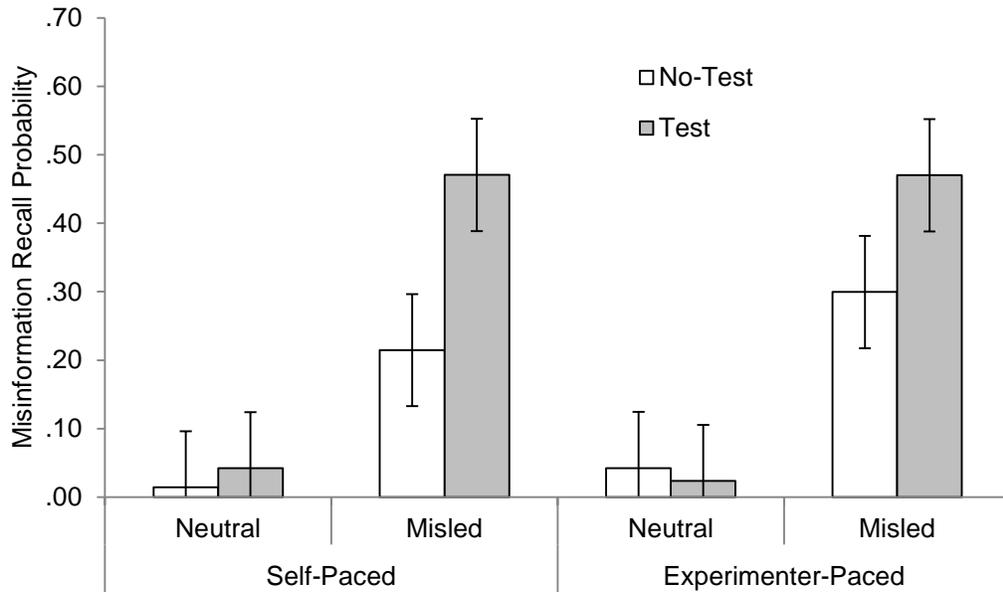
Figure 5. Misinformation recall probabilities in the final test of Experiment 2.

In examining misinformation recall probabilities for the highly confident responses, there was an RES effect in both the self-paced ($M = .49$, $SD = .35$ for tested participants and $M = .22$, $SD = .20$ for nontested participants) and experimenter-paced conditions ($M = .45$, $SD = .36$ for tested participants and $M = .31$, $SD = .27$ for nontested participants), $t(58) = 3.72$, $p < .01$, $d = .95$ and $t(58) = 1.67$, $p = .10$, $d = .44$, respectively. Therefore, the misinformation recall of tested participants was typically accompanied by high confidence judgments.

I performed a conditional analysis to examine final test accuracy depending on whether the participant successfully recalled an item on the initial test (Table 4). Across both pacing conditions, misinformation recall probability was quite high for initially correct ($M = .41$) and the initially incorrect items ($M = .55$), $t(56) = 2.56$, $p = .01$, $d = .26$.

Like Experiment 1a, being able to recall an item correctly during the initial test did not protect participants from the influence of RES, as the misinformation recall probability for these initially-correct items was significantly greater than that of the no-test condition ($M = .26$), $t(115) = 5.08$, $p < .01$, $d = .91$. I again examined the effects of encountering misinformation on retention of the initially correct items. Presenting misinformation dropped correct recall probability on the final test from .91 (neutral items) to .58 (misled items), $t(58) = 6.51$, $p < .01$, $d = .93$.

To examine the effect of reading time in the self-paced condition on misinformation susceptibility, I performed a median split analysis of the response time (RT) data for blocks that included the misinformation and compared slow readers ($M = 13.74$ sec) to fast readers ($M = 7.14$ sec). Although slow readers were numerically less suggestible ($M = .30$; $SD = .27$) than fast readers ($M = .38$; $SD = .31$), this difference was not statistically significant, $t(58) = 1.15$, $p = .25$. Somewhat surprisingly, unlike Gordon and Thomas (2013), tested participants did not spend more time reading blocks that included misinformation compared to nontested participants, $t < 1$, $p = .87$. Gordon and Thomas presented their misinformation narrative sentence-by-sentence whereas misinformation was embedded in larger blocks in the current study which may account for the differences here. Across the test/no-test conditions, participants slowed down when reading blocks that included misinformation ($M = 10.44$ sec, $SD = 4.15$; compared to neutral blocks, $M = 9.11$, $SD = 2.94$), $t(59) = 2.08$, $p = .04$, $d = .37$, likely because blocks that included misinformation contained slightly more words ($M = 35.71$) than neutral blocks ($M = 33.43$).

Post-Experiment Questions

In a post-experiment questionnaire (see Table 7 for probabilities), participants were asked whether they noticed any incorrect information in the narrative. A 2 (initial testing) X 2 (pacing) logistic regression analysis revealed no significant interaction between the variables, $\chi^2 < 1$, $p = .56$. Narrative pacing did not affect whether participants noticed any misinformation, χ^2 (1, $N = 119$) = 1.13, $p = .29$. The nontested participants were more likely to claim to have noticed misinformation (93%; 76% of tested participants noticed the misinformation), χ^2 (1, $N = 119$) = 6.75, $p = .01$, $\varphi = .24$. This post-test question, however, was not very fine grained (i.e., participants were not asked to specify what misinformation they had noticed). Moreover, the question came after the final test and not immediately following the misinformation narrative, so it may have been difficult for participants to think back to the narrative that had occurred more than 30 min prior to the post-experiment question.

I also examined the effect of narrative studying strategies on misinformation recall (as reported in the post-experiment question). Most participants' (119 out of the 120 participants—one participant did not answer the question) responses could be categorized into three broad strategies— simply read the narrative, visualized the video, or compared the narrative to what they remember from the video. Interestingly, participants who indicated that they made some comparison between the video and the narrative were the least suggestible ($M = .30$) compared to those who indicated that they simply read the narrative ($M = .43$) and those who reported visualizing the narrative ($M = .38$), although this difference was not statistically significant, $F(2, 116) = 1.52$, $p = .22$, power = .32.

Table 7

Mean Final Test Misinformation Recall Probabilities (and Standard Deviations) Depending on Narrative Encoding Strategy (Compared Narrative to Memory, Visualized the Narrative, Simply Read the Narrative), Whether Participants Read the Narrative Blocks Multiple Times, and Whether Participants Noticed Any Misinformation in the Narrative in Experiment 2

	Narrative Encoding Strategy			Read Multiple Times		Noticed Misinformation	
	Compared	Visualized	Read	Yes	No	Yes	No
Self-Paced							
No-Test	.24 (.23) n = 9	.22 (.16) n = 16	.17 (.12) n = 5	.19 (.16) n = 15	.24 (.22) n = 15	.22 (.18) n = 27	.19 (.09) n = 3
Test	.25 (.28) n = 8	.57 (.29) n = 15	.48 (.38) n = 6	.34 (.33) n = 13	.57 (.29) n = 16	.37 (.30) n = 21	.70 (.26) n = 8
Experimenter-Paced							
No-Test	.19 (.15) n = 12	.35 (.24) n = 17	.71 (.00) n = 1	.29 (.25) n = 18	.32 (.20) n = 12	.30 (.23) n = 29	.43 (.00) n = 1
Test	.54 (.27) n = 10	.40 (.37) n = 18	.66 (.08) n = 3	.48 (.34) n = 24	.45 (.32) n = 6	.39 (.32) n = 24	.74 (.12) n = 5

Summary

Based on the results from Experiment 2, it can be concluded that increased presentation time of the misinformation cannot account for the test reduced suggestibility found in Experiment 1b. In order to keep the instructions across the narrative and question presentations as similar as possible, there were no specific instructions given to participants that they should spend the entire 30 sec thinking about the information provided in the blocks. These data suggest that participants simply read the block on their screen and waited for the next block to appear. Therefore, providing more time for the task did not equate to a change in encoding strategy.

An increase in misinformation exposure alone did not result in test-reduced suggestibility; however, presenting misinformation in questions may, by design, encourage tested participants to spend more time critically evaluating the information provided. In addition to the retrieval aspect included in the misleading questions, less contextual detail was presented in the questions as compared to the audio narrative in Experiment 1. Whether the misinformation phase included retrieval and additional contextual detail was manipulated in Experiment 3.

CHAPTER 5. EXPERIMENT 3A (MISLEADING NARRATIVE)

One key difference between the misinformation narrative and the misleading questions was that the question-based misinformation showed details in relative isolation. When misinformation was presented in a narrative, it was embedded within a story that was rich in contextual detail. This is often not the case when misinformation is presented in a question. The amount of contextual information presented during the misinformation phase was manipulated in Experiment 3. Loftus (1979) found that people were more likely to reject a piece of misinformation when it was blatantly contradictory (e.g., describing a red wallet, the object that was stolen in a slideshow, as brown). When misinformation is presented in isolation, its contradiction may become more obvious. When embedded in a full narrative, participants may be less able to scrutinize each detail due to the sheer amount of information presented. Alternatively, when misinformation is presented in a full narrative, it may be more believable because information is more persuasive when it is presented in an elaborate narrative than in a list (Adaval & Wyer, 1998; Green & Brock, 2000). Overall, presenting misinformation in isolation should reduce the misinformation effect, especially for tested participants who are more likely to have retained the original event details.

In Experiment 3a, misinformation was either presented in a full narrative that recapitulated the story of the video event (*integrated condition*) or only in sentences that pertained directly to the 14 critical details (*isolated condition*, without filler information). In Experiment 3b, misinformation was either presented in questions embedded in a narrative with filler information (*integrated condition*) or the questions were presented without the narrative filler information (*isolated condition*). Both conditions were

experimenter-paced. I hypothesized that tested participants should be more likely to reject misinformation presented in isolation than nontested participants. However, when misinformation is embedded in a full narrative, testing should enhance suggestibility.

Method

      Participants and Design. Experiment 3a used a 2 (test, no-test) X 2 (contextual detail: isolated, integrated) X 2 (postevent information: neutral, misled) mixed design. Initial testing and contextual detail were manipulated between subjects. Postevent information was manipulated within subjects. A total of 131 participants completed this experiment. Eleven participants were excluded from analyses because seven were not proficient in English, three did not follow instructions, and one due to a computer error. Therefore, all analyses were based on the remaining 120 participants (71 female; mean age = 18.77, SD = 1.16), with 30 in each between-subjects condition.

      Materials and Procedure. Experiment 3a used the same materials and procedure as Experiment 2 with the exception of the misinformation phase. The narrative was presented visually, with sentences presented in blocks (like Experiment 2). However, there were more blocks of information so that the critical detail blocks contain fewer words compared to those in Experiment 2 (see Appendix E). This was done to aid comparison between the data from Experiments 3a and 3b. Specifically, the critical blocks in the narrative were altered so that they were as similar as possible to the misleading questions. For example, in Experiment 1b, regarding the warning shot critical detail, participants were asked "Just before the robber fires the two warning shots, what was the emergency with one of the employees?" In Experiment 2, the critical block read, "Inside the bank, Ruth expresses concern for a woman with asthma who needs her

medication. This angers the robber so he grabs Ruth pointing a gun at her once again. He fires two warning shots into the ceiling." This was altered in Experiment 3 to read, "Inside the bank, Ruth says that a woman with asthma needs her medication. This angers the robber so he fires two warning shots into the ceiling." Therefore, the block included only the critical detail (the number of warning shots) and the related detail inquired by the misleading question (the asthma attack). Participants were given 30 sec to read each block (i.e., the task was experimenter paced). In the isolated condition, only the blocks that included the critical details were presented. Specifically, participants read only 14 blocks of information (i.e., these are presented with an asterisk in Appendix E). In the integrated condition, the filler sentences were included so that all 28 blocks were presented. Note that the only difference between the two conditions was the inclusion of the filler (i.e., contextual) information.

After the final cued recall test, participants completed an unconstrained cued recall test (unconstrained cued recall; also known as modified modified free recall, Barnes & Underwood, 1959). The unconstrained cued recall test contained the same questions as the final test, but participants were instructed to recall details from both the video and the narrative/questions even if the details contradicted each other (see Appendix F for instructions given to participants). Participants were given 30 sec to answer each question and were not asked to specify the source of their recalled details. Their responses were scored in the same way as in the cued recall test, but because the unconstrained cued recall test was designed to elicit multiple responses for the misleading questions, the combined probabilities of Correct, Misinformation, Other, and No Answer could exceed 1. This test was included to examine whether participants remembered both

the details presented in the video and in the narrative and whether the likelihood of remembering each varied with initial testing. If participants encoded the misinformation, but chose to withhold it during the final cued recall test, then misinformation recall probability would be greater in the unconstrained cued recall test than the final test. Note that the unconstrained cued recall test is an exploratory procedure and was contaminated by the final test that immediately preceded it.

Results and Discussion

The main comparison of interest for Experiments 3a and 3b was the interaction between contextual detail and initial testing on later correct and misinformation recall probabilities. Analyses pertaining to post-experiment questions were exploratory in nature.

Initial Test

Initial test data are presented in Table 2 and were coded in the same manner as the previous experiments. Once again, spontaneous misinformation recall probability was very low ($M = .03$).

Final Test

Correct Recall. Correct recall data are presented in Figure 6. No answer and other recall probabilities are presented in Table 8. A 2 (test, no-test) X 2 (contextual detail) X 2 (postevent information) ANOVA revealed a significant misinformation effect with participants recalling fewer correct details for misled items ($M = .39$) than neutral items ($M = .52$), $F(1, 116) = 30.53$, $p < .01$, $d = 1.02$.
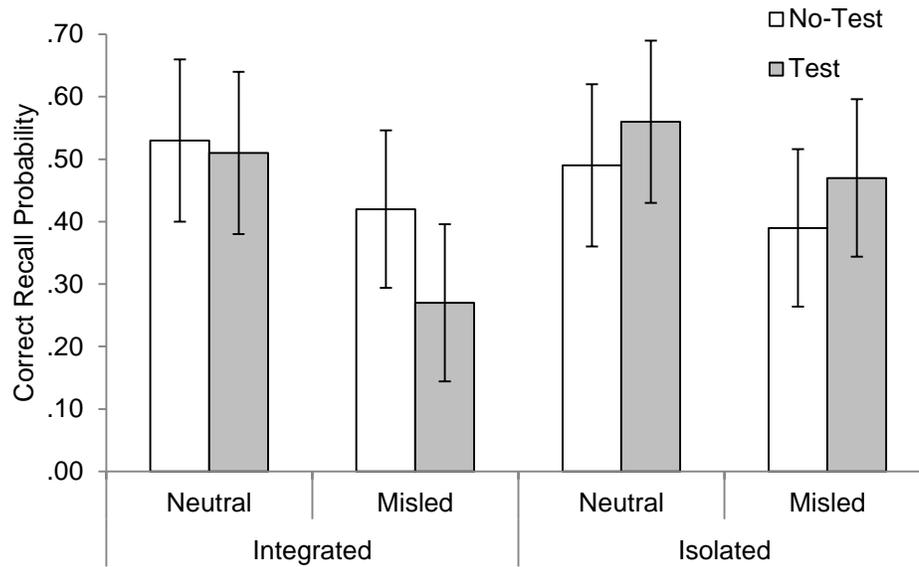
Figure 6. Probability of correct recall on the final test of Experiment 3a (misinformation presented in sentences). Error bars indicate 95% confidence intervals.

There was also a significant crossover interaction between initial testing and contextual detail, $F(1, 116) = 5.49$, $p = .02$, $d = .43$. Testing increased accurate recall probability in the isolated condition, ($M = .51$ for test; $M = .44$ for no-test), $t(58) = 1.50$, $p = .14$, $d = .37$—a non-significant testing effect. Whereas testing reduced accurate recall probability in the integrated condition ($M = .39$ for test; $M = .47$ for no-test), $t(58) = 1.84$, $p = .07$, $d = .48$. No other interactions, main effects, or simple effects were significant.

Table 8

Mean Probabilities (and Standard Deviations) of No Answer and Other Recall in the Final Test of Experiment 3a (Misinformation Presented in Sentences)

No Answer

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.02 (.05)	.04 (.06)	.06 (.07)	.03 (.06)
Misled	.01 (.04)	.01 (.04)	.01 (.04)	.01 (.04)

Other Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.45 (.20)	.43 (.17)	.42 (.20)	.38 (.22)
Misled	.21 (.18)	.19 (.15)	.23 (.25)	.17 (.14)

Misinformation Recall. Misinformation recall probabilities are displayed in Figure 7. A 2 (test, no-test) X 2 (contextual detail) X 2 (postevent information) ANOVA revealed a marginally significant 3-way interaction, $F(1, 116) = 2.95$, $p = .09$, $d = .03$. There was also a marginally significant interaction between postevent information and contextual detail, $F(1, 116) = 3.25$, $p = .07$, $d = .32$. Misinformation recall probability was numerically higher for misled items presented in a full narrative ($M = .44$) than those presented in isolation ($M = .36$), $t(118) = 1.60$, $p = .11$, $d = .30$, whereas no differences were found for neutral items ($M = .01$ and $M = .03$ for integrated and isolated conditions respectively), $t(118) = 1.31$, $p = .19$.

As expected, misinformation presentation increased overall false recall

probability from .02 for neutral to .40 for misled items, $F(1, 116) = 232.40$, $p < .01$, $d =$

2.81—a misinformation effect. Most importantly, when I considered data from the

misled items, the interaction between initial testing and contextual detail was significant,

$F(1, 116) = 4.33$, $p = .04$, $d = .38$. There was an RES effect in the integrated condition

($M = .53$ for test; $M = .36$ for no-test), $t(58)$, $p = .01$, $d = .71$, but not in the isolated

condition ($M = .36$ for test; $M = .37$ no-test), $t < 1$, $p = .83$.
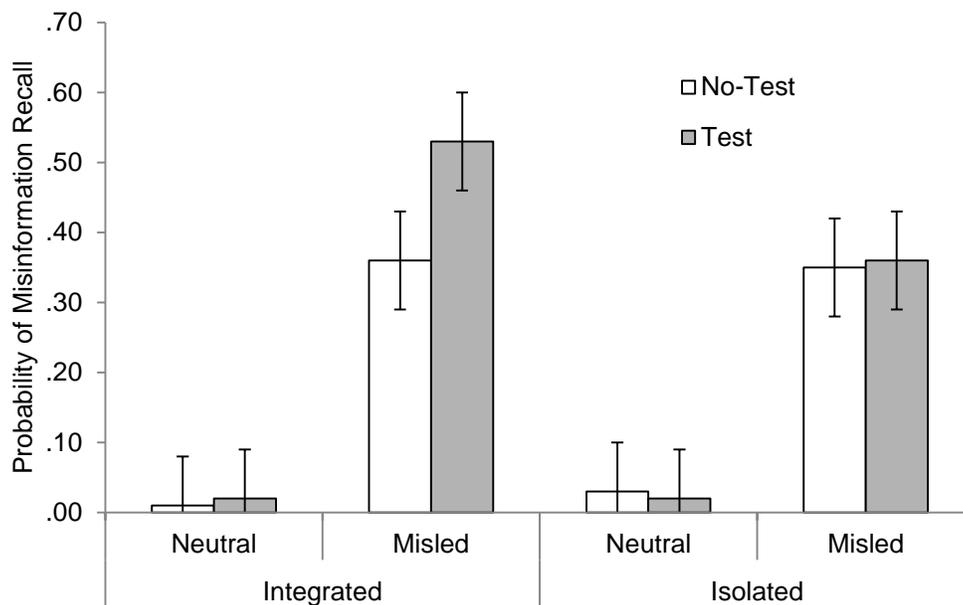
Figure 7. Misinformation recall probability on the final test of Experiment 3a

(misinformation presented in sentences).

I once again examined misinformation recall probability for highly confident

responses (a confidence rating of 4 or 5—"I am sure" or "I am very sure"). Like in

Experiment 1a, the RES effect remained intact even among these highly confident

responses for the integrated narrative condition ($M = .56$, $SD = .34$ for test and $M = .38$,

$SD = .29$ for no-test), $t(57) = 2.17$, $p = .03$, $d = .57$. However, no difference was found in

the isolated condition ($M = .34$, $SD = .33$ for test and $M = .36$, $SD = .30$ for no-test), $t < 1$,

$p = .77$.

To further investigate the effect of initial testing on later suggestibility, a

conditional analysis was conducted to examine final test accuracy depending on whether

participants successfully recalled an item on the initial test (see Table 4). Across both the

integrated and isolated conditions, tested participants were more likely to report the

misinformation on the final test if they were initially incorrect for a given item ($M = .59$)

than otherwise ($M = .36$), $t(56) = 4.42$, $p < .01$, $d = .57$. Like Experiment 1a,

misinformation had a powerful negative effect on retention of initially-correct items,

dropping correct recall probability on the final test from .92 (neutral items) to .52 (misled

items), $t(28) = 6.40$, $p < .01$, $d = 1.52$ in the integrated narrative condition. A similar

result was found in the isolated narrative condition ($M = .93$ for neutral items and $M = .67$

for misled items), $t(28) = 4.04$, $p < .01$, $d = .82$.

Unconstrained Cued Recall Test

Correct, misinformation, no answer, and other recall probabilities are displayed in

Table 9. Data from the unconstrained cued recall test were essentially the same as the

final test except that overall recall probabilities were slightly higher because participants

were free to respond with multiple answers to the questions. There was a significant

interaction between postevent information and contextual detail, $F(1, 116) = 8.77$, $p <$

.01, $d = .55$. Specifically, there was an RES effect in the integrated condition ($M = .57$

Table 9

Mean Probabilities (and Standard Deviations) of Correct, Misinformation, No Answer, and Other Recall in the Unconstrained Cued Recall Test in Experiment 3a (Misinformation Presented in Sentences)

Correct Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.57 (.22)	.58 (.21)	.50 (.21)	.56 (.21)
Misled	.49 (.23)	.42 (.26)	.50 (.24)	.58 (.27)

Misinformation Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.06 (.09)	.04 (.08)	.07 (.09)	.08 (.11)
Misled	.57 (.28)	.70 (.22)	.50 (.26)	.52 (.30)

No Answer

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.01 (.04)	.03 (.06)	.03 (.06)	.02 (.05)
Misled	.01 (.04)	.01 (.04)	.00 (.03)	.00 (.03)

Other Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.50 (.21)	.46 (.19)	.51 (.19)	.43 (.19)
Misled	.29 (.18)	.28 (.21)	.33 (.21)	.24 (.17)

for nontested and $M = .70$ for tested), $t(58) = 2.04$, $p = .05$, $d = .52$, but not in the isolated

condition, $t < 1$, $p = .76$.

Post-Experiment Questions

See Table 10 for data from the post-experiment questionnaire. Participants were

asked to describe their encoding strategy during the narrative. Like Experiment 2,

participants who indicated that they made comparison between the video and the

narrative were less suggestible ($M = .27$) than participants who reported simply reading

the narrative ($M = .48$) and visualizing the video ($M = .46$), $F(2, 113) = 6.86$, $p < .01$.

Summary

Experiment 3a revealed that presenting misinformation in an isolated manner

eliminated the RES effect. One prediction made was that misinformation presented in

isolation would be easier to reject, particularly by tested participants who have a stronger

event memory. If tested participants are encoding the misinformation, but choosing not

to report it on the final test, then an RES effect would emerge in unconstrained cued

recall test data. If, however, tested participants noticed the misinformation and

immediately stopped rehearsal of that information (in an effort to prevent later false

recall), then they should recall the misinformation less often in the unconstrained cued

recall test. The unconstrained cued recall test data showed that tested participants

recalled the misinformation at a lower rate when it was presented in isolation compared

to when it was integrated into a full narrative (the integrated/isolated nature of the

misinformation phase did not affect misinformation recall of nontested participants).

Unfortunately, it is impossible to make strong conclusions from these data because the

unconstrained cued recall test was contaminated by the final test that preceded it.

Table 10

Mean Final Test Misinformation Recall Probabilities (and Standard Deviations) Depending on Narrative Encoding Strategy (Compared Narrative to Memory, Visualized the Narrative, Simply Read the Narrative), Whether Participants Read the Narrative Blocks Multiple Times, and Whether Participants Noticed Any Misinformation in the Narrative in Experiment 3a (Misinformation Presented in Sentences)

	Narrative Encoding Strategy			Read Multiple Times		Noticed Misinformation	
	Compared	Visualized	Read	Yes	No	Yes	No
Integrated							
No-Test	.22 (.16) n = 9	.44 (.25) n = 19	.22 (.11) n = 2	.36 (.25) n = 4	.36 (.18) n = 26	.33 (.21) n = 28	.79 (.30) n = 2
Test	.53 (.41) n = 3	.51 (.21) n = 20	.57 (.26) n = 7	.55 (.24) n = 28	.29 (0) n = 2	.52 (.25) n = 25	.57 (.20) n = 5
Isolated							
No-Test	.33 (.21) n = 9	.45 (.31) n = 15	.25 (.29) n = 4	.40 (.27) n = 26	.22 (.27) n = 4	.37 (.27) n = 27	.38 (.36) n = 3
Test	.20 (.24) n = 14	.40 (.32) n = 9	.66 (.21) n = 5	.37 (.32) n = 25	.28 (.25) n = 5	.29 (.27) n = 26	.78 (.15) n = 4

CHAPTER 6. EXPERIMENT 3B (MISLEADING QUESTIONS)

Method

Participants. Experiment 3b used the same design as Experiment 3a. A total of 131 participants completed this experiment. Eleven participants were excluded from analyses; six were not proficient in English, three did not follow instructions, one had participated in a similar experiment previously, and one because of computer error. Therefore, all analyses were based on the remaining 120 participants (60 female; mean age = 19.20, SD = 2.22), with 30 in each between-subjects condition.

Materials and Procedure. Experiment 3b used the same materials and procedure as Experiment 3a with the exception of the misinformation phase. In the isolated condition, misleading questions were presented in the same way as in Experiment 1b. In the integrated condition, participants saw the same questions, except that the questions were embedded in an experimenter-paced written narrative (see Appendix G). Participants were given 30 sec to read each block and answer each question. Like Experiment 3a, this experiment also included an unconstrained cued recall test.

Results and Discussion

Initial Test

Initial test data are presented in Table 2 and were coded in the same manner as the previous experiments. Once again, spontaneous misinformation recall probability was low (M = .02).

Misleading Questions Phase

Responses from the misleading questions were coded as either *correct*, *no answer*, or *other* responses. Recall probabilities are presented in Table 11. In Experiment 1b, tested participants recalled marginally fewer correct details than nontested participants during the misleading question phase, which can be interpreted as a retrieval-induced forgetting effect. However, in the present experiment, there was no difference in correct recall probability between tested and nontested participants in the isolated or integrated condition, $ts < 1.41$, $ps > .16$. Clearly, these results differ from those in Experiment 1b. I discuss this difference more thoroughly in the General Discussion.

Intriguingly, there was a significant effect of contextual detail, such that embedding questions in a narrative facilitated correct recall ($M = .82$ for integrated, $M =$

Table 11

Mean Probabilities (and Standard Deviations) of Correct, No Answer, and Other Recall on the Misleading Questions Test in Experiments 3b

Integrated

	Correct	No Answer	Other
No-Test	.80 (.13)	.03 (.06)	.17 (.10)
Test	.84 (.11)	.04 (.05)	.12 (.09)

Isolated

	Correct	No Answer	Other
No-Test	.71 (.14)	.01 (.03)	.28 (.14)
Test	.70 (.11)	.04 (.06)	.25 (.10)

.71 for isolated), $t(118) = 4.90$, $p < .01$, $d = .88$. The added contextual detail may have

assisted in reinstating the context of the event, thus providing additional retrieval cues

and enhancing recall. Indeed, mental, verbal, and physical context reinstatement have

been shown to improve eyewitness recall and recognition performance (Dando, Wilcock,

& Milne, 2009; Malpass & Devine, 1981; Smith & Vela, 1992).

Final Test

Correct Recall. Figure 8 displays the correct recall probabilities. Table 12

shows no answer and other recall probabilities.
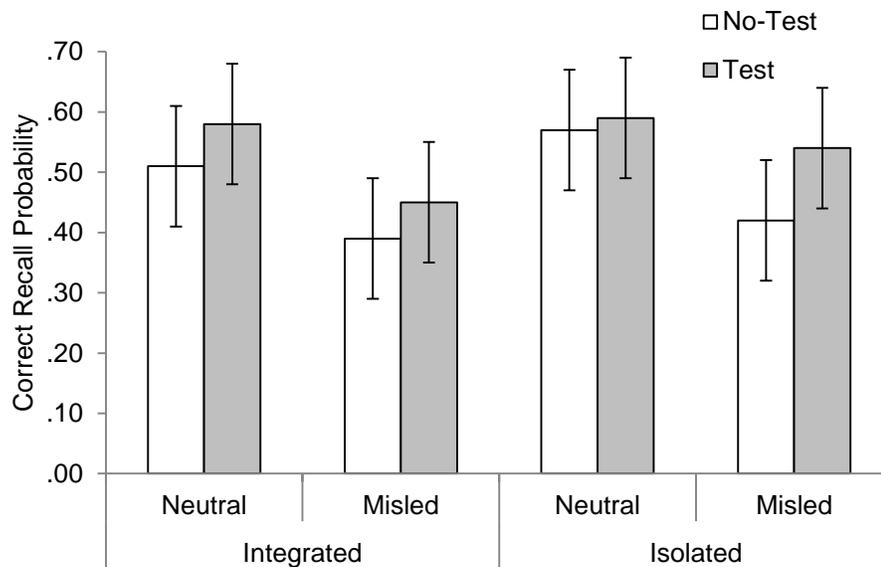
Figure 8. Correct recall probabilities in the final test of Experiment 3b (misinformation

presented in questions). Error bars indicate 95% confidence intervals.

A 2 (test, no-test) X 2 (contextual detail) X 2 (postevent information) ANOVA showed

no significant interactions. There was, however, a significant testing effect ($M = .53$ for

test; $M = .47$ for no-test), $F(1, 116) = 5.41$, $p = .02$, $d = .43$. Moreover, presenting

misinformation reduced correct recall probability from .56 for neutral items to .45 for

misled items, $F(1, 116) = 24.44$, $p < .01$, $d = .91$.

Table 12

Mean Probabilities (and Standard Deviations) of No Answer and Other Recall in the Final Test of Experiment 3b (Misinformation Presented in Questions)

No Answer

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.05 (.09)	.03 (.06)	.02 (.05)	.02 (.06)
Misled	.04 (.06)	.03 (.06)	.06 (.07)	.01 (.04)

Other Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.40 (.21)	.36 (.15)	.35 (.19)	.36 (.23)
Misled	.33 (.19)	.17 (.15)	.20 (.16)	.26 (.18)

Misinformation Recall. Misinformation recall probabilities are displayed in

Figure 9. There was a significant 3-way interaction between postevent information,

initial testing, and contextual detail, $F(1, 116) = 6.66$, $p = .01$, $d = .48$. Not surprisingly,

there was a significant misinformation effect, such that misinformation recall probability

was higher for misled items ($M = .28$) than for neutral items ($M = .04$), $F(1, 116) =$

109.38, $p < .01$, $d = 1.93$. Most important for current purposes, there was a crossover interaction between testing and contextual detail, $F(1, 116) = 10.97$, $p < .01$, $d = .61$. For misled items, initial testing increased suggestibility when misinformation was presented via questions embedded within a narrative ($M = .36$ for tested and $M = .24$ for nontested participants; an RES effect), $t(58) = 2.47$, $p = .02$, $d = .67$. However, replicating the results from Experiment 1b, testing reduced suggestibility when misinformation was presented via questions isolated from their context ($M = .19$ for tested and $M = .32$ for nontested) – a testing effect, $t(58) = 2.01$, $p = .05$, $d = .53$.
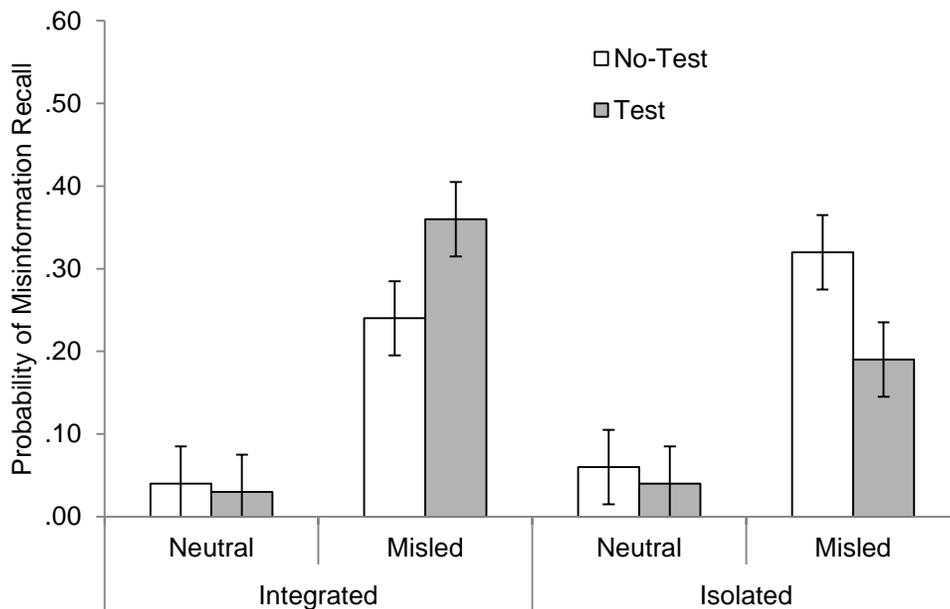

Figure 9. Misinformation recall probability in the final test of Experiment 3b (misinformation presented in questions). Error bars indicate 95% confidence intervals.

In examining only highly confident responses, an RES effect remained for the integrated condition ($M = .37$, $SD = .28$ for tested and $M = .28$, $SD = .17$ for nontested), though this difference was not statistically significant, $t(55) = 1.48$, $p = .14$, power $= .42$. Replicating the results from Experiment 1b, a testing effect was observed for highly confident responses in the isolated condition ($M = .16$, $SD = .25$ for tested and $M = .37$, $SD = .31$ for nontested), $t(57) = 2.87$, $p < .01$, $d = .75$.

To further investigate the effect of initial testing on later suggestibility, I performed a conditional analysis to examine final test performance depending on whether the participant successfully recalled an item on the initial test. In the integrated condition, participants were less likely to report misinformation if they had been initially correct on an item ($M = .23$, $SD = .26$) than otherwise ($M = .48$, $SD = .31$), $t(28) = 3.14$, $p < .01$, $d = .64$. The same pattern was found in the isolated condition ($M = .10$, $SD = .17$ for initially correct items and $M = .31$, $SD = .34$ for initially incorrect items), $t(28) = 3.82$, $p < .01$, $d = .84$. The effect of misinformation on initially correct items was also examined. In the integrated condition, presenting misinformation reduced correct recall from .94 ($SD = .11$; neutral items) to .74 ($SD = .25$; misled items), $t(29) = 4.14$, $p < .01$, $d = .79$. A similar effect was found in the isolated condition ($M = .94$, $SD = .12$ for neutral and $M = .83$, $SD = .18$ for misled items), $t(29) = 2.95$, $p < .01$, $d = .60$.

Table 13

Mean Probabilities (and Standard Deviations) of Correct, Misinformation, No Answer, and Other Recall in the Unconstrained Cued Recall Test of Experiment 3b (Misinformation Presented in Questions)

Correct Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.54 (.20)	.59 (.19)	.53 (.21)	.58 (.19)
Misled	.44 (.19)	.51 (.20)	.48 (.21)	.60 (.18)

Misinformation Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.11 (.16)	.07 (.10)	.08 (.09)	.08 (.10)
Misled	.33 (.21)	.46 (.19)	.33 (.27)	.33 (.27)

No Answer

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.03 (.07)	.03 (.06)	.03 (.08)	.02 (.05)
Misled	.02 (.05)	.03 (.07)	.04 (.06)	.02 (.06)

Other Recall

	Integrated		Isolated	
	No-Test	Test	No-Test	Test
Neutral	.49 (.20)	.40 (.21)	.47 (.21)	.44 (.20)
Misled	.43 (.21)	.26 (.16)	.33 (.20)	.33 (.16)

Unconstrained Cued Recall Test

Correct, no answer, and other recall probabilities are displayed in Table 13. Data from the unconstrained cued recall test were essentially the same as the final test except that overall recall probabilities were slightly higher. Like the final test, there was an RES effect in the integrated questions condition ($M = .46$ for tested and $M = .33$ for nontested), $t(58) = 2.50$, $p = .02$, $d = .65$, but not in the isolated condition, $t < 1$, $p = 1$.

Post-Experiment Questions

See Table 14 for data from the post-experiment questionnaire. Participants who indicated that they made some comparison between the video and the misleading questions were less suggestible ($M = .08$) than participants who simply read the narrative ($M = .25$) and those who reported visualizing the video ($M = .29$), $F(2, 113) = 3.12$, $p = .05$. It is unclear whether participants who made comparisons between the narrative and the video were less suggestible specifically because they used this strategy or if detection of a misleading detail caused them to employ this strategy.

A post-experiment question asked participants whether they had noticed any misinformation in the narrative phase. A 2 (contextual detail) X 2 (test, no-test) logistic regression analysis revealed a significant interaction, $\chi^2 (1, N = 120) = 5.74$, $p = .02$. In the isolated condition, 87% of tested participants and 40% of nontested participants claimed to have noticed misinformation in the questions, $\chi^2 (1, N = 60) = 14.07$, $p < .01$, $\varphi = .48$. However, there was no such difference in the integrated condition (60% of tested and 53% of nontested participants), $\chi^2 < 1$, $p = .60$. These data lend support to the idea that isolated misinformation may increase conflict detection for tested participants.

Table 14

Mean Final Test Misinformation Recall Probabilities (and Standard Deviations) Depending on Narrative Encoding Strategy (Compared Narrative to Memory, Visualized the Narrative, Simply Read the Narrative), Whether Participants Read the Narrative Blocks Multiple Times, and Whether Participants Noticed Any Misinformation in the Narrative in Experiment 3b (Misinformation Presented in Questions)

	Narrative Encoding Strategy			Read Multiple Times		Noticed Misinformation	
	Compared	Visualized	Read	Yes	No	Yes	No
Integrated							
No-Test	.14 (.15) n = 3	.29 (.14) n = 21	.14 (.09) n = 6	.25 (.15) n = 28	.22 (.11) n = 2	.21 (.15) n = 16	.29 (.13) n = 14
Test	.14 (.00) n = 1	.36 (.20) n = 22	.36 (.27) n = 6	.32 (.19) n = 21	.44 (.24) n = 9	.29 (.20) n = 18	.45 (.19) n = 12
Isolated							
No-Test	.00 (.00) n = 0	.31 (.29) n = 25	.24 (.09) n = 3	.39 (.30) n = 17	.23 (.22) n = 13	.29 (.24) n = 12	.34 (.30) n = 18
Test	.00 (.00) n = 3	.20 (.20) n = 23	.24 (.41) n = 3	.20 (.21) n = 21	.17 (.22) n = 9	.17 (.20) n = 26	.32 (.30) n = 4

Summary

Experiments 3a and 3b revealed that the amount of contextual detail present during misinformation exposure interacts with initial testing. Specifically, when many contextual details are included in the misinformation phase, initial testing enhances suggestibility. However, when few contextual details are present, initial testing can reduce misinformation recall probabilities (Experiment 3b) or have virtually no effect on later suggestibility (Experiment 3a) and increase accurate recall probabilities. I describe some potential explanations for these findings in the General Discussion.

CHAPTER 7. GENERAL DISCUSSION

In this dissertation, I sought to understand potential boundary conditions of the RES effect. Specifically, I examined whether prior retrieval would enhance suggestibility when misinformation was presented in questions or a narrative (Experiment 1). Consistent with previous studies, when misinformation was presented in a narrative, initial testing exacerbated the misinformation effect (e.g., Chan et al., 2009). However, when misinformation was embedded in questions that inquired about other details, initial testing reduced suggestibility. I identified three differences between the narrative and question presentations that may account for these disparate findings. First, misinformation was presented for a full 30 seconds during the misleading questions but only briefly in the audio narrative. This possibility was addressed in Experiment 2. Second, additional contextual details were included in the narrative that were not present in the misleading questions; and third, the misleading questions involved a retrieval component whereas no retrieval was necessary in the narrative. These possibilities were addressed in Experiments 3a and 3b.

In Experiment 2, misinformation presentation duration was manipulated in a self-paced or experimenter-paced procedure. I found that the length of the misinformation presentation had no effect on RES. Misinformation was embedded in a narrative in Experiment 3a and in questions in Experiment 3b. In these experiments, I manipulated whether the misinformation phase included many contextual details (integrated condition) or very few contextual details (isolated condition). In Experiment 3a, an RES effect was observed in the integrated condition, but not in the isolated condition (there was, however, a testing effect in accurate recall). In Experiment 3b, there was once again

an RES effect in the integrated condition, but a testing benefit emerged in the isolated

condition. In the following sections, I elaborate on the main findings of this dissertation.

Experiment 1: Retrieval-Reduced Suggestibility with Questions

I hypothesized that testing might reduce suggestibility when misinformation is

presented in questions because attempting to answer a question may cause participants to

retrieve other related information in memory. The tested participants, then, would be

more likely than the nontested participants to notice the inconsistencies between what

they remembered from the witnessed event (or what they had recalled in the initial test)

and the information presented in the misinformation phase. Consistent with this

hypothesis, tested participants recalled fewer misleading details on the final test than

nontested participants. A conditional analysis revealed that when misinformation was

presented in questions, tested participants were able to reject the misinformation only for

items that were correctly recalled during the initial test. This finding suggests that tested

participants were in fact detecting a conflict and that this conflict detection was primarily

driven by people comparing their memory of what was recalled on the initial test with the

misinformation.

In Experiment 1a, the misinformation was presented in a story-like audio

narrative that recapped much of the witnessed event in order to keep the experimental

design as similar as possible to previous RES studies (e.g., Chan et al., 2009). The

misleading questions in Experiment 1b, on the other hand, were presented in a similar

manner as previous studies in which initial testing reduced suggestibility (e.g., Pansky &

Tenenboim, 2011). In this case, questions were presented visually and participants were

given 30 sec to answer each question. In contrast to the narrative, these questions

appeared without any contextual information about the witnessed event. Because the RES effect has been demonstrated in a written narrative presented visually (see Gordon & Thomas, 2013), it is unlikely that differences in modality alone contributed to the testing/misinformation interaction. However, the amount of time that the misinformation was presented, the level of contextual detail, and whether the misinformation phase involved a retrieval component could have contributed to the elimination of the RES effect in Experiment 1b. These differences were examined in Experiments 2 and 3.

Experiment 2: Misinformation Pacing

In Experiment 2, I manipulated whether the misinformation narrative was self-paced or experimenter-paced. I hypothesized that providing participants with additional time on the narrative might result in an elimination of the RES effect. The logic was that tested participants may utilize the additional time to recall the information they had retrieved during the initial test and thereby notice the discrepancy between the narrative and the event. However, the results indicate that narrative presentation duration had no effect on RES. Rather, an RES effect remained in both the self-paced and experimenter-paced conditions. Therefore, the misinformation exposure time likely did not contribute to the testing effect observed when misinformation was presented in questions in Experiment 1b. The self-paced procedure yielded enough time for participants to process the information in each block.

An RES effect may have remained in the experimenter-paced condition because participants simply read the information on the screen and then waited for the next block to appear (as opposed to using the extra time to engage in more elaborative processing). Another possibility is that participants might have simply read blocks multiple times until

a new block appeared on the screen. If this was the case, then an alternative experiment may better suit this strategy. Participants could hear the narrative several times (compared to a group who only hears it once). This would then mimic the strategy of reading the information over and over. Approximately 58% of participants (28 in the self-paced condition and 42 in the experimenter-paced condition) reported reading some (or all) blocks more than once. Note that more participants in the experimenter-paced condition claimed to have read the blocks more than once. Intriguingly, self-paced participants who claimed to have read the blocks more than once were less suggestible ($M = .26$) compared to participants who only read the block once ($M = .41$), $t(57) = 2.00$, $p = .05$. Experimenter-paced participants, however, were just as suggestible regardless of how many times they read the blocks, $t < 1$, $p = .72$. Perhaps self-paced participants who read blocks more than once did so because they detected a conflict; experimenter-paced participants, however, may have done so to fill time.

A more fine-grained question asking participants how many times they read each block following each trial might have revealed more information about the differences between the self-paced and experimenter-paced conditions. In addition, a question asking how often they read the sentences multiple times may have clarified these results. The question asked participants if they read *any* of the sentences more than once. Some participants might have done so for one or two blocks whereas others might have implemented that strategy for all blocks of information. Another potential contributor to an RES effect with a narrative (Experiment 1a) and a testing effect with questions (Experiment 1b) was the amount of filler information included in the misinformation phase which was examined in Experiment 3.

Experiment 3: Misinformation and Contextual Detail

To address the question of how contextual detail and retrieval at misinformation exposure affect suggestibility, I manipulated whether the misinformation phase included many or few contextual details and whether misinformation was embedded in a narrative or questions in Experiment 3. Presenting misinformation in isolation (with minimal contextual information) resulted in an elimination of the RES effect. However, including many contextual details (in the integrated condition) resulted in RES regardless of whether misinformation was presented via a narrative or questions. As described in the introduction, several studies adopting a paradigm similar to that of previous RES studies found testing to reduce suggestibility (Table 1). For example, LaPaglia and Chan (2012) found that describing a perpetrator resulted in less suggestibility (in both recall and recognition). Besides the apparent difference in stimuli, the misinformation in this study was presented in a narrative that lasted only about 20 sec and therefore did not include many contextual details. Likewise, Huff et al. (2013) presented misinformation in word lists (and therefore no contextual details were present) and found that retrieval reduced suggestibility. Misleading questions, by design, contain few contextual details. This may have contributed to Pansky and Tenenboim (2011) and Saunders and MacLeod's (2002) findings that initial testing reduced suggestibility for misinformation presented in questions. In the following section, I offer several possible explanations as to what contributed to the interaction between initial testing and contextual detail.

Discourse Comprehension and Narrative Persuasion

In the comprehension of discourse, people use the information provided in a narrative to make inferences about what will happen next, the motives of the characters,

etc. (Graesser, Millis, & Zwaan, 1997; Zwaan & Radvansky, 1998). When less information is provided in the narrative, the reader must make more inferences (i.e., information must be "filled in" so that the narrative is easy to understand; Emberson, Lupyan, Goldstein, & Spivey, 2010). In the integrated condition, many of the events that took place in the video were provided in the narrative. In the isolated condition, half of the blocks of information were removed; thus participants may have been inclined to mentally fill in the missing information. Retrieving these missing details could facilitate retrieval of other details (Chan, 2009) and put participants into a retrieval mode when they are reading the critical sentences—thus increasing the likelihood of detecting the misinformation. When tested participants fill in the missing information, they can rely on their memory for both the video and the information retrieved during the initial test (whereas nontested participants can only rely on the former); therefore, correcting the misinformation may come easier to the tested participants than the nontested participants.

Previous research has shown that elaborate narratives containing many details are not only easier to understand, but also tend to be more persuasive compared to information presented in a list format (perhaps because the information is easier to follow; Adaval & Wyer, 1998; Green & Brock, 2000). Green and Brock examined how transportation into a narrative affected both feelings about the narrative and one's ability to detect discrepancies in the narrative. Transportation was defined as the vividness of the images that come to mind while reading a narrative, relevance to the reader's life, emotionality of the narrative, etc. (as measured by self-report). In their study, participants read various stories. One group of participants was asked to become immersed in the story (narrative transportation condition), another group was told to

focus on surface aspects of the story (evaluate whether the story is appropriate for a fourth grade reading level; surface condition), and a third group was simply told to read the story (control condition). In addition, all participants were instructed to circle any information in the story that they believed to be false (i.e., something that contradicts a fact or does not make sense). Participants who were highly transported into the narrative (i.e., they claimed to be immersed into the story) circled fewer falsehoods than participants who were not transported into the story. Overall, participants in the narrative transportation condition were more accepting of the story and rated it as more authentic. Green and Brock suggest that this occurs because participants who were transported into the narrative altered their real-world beliefs to match the beliefs in the story-world.

Relating the findings of Green and Brock (2000) to the current study, presenting misinformation in a narrative rich in contextual detail may increase the likelihood that participants become transported into the narrative and thus less able to detect misinformation. Because initial testing enhances learning of misinformation (Gordon & Thomas, 2013), an RES effect occurs. When few contextual details are present and the narrative lacks the flow of a story, it is more difficult for participants to be transported into the narrative, making it less persuasive. When provided with a less persuasive narrative, tested participants may engage in a different encoding strategy (e.g., comparing the narrative/questions to their responses in the initial test) which may make them more able to notice the inconsistencies in the narrative. Indeed, in Experiment 3a, more participants in the integrated condition reported that they imagined the scenes during the narrative (65%) than in the isolated condition (38%), χ^2 (1, $N = 116$) = 5.72, $p = .02$, $\varphi = .22$. This same effect, however, was not found in Experiment 3b when misinformation

was embedded in questions (75% in the integrated and 84% in the isolated condition reported imagining the scenes of the narrative), χ^2 (1, $N = 116$) = 2.20, $p = .14$, perhaps because many used imagery to answer the misleading questions. In terms of the reported use of the comparison encoding strategy, the interaction between initial testing and contextual detail was significant in Experiment 3a, χ^2 (1, $N = 116$) = 5.26, $p = .02$. Specifically, tested participants were more likely to claim to compare the narrative to their memory for the video if the narrative contained fewer contextual details (50%) than when the narrative contained many contextual details (10%), χ^2 (1, $N = 58$) = 11.18, $p <$ .01, $\varphi = .44$. There was no difference, however, between the integrated (30%) and isolated (32%) conditions for nontested participants, $\chi^2 < 1$, $p = .86$. This interaction was not found in Experiment 3b when misinformation was embedded in questions, $\chi^2 < 1$, $p =$ 1, perhaps because participants were confused about the question which asked if they noticed any incorrect information in the questions (which could refer to the initial test, final test, or misleading questions).

As potential evidence that transportation might have affected suggestibility in the current paradigm, I found that visualizing the narrative at encoding increased suggestibility. Specifically, in Experiment 3a, participants were more suggestible had they reported visualizing the information presented during the misinformation phase ($M =$ .46) than had they reported a different strategy (i.e., simply reading the narrative or comparing the narrative to the video; $M = .34$), $t(114) = 2.32$, $p = .02$, $d = .44$. The same effect was found when misinformation was presented in questions (Experiment 3b; $M =$ .29 for those who visualized the narrative and $M = .20$ for those who reported another strategy), $t(114) = 1.81$, $p = .07$, $d = .41$, suggesting that visualization (an aspect of

transportation) is an important component in the induction of false memories (Garry, Manning, & Loftus, 1996; Hyman & Pentland, 1996; Lindsay, Hagen, Read, Wade, & Garry, 2004; Mazzoni & Memon, 2003).

The idea that more contextual detail results in greater transportation into a narrative, and thus greater suggestibility seems to be a viable explanation for these data. This account could be tested in a future experiment in which participants complete a transportation measure following a (within-subjects) RES paradigm. A comparison of self-reported highly transported individuals and non-transported individuals might reveal an RES effect for the transported participants and a reversal or null effect for the non-transported participants. Alternatively, it may be that the sheer amount of information at misinformation exposure is what is driving the contextual detail by testing interaction.

Information Overload and Source Credibility

The primary difference between the integrated and isolated conditions was that there was simply more information in the integrated condition. It may be that the amount of information presented during the misinformation phase, as opposed to narrative transportation, determines whether testing reduces or enhances suggestibility. In the integrated condition, there may be too much information to monitor the veracity of each detail presented. Moreover, even when a conflict is detected, it may be more difficult to remember which detail was presented incorrectly because there is more information interfering with that memory. Tested participants may simply encode the misinformation better than nontested participants (Attention Capture Hypothesis; Gordon & Thomas, 2013), thus resulting in an RES effect with a lengthy narrative. However, when very few contextual details are present, it is easier for tested participants to detect the conflict

between the narrative/questions and the critical event video or their responses during the initial test because there are fewer details that could potentially interfere with their memory for these conflicts.

Alternatively, more contextual details may make the narrative appear more credible. Indeed, previous research has shown that mock jurors are more inclined to believe eyewitness testimony when the witness describes the event in a greater degree of detail (Bell & Loftus, 1988; 1989). If the credibility of the narrative is called into question, it is likely that participants will alter their encoding strategy while reading the narrative.

To address whether the amount of information is the important factor for the testing/contextual detail interaction, one can manipulate whether the narrative blocks are presented in a chronological or random order. Embedding the misinformation in a random-ordered narrative should reduce the transportative nature of the narrative (because the story would not flow in the order that the events had occurred) and interrupt natural discourse comprehension, but not the amount of information presented. Therefore, if an RES effect remains when misinformation blocks are presented in a random order, it is likely that the amount of information, and not the transportative nature of the narrative that determines whether initial testing increases or reduces misinformation recall probabilities. Data collection for this experiment is currently underway.

Experiment 2 may also shed light on the feasibility of the idea of information overload contributing to the RES effect in integrated misinformation presentation (and not in the isolated condition). Specifically, providing participants with more time per

block of information should reduce the cognitive load of the task (Mayer & Chandler, 2001), thus reducing suggestibility. However, because Experiment 2 showed an RES effect regardless of presentation duration, this possibility might be ruled out.

Question and Narrative-based Misinformation

Although the amount of contextual detail altered whether initial testing increased or reduced suggestibility, the presentation of misinformation in the form of questions or a narrative also affected suggestibility. Across Experiments 3a and 3b, misinformation recall probability for misled items was greater when misinformation was presented in a narrative ($M = .44$) than when it was presented in misleading questions ($M = .27$), $t(118) = 3.59$, $p < .01$, $d = .66$. When this comparison was made for only the nontested participants, the effect remained ($M = .36$ for narrative and $M = .28$ for questions), but was only marginally significant, $t(118) = 1.91$, $p = .06$, $d = .33$.

A majority of previous studies have found greater suggestibility with misleading questions than narratives (e.g., Saunders, 2009; Zaragoza & Lane, 1994). These studies differed in the level of contextual detail presented during the misinformation phase. For instance, Saunders compared an integrated narrative to isolated questions and found greater suggestibility for questions with central, but not peripheral details—the current study used primarily peripheral details. Zaragoza and Lane included many contextual details in their presentation of misinformation for both the narrative and questions, but the final test was source recognition whereas the current study used recall. As I described in the introduction, findings regarding how misleading questions and narratives affect suggestibility are mixed (Gobo, 2000; Zaragoza & Lane, 1994). It is unclear why the methods of the current study produced a greater misinformation effect with a narrative

compared to questions while other studies found the opposite. What is clear is that the primary difference between a narrative and question presentation (aside from contextual detail differences) is that questions involve a retrieval component. Retrieval can either induce forgetting or facilitate memory of nontested, but related information (Chan, 2009). In the following section, I describe how retrieval-induced forgetting and retrieval-induced facilitation may have come into play in the current study.

Retrieval-Induced Forgetting and Facilitation

In Experiment 1b, initially tested participants recalled marginally fewer correct details during the misleading question phase compared to nontested participants. This suggested retrieval-induced forgetting. Specifically, retrieving details during the initial test impaired later recall of related details (such as those queried during the misleading questions). However, the effect on correct recall was only marginally significant in Experiment 1b and not replicated in Experiment 3b; therefore it is likely that the retrieval-induced forgetting in Experiment 1b was a Type I error. There is another potential explanation for these results. It could be that tested participants were simply more likely to detect a conflict during the misleading questions. Detecting the conflict could have diverted their attention to the task at hand (i.e., answering the questions). However, it is difficult to conclude anything from these data given that the difference was only marginally significant in Experiment 1a and was not replicated in Experiment 3b.

If initial testing did result in retrieval-induced forgetting, then tested participants may not be fully encoding the misinformation when it is presented in questions. Instead, they may be focusing their attention on the to-be-remembered detail and therefore not reading the entire question in the misinformation phase. It is for this reason that I

included the unconstrained cued recall test after the final cued recall test in Experiment 3b. If tested participants were not actually encoding the misinformation, then they should recall fewer misinformation details on the unconstrained cued recall test. However, if tested participants were encoding the misinformation better than or as well as nontested participants, then there would be an RES effect in the unconstrained cued recall test. The data indicated that tested participants encoded the misinformation to the same extent as nontested participants (see the isolated condition in Figure 9). Tested participants were, in fact, better able to reject the misinformation embedded in the questions. This lends support to the idea that tested participants may have recalled fewer correct details during the misleading questioning phase because they were detecting a conflict.

If tested participants covertly retrieved the original, related detail during misleading questioning (retrieval-induced facilitation; Chan et al., 2006), they may have been aware of the misinformation and chose to reject it. However, misinformation recall in the unconstrained cued recall test was still lower for tested participants given misleading questions ($M = .39$) compared to misinformation in a narrative ($M = .61$), $t(118) = 4.58, p < .01, d = .84$. Therefore, presenting misinformation in questions did affect how participants encoded the misinformation. An alternative explanation for these findings is that tested participants were more likely to detect a conflict and stopped the encoding or rehearsal of the misinformation as a means to prevent the misinformation from altering their memory. Tested participants would then recall fewer misinformation details on both the final test and the unconstrained cued recall test.

One confound, however, was that the unconstrained cued recall test immediately followed a cued recall test and thus could have been influenced by the prior test.

Moreover, the unconstrained cued recall test was confounded by output interference (Roediger & Schmidt, 1980; Tulving & Arbuckle, 1963). Specifically, recalling the detail from the video could have hindered one's ability to recall the misleading detail from the narrative (and vice versa). A better test of whether initial testing and contextual detail affected the encoding of the misinformation would be to replace the final test with a test over just the misinformation phase (and not the video).

Mechanisms of Retrieval-Enhanced Suggestibility

In the introduction, I mentioned two potential mechanisms of RES: the Reconsolidation Hypothesis and the Attention Capture Hypothesis. Of interest is how these hypotheses fit in with the findings of this dissertation. The Reconsolidation Hypothesis posits that retrieval enhances suggestibility because testing destabilizes a memory, which makes it vulnerable to interference. When misinformation is introduced during this reconsolidation process, it may become integrated into the original event memory. In the present study, no RES effect occurred when the misinformation phase contained fewer contextual details, even though misinformation had been presented within the reconsolidation window (Schiller, Monfils, Raio, Johnson, LeDoux, & Phelps, 2010; Xue, et al., 2012). How, then, can the Reconsolidation Hypothesis account for these findings? Chan and LaPaglia (2013) explain that in order for new information to interfere with reconsolidation of the original memory, it had to be perceived as being related to the original event memory. In their study, participants watched a video of a terrorist attack. When the new information was presented within a new context (in this case it was a story about a drug bust), no memory impairment was found.

To extend this idea, it may be that the two learning episodes (i.e., the event video and the misinformation phase) must contain similar levels of contextual detail in order for the misinformation to update the original detail in memory. If tested participants were detecting a conflict between the video and the information provided in the questions, then they would not update their original memory. Future studies may examine whether presenting misinformation in an isolated manner or in questions soon after initial retrieval can impair memory for the original event using a forced choice recognition test as in Chan and LaPaglia's (2013) study. If participants are not encoding the misinformation well when it is presented in questions, it is likely that no memory impairment would occur. An interruption in reconsolidation is not necessary, however, for an RES effect to occur. In fact, previous studies have found RES when there was a lengthy delay between the initial test and the misinformation (i.e., one week, Chan & Langley, 2010; Chan & LaPaglia, 2011). Thus, the misinformation was presented outside of the reconsolidation window.

The Attention Capture Hypothesis suggests that initial testing enhances encoding of the misinformation and thus results in greater suggestibility (Gordon & Thomas, 2013). When misinformation is embedded within a full narrative, initial testing enhances the attention participants give to the misleading, critical details. Although, the same may be true when misinformation is presented in isolation or in misleading questions; misinformation presented in isolation may not be as persuasive as when it is presented in a story-like narrative and therefore easier for tested participants to detect a conflict. Therefore, this "attention capture" may work in different ways depending on the how

misinformation is presented (i.e., enhancing encoding of the misinformation in the integrated condition and change detection in the isolated condition).

Applied Implications

The findings of this dissertation have many applied implications. For instance, following a crime (e.g., a hit-and-run car accident), a witness may be exposed to misinformation. Misinformation can come in many forms—e.g., leading and misleading questions, a news report containing erroneous details, etc. However, prior to misinformation exposure, a witness is likely to report the event to a 911 operator or a police officer. This recall attempt can be thought of as an initial test and may be in the form of free recall (i.e., "Tell me what happened.") or cued recall (i.e., "What type of vehicle did the perpetrator drive?") or some combination of both. Previous studies have shown that free and cued recall initial testing can enhance (e.g., Chan et al., 2009; Wilford et al., 2012) or reduce (e.g., LaPaglia & Chan, 2012; Pansky & Tenenboim, 2011) an eyewitness' susceptibility to later presented misinformation. The results from this dissertation suggest that how misinformation is presented affects whether initial retrieval enhances or reduces suggestibility. Given that a recall attempt is almost certain to occur after a witnessed event, it is encouraging to know that, under some circumstances, such retrieval may protect one from the harmful effects of misinformation. Based on the present results, I speculate that when misinformation is presented in a news report that describes the event in great detail, initial recall may lead to greater suggestibility. However, when misinformation is embedded in questions or a short news report with very few contextual details, initial recall may protect memory.

Although I found initial testing to reduce suggestibility under some circumstances, it did not completely eliminate the misinformation effect. Previous attempts to reduce the misinformation effect have found that providing participants with a warning about the credibility of a source can reduce the damaging effects of misinformation—especially when the warning is specific (Greene, Flynn, & Loftus, 1982; Lindsay, 1990; Wright, 1993). When a subtle warning is provided within an RES paradigm (with a full narrative), no test-enhanced suggestibility is found (Thomas et al., 2010). Perhaps it would be fruitful to examine the effect of initial testing and warning on later suggestibility when misinformation is *isolated*. The combined benefits of a warning and initial testing may work to eradicate the misinformation effect altogether.

Many factors that lead to false memory reports, such as misinformation exposure, are beyond control in actual criminal cases (i.e., estimator variables; Wells, 1978); however, it is possible to make jurors and police investigators aware of these findings so that they may better assess the accuracy of witness statements. In collaboration with the Innocence Project and the Association of Criminal Defense Lawyers of New Jersey, New Jersey modified juror instructions for evaluating eyewitness evidence (Weiser, 2012). It appears that some states, including Florida and Massachusetts, may follow suit. Reform like this is an important advancement in protecting innocent suspects from faulty eyewitness testimony.

Concluding Remarks

It has been well documented that testing can enhance memory retention (Roediger & Karpicke, 2006a; Spitzer, 1939). Recently, researchers have attempted to apply the testing effect to educational and eyewitness settings (e.g., Roediger & Karpicke, 2006b;

La Rooy, Pipe, & Murray, 2005). Indeed, it seems intuitive that a method that improves memory retention can also protect against suggestion. In line with this notion, several studies have found testing to be an effective means to reduce suggestibility (e.g., Gabbert, Hope, Fisher, & Jamieson, 2012; Pansky & Tenenboim, 2010). However, recent work shows that testing can sometimes produce the opposite effect, such that it increases susceptibility to later presented misinformation (e.g., Chan et al., 2009). Because of these conflicting findings, it is imperative to understand the circumstances under which testing increases or reduces suggestibility because witnesses are likely to recall an event soon after its occurrence and may be exposed to misinformation from a variety of sources (e.g., other witnesses or the news media). Results from this dissertation indicate that variations in misinformation presentation may account for the contrasting findings in the literature. When misinformation is presented in the absence of contextual detail, testing reduces (or has no effect on) suggestibility. However, when misinformation is embedded within many contextual details, initial testing increases misinformation recall. It remains unclear specifically why this effect occurs; however, these data represent an important step in clarifying the effects of initial testing on suggestibility.

APPENDIX A

Initial, final, and unconstrained cued recall test questions for all experiments.

1. What was the name of the bank being robbed? [Correct Answer: City Central Bank; Misinformation: City Towers Bank]

2. Why did the manager, Ruth Skellar, ask an employee to call the security company? (before the robber arrived) [Correct Answer: There was an error code on the door; Misinformation: The alarm had mistakenly gone off]

3. When Ruth is going to retrieve the money, she runs into a bank employee. What does she say to her to warn her of the robbery in progress? [Correct Answer: "Danger"; Misinformation: "Robber"]

4. What type of car does Sgt. Parker arrive to the bank in? [Correct Answer: SUV; Misinformation: Sedan]

5. At first, who do the police think the robber is? [Correct Answer: The Monday Morning Bandit; Misinformation: The Early Bandit]

6. How long does the robber give the police to get him the money? [Correct Answer: Until noon; Misinformation: One hour]

7. How did the police gain access to the bank? [Correct Answer: Subway tunnel; Misinformation: Sewage tunnel]

8. How many warning shots did the robber fire? [Correct Answer: Three; Misinformation: Two]

9. What did the police throw into the building as they entered? [Correct Answer: Flash grenade; Misinformation: Tear gas]

10. What color are the walls of the hallway that Ruth and George (the robber) are sitting in? [Correct Answer: Green; Misinformation: Beige]

11. When Sgt. Parker is negotiating with the robber, what color is the phone he is using? [Correct Answer: Green; Misinformation: Black]

12. What is the name of George's wife? [Correct Answer: Mary; Misinformation: Sarah]

13. Where was the account in which George wanted the money transferred? [Correct Answer: Retirement home; Misinformation: A personal account]

14. How many people were going to lose their jobs if Ruth hadn't stepped in?
    [Correct Answer: 62; Misinformation: 55]

APPENDIX B

Post-experiment questions included in all experiments.

1. How old are you?
2. What is your sex?
3. How many years of college (including this year) have you had?
4. What is your ethnicity/race?
5. What is your primary language?
6. How many hours of sleep did you get last night?
7. Have you ever seen either of the videos from the experiment today? If so, which one(s) and when?

Additional questions included in Experiments 2 and 3 only. In Experiment 3b, the word "narrative" is substituted with "questions".

8. When you were reading the narrative, did you read any of the sentences more than once?
9. What was your process while reading the narrative? In other words, did you simply read it, did you imagine the video, etc. Please explain.
10. Did you notice any incorrect information in the narrative?
11. How mentally alert are you? Please indicate alertness on a scale from 1 - 6, with 1 meaning very groggy and 6 meaning very alert.
12. Did you follow all the instructions in the experiment? Or to put another way, did you take the experiment seriously? Again, please indicate your response on a 6-point scale, with 1 meaning "I did not take it seriously or did not try to follow instructions" and 6 meaning "I took the experiment very seriously and tried to follow all instructions".

APPENDIX C

Questions presented during the misinformation phase of Experiment 1b. The misinformation was never italicized for participants.

Neutral Questions

1. In the first scene in the bank, what is the manager, Ruth Skellar, discussing with her employees?

2. Who did Ruth ask to call the security company?

3. Just before Ruth warns an employee of the robber, what was that employee asking for?

4. When Sgt. Parker arrived at the bank, who was with him?

5. How many banks did the police say the robber had previously robbed?

6. In addition to the money, the robber gives the police limited time to also get him what?

7. When the police blow up a wall underground, what distraction do they use to cover up the noise?

8. Just before the robber fires the warning shots, what was the emergency with one of the employees?

9. After the police came into the building, how did the robber get them to leave?

10. What side of the hallway was Ruth sitting on while George is on the phone with the police?

11. When Sgt. Parker is on his phone talking to George, what tactics does he use to calm him down?

12. What did the security guard say that the robber had said about his wife after he got fired?

13. What were the first two digits of the account number that George gives to Sgt. Parker?

14. If it wasn't for Ruth, many people would have lost their jobs. How many people did she end up firing?

Misleading Questions (misinformation in italics)

1. In the first scene in *City Towers Bank*, what is the manager, Ruth Skellar, discussing with her employees?

2. Who did Ruth ask to call the security company about *the alarm mistakenly going off*?

3. Just before Ruth says to an employee *"robber"* to warn her, what was that employee asking for?

4. When Sgt. Parker arrived at the bank in a *sedan*, who was with him?

5. How many banks did the police say *the Early Bandit* had previously robbed?

6. In addition to the money, the robber gives the police *one hour* to also get him what?

7. When the police blow up a wall underground in the *sewage tunnel*, what distraction do they use to cover up the noise?

8. Just before the robber fires the *two* warning shots, what was the emergency with one of the employees?

9. After the police came into the building using *tear gas*, how did the robber get them to leave?

10. What side of the *beige* hallway was Ruth sitting on while George is on the phone with the police?

11. When Sgt. Parker is on his *black* phone talking to the robber, what tactics does he use to calm him down?

12. What did the security guard say that the robber had said about his wife, *Sarah*, after he got fired?

13. What were the first two digits of the account number for *the personal account* that George gives to Sgt. Parker?

14. If it wasn't for Ruth, *55* people would have lost their jobs. How many people did she end up firing?

APPENDIX D

A single counterbalance of the blocks of information presented in the narrative phase of Experiment 2. Each solid line indicates a new screen. The misinformation is italicized and the neutral item is underlined. Asterisks (**) signify that the block pertains to a critical detail.

**The scene opens with the front of a <u>bank</u> during the day. Inside, the manager, Mrs. Ruth Skellar, is meeting with employees discussing the bank's ranking in the area. She explains that the bank's performance has vastly improved over the last 12 months and congratulates Wendy Trailer for having the top sales in their division.

During the meeting, an employee named Paul, walks in late and begins to apologize. Once Ruth dismisses everyone, she asks to have a word with Paul. He attempts to apologize again but Ruth cuts him off asking him to straighten out his priorities.

**Paul leaves and Ruth asks that someone at the front desk call the alarm company because the alarm had *mistakenly gone off earlier in the day*.

She proceeds into her office when the door is shut behind her. A robber dressed in all black and a ski mask points a gun at her, hands her two bags, and asks for $500,000 in cash. He asks Ruth to repeat his request then rushes her out of the room, gun still pointed at her.

**Ruth heads back downstairs and is greeted by an employee who requests to go to her office. She says no, attempting to conceal her fear, and informs the employee of <u>the robber</u>.

This employee sees a robber in the window and informs Wendy that there is a robbery. Wendy hits the alarm system and everyone in the bank rushes to the door. Just as Ruth is about to leave, the robber grabs her and points the gun at her head, telling her to calm everyone down.

**Police cars rush to the bank. Sergeant Gregory Parker and two other cops arrive on the scene in a *sedan*.

**They discuss what information they have on the guy, but someone disabled video and audio that morning. The police assume that this robber is a <u>career bank robber</u> who robbed six banks previously.

The cops discuss ways to enter the bank without the robber seeing them. Meanwhile, inside the bank a phone rings. The robber takes notice and answers, greeted by the police.

**The robber demands that the police get him his money and a car in *one hour*.

He then hands the phone to Ruth and points a gun at her head. She informs the police that the robber will kill them all if they don't follow his requests.

The cops call the robber back and try to get inside his head, gathering as much information about the robber as possible. After the phone call, Ruth attempts to reason with the robber, informing him that some of them need to use the restroom. He points a gun at her head and she sits down quietly.

**Meanwhile, the cops are making their way through the <u>tunnels</u>. The cops call the robber and inform him that the alarm had reset and is going to go off again shortly. The cops blow up a hole in the wall to the bank, masking it with the alarm sound, and enter the building.

**Inside the bank, Ruth expresses concern for a woman with asthma who needs her medication. This angers the robber so he grabs Ruth pointing a gun at her once again. He fires *two warning shots* into the ceiling.

**At that moment the police <u>enter the building</u>. The robber recedes into the hallway near the elevator, still grasping Ruth. They ask him to put down his gun but he refuses and threatens to shoot her. The cops all leave with the other hostages and the robber has Ruth lock the door.

He then grabs her and heads up the stairs near her office. He throws her against the wall and his mask comes off, revealing his identity. Ruth recognizes him as a man named George.

The scene cuts to the police who have reconnected the video in the bank, but not the audio. They see a video clip of the robber with his face revealed and Ruth in the hallway near her office. They call in the bank security guard who identifies the man as George Orstin, who was the head of security at the bank. Two months ago Ruth fired him.

The police begin to go over his file and all of the information they have on him. A doctor offers advice of how to deal with a disgruntled employee. The police discuss the situation with Wendy and Paul. They inform the police that Ruth came in and saved the bank a year ago, but has let go of numerous employees. They sympathize with George's feelings since they don't care for Ruth either.

**It cuts to a quick scene revealing that Ruth and George are still in the *beige hallway*. Ruth is sitting on the left side.

**The cops argue over the best way to reason with George and call him using a <u>wireless phone</u>. Over the phone, Sgt. Parker tries to get into George's head and empathize with him.

George is angry so he demands that he gets what he wants in half an hour or he will kill Ruth. He demands that the money be transferred directly in the bank and gives them a bank account number. George is angry with Ruth and wants to know how she could take a 20 year employee and kick him out of the company. Ruth says it was standard procedure, nothing personal. The police try and relate George to Ruth but he hangs up.

**Outside the bank, Officer Callaghan speaks with the security guard who says this is very unlike George. In fact, all George said when he was fired was that he would now have more time to spend with his wife, *Sarah*.

**Meanwhile, Wendy helps a cop navigate the account that George had given them and learn more about <u>the account</u>.

The cops continue their banter with George. Ruth cuts in and tells George she hates firing people and hates that she knows everyone dislikes her.

**She continues in saying that she worked hard to build the bank up so everyone could keep their jobs, but she still had to fire several people. If she hadn't come to their branch, it would have closed and *55 people* would have lost their jobs.

She apologizes to George and George hangs up on the police, obviously agitated that he is feeling bad for Ruth.

APPENDIX E

A single counterbalance of the blocks of information to be presented in the narrative phase of Experiment 3a. Each solid line indicates a new screen. The misinformation is italicized and the neutral item is underlined. Asterisks (**) signify that the block pertains to a critical detail.

**In the first scene in the <u>bank,</u> the manager, Ruth Skellar, is meeting with employees discussing the bank's ranking in the area.

She explains that the bank's performance has vastly improved over the last 12 months and congratulates Wendy Trailer for having the top sales in their division.

During the meeting, an employee named Paul, walks in late and begins to apologize. Once Ruth dismisses everyone, she asks to have a word with Paul. He attempts to apologize again but Ruth cuts him off asking him to straighten out his priorities and Paul leaves.

**Ruth asks that someone at the front desk call the security company because *the alarm had mistakenly gone off earlier in the day*.

She proceeds into her office when the door is shut behind her. A robber dressed in all black and a ski mask points a gun at her, hands her two bags, and asks for $500,000 in cash. He asks Ruth to repeat his request then rushes her out of the room, gun still pointed at her.

**Ruth is greeted by an employee who requests to go to her office. She says no, attempting to conceal her fear, and informs the employee of <u>the burglary in progress</u>.

This employee sees a robber in the window and informs Wendy that there is a robbery. Wendy hits the alarm system and everyone in the bank rushes to the door. Just as Ruth is about to leave, the robber grabs her and points the gun at her head, telling her to calm everyone down. The police rush to the bank.

**<u>Sergeant Gregory Parker</u> and two other cops arrive on the scene in a *sedan*.

They discuss what information they have on the guy, but someone disabled video and audio that morning.

**The police assume that this robber is a <u>career bank robber</u> who robbed six banks previously.

The cops discuss ways to enter the bank without the robber seeing them. Meanwhile, inside the bank a phone rings. The robber takes notice and answers, greeted by the police.

**The robber demands that the police get him his money and a car in *one hour*.

He then hands the phone to Ruth and points a gun at her head. She informs the police that the robber will kill them all if they don't follow his requests.

The cops call the robber back and try to get inside his head, gathering as much information about the robber as possible. After the phone call, Ruth attempts to reason with the robber, informing him that some of them need to use the restroom. He points a gun at her head and she sits down quietly.

**The police make their way through the tunnels and blow up a hole in the wall to the bank, masking it with the alarm sound.

**Inside the bank, Ruth says that a woman with asthma needs her medication. This angers the robber so he fires *two warning shots* into the ceiling.

**The police enter the building. The robber grasps Ruth and threatens to shoot her.

The cops all leave with the other hostages and the robber has Ruth lock the door. He then grabs her and heads up the stairs near her office. He throws her against the wall and his mask comes off, revealing his identity. Ruth recognizes him as a man named George.

The scene cuts to the police who have reconnected the video in the bank, but not the audio. They see a video clip of the robber with his face revealed and Ruth in the hallway near her office. They call in the bank security guard who identifies the man as George Orstin, who was the head of security at the bank. Two months ago Ruth fired him.

The police begin to go over his file and all of the information they have on him. A doctor offers advice of how to deal with a disgruntled employee. The police discuss the situation with Wendy and Paul. They inform the police that Ruth came in and saved the bank a year ago, but has let go of numerous employees. They sympathize with George's feelings since they don't care for Ruth either.

**Ruth and George are still in the *beige* hallway. Ruth is sitting on the left side.

**Sgt. Parker calls George using a wireless phone and tries to calm him down by empathizing with him.

George is angry so he demands that he gets what he wants in half an hour or he will kill Ruth. He demands that the money be transferred into an account. George is angry with Ruth and wants to know how she could take a 20 year employee and kick him out of the company. Ruth says it was standard procedure, nothing personal. The police try and relate George to Ruth but he hangs up.

**Outside the bank, the security guard says that all the robber said when he was fired was that he would now have more time to spend with his wife, *Sarah*.

**Meanwhile, the police learn more about <u>the account</u> that began with 0-6 that George had given to Sgt. Parker.

The cops continue their banter with George. Ruth cuts in and tells George she hates firing people and hates that she knows everyone dislikes her. She continues in saying that she worked hard to build the bank up so everyone could keep their jobs.

**If it wasn't for Ruth, *55* people would have lost their jobs, yet she only fired 7 people.

She apologizes to George and he hangs up on the police. He says, "No more talking!" obviously agitated that he is feeling bad for Ruth.

APPENDIX F

Unconstrained Cued Recall Test instructions.

In the following test, you will be asked the same questions you just answered. However, this time we want you to answer with as much information as you can remember, regardless of where you remember it from. For instance, if I asked you what animal the robber had for a pet and you remember seeing a dog in the video, reading about a cat in a narrative or questions and for some reason you also remember a hamster, then answer with "dog, cat, and hamster." You will have 30 seconds to answer each question. Once a question shows up, you may begin typing in your answer.

APPENDIX G

A single counterbalance of the blocks of information to be presented in the integrated question condition of Experiment 3b. Each solid line indicates a new screen. The misinformation is italicized and the neutral item is underlined. The critical detail was always included in a question. Asterisks (**) signify that the block pertains to a critical detail.

**In the first scene in the bank, what is the manager, Ruth Skellar, discussing with her employees?

She explains that the bank's performance has vastly improved over the last 12 months and congratulates Wendy Trailer for having the top sales in their division.

During the meeting, an employee named Paul, walks in late and begins to apologize. Once Ruth dismisses everyone, she asks to have a word with Paul. He attempts to apologize again but Ruth cuts him off asking him to straighten out his priorities and Paul leaves.

**Who did Ruth ask to call the security company about *the alarm mistakenly going off earlier in the day*?

She proceeds into her office when the door is shut behind her. A robber dressed in all black and a ski mask points a gun at her, hands her two bags, and asks for $500,000 in cash. He asks Ruth to repeat his request then rushes her out of the room, gun still pointed at her.

**Just before Ruth warns an employee of the burglary in progress, what was that employee asking for?

This employee sees a robber in the window and informs Wendy that there is a robbery. Wendy hits the alarm system and everyone in the bank rushes to the door. Just as Ruth is about to leave, the robber grabs her and points the gun at her head, telling her to calm everyone down. The police rush to the bank.

**When Sgt. Parker arrived at the bank in a *sedan*, who was with him?

They discuss what information they have on the guy, but someone disabled video and audio that morning.

**How many banks did the police say the robber had previously robbed?

The cops discuss ways to enter the bank without the robber seeing them. Meanwhile, inside the bank a phone rings. The robber takes notice and answers, greeted by the police.

**In addition to the money, the robber gives the police *one hour* to also get him what?

He then hands the phone to Ruth and points a gun at her head. She informs the police that the robber will kill them all if they don't follow his requests.

The cops call the robber back and try to get inside his head, gathering as much information about the robber as possible. After the phone call, Ruth attempts to reason with the robber, informing him that some of them need to use the restroom. He points a gun at her head and she sits down quietly.

**When the police blow up a wall underground in the tunnel, what distraction do they use to cover up the noise?

**Inside the bank, just before the robber fires the *two warning shots*, what was the emergency with one of the employees?

**After the police came into the building, how did the robber get them to leave?

The cops all leave with the other hostages and the robber has Ruth lock the door. He then grabs her and heads up the stairs near her office. He throws her against the wall and his mask comes off, revealing his identity. Ruth recognizes him as a man named George.

The scene cuts to the police who have reconnected the video in the bank, but not the audio. They see a video clip of the robber with his face revealed and Ruth in the hallway near her office. They call in the bank security guard who identifies the man as George Orstin, who was the head of security at the bank. Two months ago Ruth fired him.

The police begin to go over his file and all of the information they have on him. A doctor offers advice of how to deal with a disgruntled employee. The police discuss the situation with Wendy and Paul. They inform the police that Ruth came in and saved the bank a year ago, but has let go of numerous employees. They sympathize with George's feelings since they don't care for Ruth either.

**What side of the *beige* hallway was Ruth sitting on while George is on the phone with the police?

**When Sgt. Parker is on his wireless phone talking to the robber, what tactics does he use to calm him down?

George is angry so he demands that he gets what he wants in half an hour or he will kill Ruth. He demands that the money be transferred into an account. George is angry with Ruth and wants to know how she could take a 20 year employee and kick him out of the

company. Ruth says it was standard procedure, nothing personal. The police try and relate George to Ruth but he hangs up.

**Outside of the bank, what did the security guard say that the robber had said about his wife, *Sarah*, after he got fired?

**What were the first two digits of the account number that George gives to Sgt. Parker?

The cops continue their banter with George. Ruth cuts in and tells George she hates firing people and hates that she knows everyone dislikes her.

**If it wasn't for Ruth, *55 people* would have lost their jobs. How many people did she end up firing?

She apologizes to George and he hangs up on the police. He says, "No more talking!" obviously agitated that he is feeling bad for Ruth.

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