

The Effects of Suggested Invisibility on Memory

by

Tanjeem Azad
M.Sc., University of Victoria, 2010
B.A., University of Calgary, 2005

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of

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in the Department of Psychology

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Supervisory Committee

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Departmental Member

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Abstract

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Erroneous suggestions can add to or contradict people's memories for previously witnessed event details. Researchers have also investigated a different kind of erroneous suggestion in which details from a target event that had actually been witnessed are erroneously suggested to not have transpired in the event. This phenomenon is referred to as the suggested invisibility effect. Previous research examining suggested invisibility has not thoroughly examined the mechanisms underlying the effect. That is, does *not* reporting previously witnessed event details reflect demand characteristics or genuine memory impairments? The current dissertation research was motivated by such questions. In a newly developed paradigm, 5 experiments examined suggested invisibility and its accompanying subjective memory. Subjects watched a crime video and 2 days later read three hand-written simulated witness testimonies. Each testimony (a) stated that two event details were not visible in the video (though they in fact were clearly displayed) and (b) mentioned two other details in broad generic terms. Subjects then completed a final memory test to assess their memory for the original crime video. Experiment 1 produced the basic effect, showing that subjects were significantly less likely to report witnessed details when they had been erroneously suggested to not have been visible compared to control details. Experiment 2A was conducted to further examine the basis of suggested invisibility, however, many subjects expressed disbelief in the testimonies and this resulted in null effects. Subsequent experiments enhanced the plausibility of the testimonies. Experiment 2B amended the rationale to subjects for reading the lengthy testimonies and replicated the suggested invisibility effect; Experiment 3 embedded suggestions of invisibility in response to cued-recall questions rather than in lengthy narratives; and, Experiment 4 presented subjects with a transcript of an interview between a witness and an experimenter. In both Experiments 3 and 4, robust effects of suggested invisibility were only attained with naïve subjects who claimed to not have been suspicious of the experimental manipulation. When suggested invisibility was observed subjects' confidence levels were similar to that of control details, suggesting that sometimes subjects were genuinely confident in not having witnessed previously seen details. Collectively, these findings support the idea that memories can be swayed in the direction of erroneous suggestions that render false reports of not having seen previously witnessed details.

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Dedication

My inspiration for academia was my bhaiya, my brother, Jalal Alamgir. He was beautiful, brilliant, full of life and love and a most gentle person I have ever known. He was one of a kind. I yearned to always follow in his footsteps and I am proud to say that moment has begun. Above all else, though, I hope to have the humility he always showed to others. I dedicate this dissertation to you, Thuvo Bhaiya, and wherever you are I hope you are cheering.

Chapter 1: Introduction

The impermanence of human memory is richly documented in cognitive psychology. Beginning with the pioneering work of British psychologist, Sir Fredrick Bartlett, memory's transient nature was observed by studying peoples' repeated recollections of "The War of the Ghosts," a North American Native fable (Bartlett, 1932). Bartlett's study revealed that with the passage of time people's memories for the fable often included errors and were greatly influenced by *schemas*, which are general knowledge structures regarding the functions and relations of various experiences and elements in the world (Brewer, 2000; Brewer & Nakamura, 1984). For example, our schema of a restaurant might entail knowledge of both the exterior and interior of a restaurant, with tables, chairs, place settings as well as waiters and hosts offering various food-related services in a restaurant. In the context of Bartlett's study, a scene in the fable describes two men hunting for seals but people's schemas influenced their memories of this scene to misremember it as a sailing event and a "canoe" as a "boat." Such misrememberings reflected how people drew on their prior knowledge and personal experiences consistent with their English culture and understanding of the world to reconstruct their memory of the fable (Newman & Garry, 2014). Bartlett's findings thus captured the *reconstructive* nature of memory, showing that memories are not stored as permanent records to be retrieved at a moment's notice; rather, our memories are constructions based on our perceptual experiences as well as the inferences we make that are influenced by prior knowledge, biases, expectations, stereotypes, and beliefs (for reviews see Loftus, 2003, 2005; Newman & Lindsay, 2009). The current research

examines how our memories can also be influenced by external suggestions to create beliefs and recollections that are illusory.

Review of the Literature

Since Bartlett's pioneering work on memory, an impressive body of empirical literature has amassed evidence to illustrate the reconstructive nature of memory. For example, Johnson, Bransford, and Solomon (1973) showed how inferences act on recollections. In their study, subjects heard various action statements such as, "when the man entered the kitchen he slipped on a wet spot and dropped the delicate glass pitcher on the floor." Subjects did not hear the implications of such statements, that is, that dropping the glass pitcher resulted in the shattering of glass and breaking the pitcher. On a later memory test, subjects were presented with previously heard and unheard statements and had to indicate which statements they had previously heard. Many subjects erroneously claimed to "hear" statements that had never been presented to them but that had implied the consequence to previously heard statements, such as this unheard statement, "when the man entered the kitchen he slipped on a wet spot and broke the delicate glass pitcher when it fell on the floor." Brewer and Treyens (1981) observed how schemas influence memory recall and reported that peoples' recollections of items in an office were influenced by how strongly items were expected to be seen, such that subjects erroneously reported expected-but-not-presented items (e.g., a set of shelves) and failed to report presented-but-unexpected items. Schemas can also incorrectly fill in the gaps of our memory. In Roediger and McDermott (1995), subjects studied several lists of semantically related words (e.g., bed, tired, awake, dream) and later, on a subsequent memory test, erroneously claimed to have "seen" words related to the theme of each

studied list (e.g., sleep). Marsh, Cook, and Hicks (2006) examined the influence of stereotypes on peoples' memories. When their subjects could not recall whether statements heard earlier came from a male or female speaker, subjects' recollections of the speaker were biased in the direction of the gender stereotypically associated with the statement, even if the statement had been uttered by the opposite gender.

Although prior research highlights the imperfections of memory, the reconstructive processes of memory allow for the detection of errors and renders accurate recognition most of the time (e.g., Brady, Konkle, Alvarez, & Olivia, 2008). As such, most memory inaccuracies are harmless and compensated for by a highly efficient and adaptive cognitive system. An adaptive system affords flexibility to update information in memory and that flexibility may "include the combining, rewriting, and blending of incoming information with information already stored in memory" (page 314, Howe, 2011). In turn, such a system has evolved to provide a comprehensive understanding of our day to day experiences, to reminisce about the past and project into the future, to serve our self-identities and social functions, and to even benefit us (for a detailed discussion regarding the function of false memories, see Howe, 2011; Newman & Lindsay, 2009). As brief examples, misrememberings of the past can promote positive self-images and influence future behaviours as well as prime subjects' solutions to later complex problems (Howe, 2011). Misremembering the past can also benefit future thinking (e.g., children experienced less distress during future procedures of lumbar puncture when they recollected a past lumbar puncture to be less painful than it actually was, Chen, Zeltzer, Craske, & Katz, 1999).

Memory imperfections become particularly salient and harmful when people are witnesses to a crime (see also Lindsay & Read, 2001, 1994, for a review on recovered memories and Hyman, Husband, & Billings, 1995; Loftus & Pickrell, 1995; Wade, Garry, Read, & Lindsay, 2002 on false memories for entire childhood events). Accuracy for the witnessed event becomes pivotal and inaccuracies may lead investigators on the wrong path to solving the crime and potentially lead to the wrongful conviction of an innocent person. One of the most pervasive forms of memory distortion to a witnessed event is exposure to erroneous external suggestions, or what is more commonly referred to as *misinformation* (Frenda, Nichols, & Loftus, 2011). A widely known method for studying the effects of misinformation on memory is the misinformation paradigm (Loftus, Miller, & Burns, 1978). In this paradigm, people witness an event, are exposed to misinformation, i.e., details are erroneously suggested to have occurred in the original event, and then complete a memory test for the original event. For example, in early research by Elizabeth Loftus and her colleagues, subjects viewed a series of slides depicting the stages involved in a car-pedestrian accident. One of the slides showed the car at a stop sign. Subjects subsequently completed a post-event questionnaire about the event, in which half of the subjects responded to the critical question containing misinformation, “Did another car pass the red Datsun while it was stopped at the yield sign?” The remaining subjects responded to the critical question containing no misinformation, “Did another car pass the red Datsun while it was stopped at the stop sign?” All subjects then completed a memory test in which they had to choose between a slide showing a stop sign and a slide showing a yield sign to indicate which slide appeared in the original event. Findings revealed that 41% of subjects who were misled

chose the stop sign compared to 75% of subjects who were not misled (Loftus et al., 1978). This robust and replicable memory phenomenon is known as the *misinformation effect*: The erroneous report of unseen misinformation for a witnessed event (Tousignant, Hall, & Loftus, 1986). Extant research has shown that misinformation can influence witness reports in different ways. For example, misinformation (a) can replace peoples' memories for details that had been witnessed, e.g., reporting that a man placed the stolen wallet in his pants' pocket even though it was placed in his jacket pocket (Zhu, Chen, Loftus, Lin, & Qi Dong, 2011); (b) can add to peoples' memories for non-existent details of an event that had not been previously witnessed, e.g., claiming to have seen broken glass when there was none in the original event (Loftus & Palmer, 1974); and (c) can even create illusory recollections for entire childhood events that had never been experienced, e.g., remembering a hot air balloon ride with a parent as a young child, even though the event had never occurred (Wade et al., 2002).

Misinformation effects may occur for various reasons. On the one hand, subjects may display *normative conformity* or a *known error* (Betz, Skowronski, & Ostrom, 1996; Newman & Lindsay, 2009, respectively) in which they knowingly report misleading suggestions. In this situation, subjects are typically aware of the inaccuracy and source of the misinformation (that misleading suggestions appeared in a post-event narrative) yet they choose to report it to comply with the demands of the experiment or to gain social acceptance. Misinformation may also be reported for *informational compliance* (Betz et al., 1996). In this situation, subjects believe the misinformation accurately reflects the original event despite not having personally witnessed it and they also remember the source of the misinformation. The current research focuses on situations where reports of

misinformation arise as informational compliance or when people are *not* aware of the source of their reported misinformation.

The Source Monitoring Framework (SMF) and Subjective Experiences of Memory

The most influential theory for understanding how misinformation effects occur is the Source Monitoring Framework (Johnson, Hashtroudi, & Lindsay, 1993; Lindsay, 2008; Lindsay, 2014). First, the SMF posits that our memories are not pinned to labels specifying their sources. This assumption rests on the notion that we rarely monitor the source of our ongoing activities and events as we experience them, e.g., it is unlikely for me to reflect that “I am now walking on a Saturday morning at 10am to go to a café to write my dissertation”. As such, we cannot directly “access” the source of a memory but we can infer a memory’s source by assessing its various characteristics as we bring the memory to mind. Memories rich in perceptual characteristics, such as vividness, sound, smell and clarity, are generally inferred to be the product of an actual prior experience rather than a product of imagination (Johnson, Foley, Suengas, Raye, 1988). Similarly, memories lacking in perceptual characteristics and realism, as well as involving more complex cognitive processes, such as reasoning, are generally attributed to imagination and to non-experienced events, e.g., “this must be a fantasy because I was too young to be a doctor” (p. 374, Johnson et al.). Attributions regarding a memory’s source are usually accurate, performed quickly, and without much deliberation. At times, however, quick decisions may fail to specify a memory’s source and during such instances other cognitive processes may be intentionally engaged in addition to assessing the characteristics of the memory. For example, in attempting to recall who mentioned the funny joke at a party you attended last weekend, you may focus on remembering the

events that preceded or followed the joke or the people who were likely to have attended the event. In summary, source monitoring should be relatively easy and accurate when a memory is richly detailed, uniquely indicative of its source, and effective decision strategies are adopted (Johnson et al., 1993).

Second, the same processes that produce accurate attributions may occasionally also produce source *misattributions* – that is, a memory is attributed to an incorrect source, such as attributing a memory of a joke you heard from a friend to having mentioned it yourself. As alluded to above, memories from different sources typically have unique characteristics that demarcate one source from another, but memories from different sources may also share characteristics, which can lead to attribution errors. For example, a mental event that was only imagined may be attributed to a perceived experience if the mental event came to mind vividly and with little effort, which are characteristics of perceived events. Extant research supports the idea that source misattributions can contribute to the misinformation effect (Johnson et al., 1996; Lindsay, 2008; Zaragoza, Belli, & Payment, 2006). Source misattributions occur when memories of misinformation have characteristics that are highly typical of memories based on a perceived event. If the misinformation is especially evocative and fosters mental imagery then this further enhances the perceptual overlap between the witnessed event and the misinformation and may render difficulty in source discrimination (e.g., Drivdahl & Zaragoza, 2001; Roediger, Meade, & Bergman, 2001). Consequently, during retrieval if the accompanying imagery of the misinformation is teeming with memory-like features, such as vivid perceptual and contextual details, then the misinformation may be misattributed to a memory (for related examples see Henkel, 2004). In this way,

memories of misinformation may, like memories of a perceived event, be rich in perceptual and semantic content. Source misattributions may also occur when the individual fails to recollect information that specifies the source of a memory. This is influenced by the extent to which processes at encoding bind together details about the event or experience that later give rise to those details that can be used for appropriate source monitoring (Johnson et al., 1993; Lindsay, 2008). Retrieval demands, such as test instructions, affect the decision criteria adopted at test, which in turn also influences source monitoring. For example, recognition memory test instructions encourage lax source monitoring to respond on the basis of familiarity, which in turn lead to higher misinformation effects. In comparison, test instructions to consider source information have been shown to encourage more careful monitoring and effectively reduce or even eliminate misinformation effects (e.g., Lindsay & Johnson, 1989; Zaragoza & Koshmider, 1989).

Misinformation effects resulting from source misattributions have been demonstrated on a source-monitoring paradigm. In this paradigm, subjects' overt source decisions are measured by identifying the source a test item (or memory) was previously experienced. Typically, subjects indicate whether the memory is from a witnessed event, a post-event narrative, both sources, or neither sources. For example, Zaragoza and Lane (1994) embedded misleading suggestions in a post-event questionnaire regarding a previously viewed target event (e.g., "When the man looked at his *wristwatch* before opening the door, did he appear anxious?"). On a later source monitoring test, subjects heard a list of items, such as the wristwatch, and indicated the source of each item by selecting one of the following four options: "saw" (the subject saw the item in the target

event), “read” (the subject read about the item in the post-event questionnaire), “both” (the subject both saw the item in the target event and read about it in the post-event questionnaire), or “neither.” Subjects were significantly more likely to erroneously attribute misleading suggestions, such as the wristwatch, to the “saw” source relative to when they had not been misled.

Although the source-monitoring paradigm is a method of examining the contribution of source monitoring errors, misattributions of misinformation to the witnessed event may not reliably reflect people’s states of awareness or *subjective experiences*. That is, subjects may sometimes genuinely believe they remembered the misleading suggestion or experience a false memory of “seeing” the misleading suggestion in the witnessed event (e.g., Ackil & Zaragoza, 1998; Lindsay, 1990; Zaragoza & Lane, 1998). There is sufficient evidence to show that conditions that foster difficulty in monitoring the source of the witnessed event details from the misleading details can sometimes lead people to genuinely believe or remember attribute witnessing misinformation (e.g., Frost, Ingraham, & Wilson, 2002; Lindsay, 1990; Zaragoza, Mitchell, Payment, & Drivdahl, 2011). To determine if source misattributions reflect illusory recollections or beliefs, researchers have implemented the remember/know procedure (Tulving, 1985; for a review see Gardiner & Java, 1993; for the distinction between beliefs vs. memories for autobiographical memories see also Scoboria, Lynn, Hessen, & Fisico, 2007). In this procedure, subjects are asked to indicate their accompanying subjective experience of *remembering*, *knowing*, or *guessing* to each reported detail on a memory test. A subjective experience of *remembering* entails an experience of recollecting a specific prior experience, as if one is experiencing the event

again when it is brought to mind; on the other hand, a subjective feeling of *knowing* entails an experience of believing the event occurred in the absence of recollection. Prior research suggests that subjective experiences of remembering or knowing do not guarantee accuracy, as people may have illusory experiences of remembering and knowing misinformation (e.g., Frost, 2000; Lane & Zaragoza, 1995; Zaragoza & Mitchell, 1996). For example, Frost (2000) noted that subjects were more likely to experience misinformation as illusory feelings of knowing with a short retention interval between witnessing the target event and reading the post-event erroneous narrative; however, if the retention interval increased to one-week and if the misinformation suggested the presence of a previously unseen detail (rather than contradicted a previously witnessed detail) then subjects claimed to have falsely remembered misinformation.

The Effects of Suggested Invisibility and Related Memory Phenomenon On Memory

Most extant research on the misinformation effect has focused on misinformation adding to or contradicting people's memories for previously witnessed details. Researchers have also investigated the effect of misinformation that erroneously suggests details from the perceived event had, in fact, *not* transpired (e.g., Candel, Hayne, Strange, & Prevoo, 2009; Otgaar, Candel, Smeets, & Merkelbach, 2010b; Otgaar, Meijer, Giesbrecht, Smeets, Candel, & Merkelbach, 2010a; Merkelbach, Roermund, & Candel, 2007; Pezdek & Roe, 1997; Williams, Wright, & Freeman, 2002; Wright, Mathews, Skagerberg, 2005). That is, the misinformation suggests that details could not be visible when they had been clearly witnessed and the aim is to demonstrate the extent to which people can be led to not report previously witnessed details. We refer to this

phenomenon as the effect of *suggested invisibility*. Consistent with the SMF, the processes involved in the misinformation effect when people misattribute misinformation to a witnessed event should also operate in the suggested invisibility effect. That is, people should also misattribute previously seen details to not having been witnessed, e.g., by imagining that the suggested detail was not clearly visible and if an unclear image comes to mind at test then that may be taken as evidence for its non-occurrence. However, prior research on suggested invisibility and related phenomena is relatively scant and unclear regarding the reliability of the effects and the accompanying mechanisms. This dissertation explores and extends this line of work with a new misinformation paradigm and investigates the cognitive processes underlying the effect.

Research into the effects of suggested invisibility on memory has mostly investigated its influence on children's memory with suggestions from an experimenter. For example, Pezdek and Roe (1997) reported that 4-year old and 10-year old children were most susceptible to misinformation suggesting a change to a previously experienced event, e.g., when an experimenter placed a hand on the child's hand when it was actually the child's shoulder. This was compared to a condition in which misinformation denied a previously experienced event, e.g., when an experimenter suggested that the experimenter had not placed a hand on the child's shoulder when she actually had and a condition when misinformation suggested an event that did not actually occur, e.g., when an experimenter suggested that the experimenter placed a hand on the child's shoulder when she had not. Children were significantly less likely to accept erroneous suggestions that an incident did not occur when it actually did relative to when the suggestions contradicted a previous experience or suggested a new experience. However, the

authors' results should be interpreted with caution given the small sample sizes ($N = 16$) across the between-group manipulation. Moreover, the suggested invisibility manipulation occurred while children were viewing an unrelated slideshow. During the show, an image of a rose appeared at which point an experimenter placed a hand on the child's shoulder. It is possible that such an image in combination with the experimenter's touch made the suggestion salient to the children thereby rendering the suggestion ineffective. In Candel et al. (2009), the suggested invisibility manipulations were in the form of a leading question (e.g., "X did not actually occur, did it?"), which may have also drawn children's attention to the occurrence of the detail and produced their null results.

In contrast, research by Otgaar and colleagues (e.g., Otgaar et al., 2010a) documented effects of suggested invisibility with children engaging in an interactive event rather than viewing a passive event (e.g., Candel et al., 2009; Pezdek & Roe, 1997). In the interactive event, each child was instructed to remove three pieces of clothing from a puppet named Lucy. Each child was subsequently interviewed individually during which time, in the *omission suggestion* condition, an experimenter erroneously informed the child that only two pieces of clothing were removed and provided evidence by showing them the puppet with the third item not removed. In the *commission suggestion* condition, an experimenter erroneously informed each child that an additional fourth piece of clothing had been removed and provided evidence by showing them the puppet with the fourth item removed. Following the manipulation, children completed an immediate interview regarding their performed actions (Interview 1), a second interview one-week later (Interview 2), and a third interview conducted by the children's parents using a structured questionnaire (Interview 3) one week after Interview 2. Results

suggested an effect of suggested invisibility only in Interview 1, as the effect decreased substantially with time, which suggests that social compliance, in which children merely assented to the experimenter's suggestion, may have contributed to the effect obtained initially (for similar findings see Otgaar et al., 2010b).

Only two empirical investigations of suggested invisibility have been examined with adults. Wright et al. (2005) paired subjects with a confederate who suggested the presence of unseen items and also erroneously denied the presence of seen items. Results indicated robust effects of misinformation that erroneously suggested the presence of unseen items relative to denying previously witnessed items, thereby showing a weak effect of suggested invisibility. Merckelbach et al. (2007) adopted a similar procedure but with photos of household scenes and items. Their results showed robust effects of both types of misinformation, as subjects erroneously recalled previously unseen items and omitted previously seen-but-denied items. However, neither Wright et al. (2005) nor Merckelbach et al. (2007) assessed the subjective experiences accompanying subjects' decisions to not report previously seen-but-denied details, e.g., whether or not subjects genuinely developed memories that omitted previously witnessed details. Thus, extant research on suggested invisibility with children and adults remains unclear given the mixed findings.

In related research, Wright, Loftus, and Hall (2001) examined the effect of subtly omitting previously witnessed event details with adults (see also, Williams, Wright, & Freeman, 2002). In two experiments, the authors observed that subjects who witnessed details and later had one of the details omitted when re-witnessing the event were less likely to later recall and recognize the detail relative to a control group who did not

receive any suggestions of omission. Gabbert, Memon, and Allan (2006) also explored the influence of erroneous suggestions that added to, contradicted, or omitted previously witnessed event details with a co-witness paradigm. Findings showed that relative to additions and contradictions, subjects were least influenced by suggestions omitting previously witnessed details, with subjects failing to report witnessed event details only 10% of the time. Both empirical investigations by Wright and colleagues (2001) and Gabbert et al. (2006) can be attributed to the retrieval-induced forgetting (RIF) phenomenon (see Anderson, Bjork, & Bjork, 1994), whereby retrieval practice of previously seen details inhibits retrieval of related-but-unpractised omitted details such that later retrieval of the related-but-unpractised details is impaired. However, an alternative explanation to their findings is that demand characteristics may have potentially contributed to subjects' decision to withhold reports of previously witnessed details. That is, subjects may have noted the omission of the previously witnessed detail in the second viewing (or when a co-witness failed to report a detail during discussion) and at the time of the test they may have knowingly withheld reporting the detail if they figured out the purpose of the study and assumed they should not report the omitted detail. Furthermore, both methodologies examined the effects of implicit (e.g., merely removing a critical scene from a story) rather than explicit suggestions regarding the non-occurrence of previously witnessed event details. Such a methodology, however, does not allow for a test of whether genuine source misattributions - subjects mistakenly attributing memories of the suggestions to memories of the witnessed event - might have affected subjects' decisions to not report witnessed details because from the perspective of the RIF, the omitted detail is inhibited.

Current Research

In light of the inconsistent as well as sparse findings in the literature regarding suggested invisibility, the goal of the dissertation research was to develop a new paradigm to investigate the effects of erroneous suggestions on memory to the extent that certain event details that actually transpired in an event could be suggested to not have been clearly visible. Specifically, the interest was in the inclusion of explicit mentions of suggested invisibility rather than implicit suggestions (e.g., Gabbert et al., 2006; Wright et al., 2001) and specifically, for the explicit suggestions to provide plausible reasons why details could not be seen. This particular methodological feature was to allow for the possibility of source misattributions as a test of the SMF (i.e., to encourage subjects to imagine *how* a detail could not have been visible) and this was not explored in prior work. Furthermore, prior manipulations of explicit suggestions of invisibility with adults may have been relatively weak to detect effects given that the stimuli (such as viewing word lists, photos of cars and faces, Wright et al., 2005) were not necessarily salient experiences of witnessing a complex event. To this end, the dissertation first describes the new paradigm, results, and general findings of Experiments 1, 2A, and 2B, each of which investigated the phenomenon of suggested invisibility and its accompanying subjective confidence experiences. Then, Experiments 3 and 4 introduce a revised paradigm as a means to address some of the problems encountered with the first three experiments using the original paradigm.

The aim of Experiment 1 was to replicate the suggested invisibility effect with a new paradigm that featured explicit suggestions that certain clearly visible details were not clearly visible. Subjects individually watched a mock crime video and then following

a 2-day delay read three hand-written simulated witness narratives. Each narrative (a) stated that two event details were not clearly visible in the video (though they in fact were clearly displayed) and (b) mentioned two other details in broad generic terms. Subjects then completed a memory test, in which they first freely recalled event details from the video and then completed specific cued-recall questions. In Experiment 2A, we examined the subjective phenomenology accompanying suggested invisibility using a modified memory test. In Experiment 2B, we amended how the testimonies were presented to make them more credible, as some subjects in Experiment 2A expressed disbelief in the testimonies. The method and procedure for Experiments 1, 2A, and 2B will be described together given their similarities, but differences will be noted where appropriate.

Chapter 2: Experiments 1 and 2

Method

Subject Characteristics

Subjects were University of Victoria undergraduates (about 70% women) who participated for optional bonus points in psychology courses. Participation was open to all students in the pool. An exclusion criterion was applied to subjects who did not report at least one critical detail on the final memory test that they had witnessed in the video. Table 1 provides additional information regarding the reasons subjects were excluded from data analysis. In Experiment 1, 46 subjects were included in the final sample; in Experiment 2A, 38 subjects were included in the final sample; and, in Experiment 2B, 60 subjects were included in the final sample.

Materials and Procedure

Session 1: Viewing eyewitness event. Subjects viewed a fictional office theft committed by a female student and then immediately provided a physical description of the culprit.

Eyewitness event. A video of a simulated office break-in shows a young woman lurking around a university campus, ultimately stealing money from an office and then making her get-away. There were two versions of the video, all identical except with regard to which four of eight critical details were visible versus not visible and this was counterbalanced across subjects. For example, one version showed the thief stealing a

Table 1

Reasons for Excluding Subjects from Final Data Analysis in Each Experiment

Experiment (Final sample size)	Figured out manipulation/did not believe testimonies/assumed different video was shown/noted erroneous suggestions	Did not report control details at test	Other (e.g., technical problems)
Total N = Total initial sample size			
Experiment 1 (N=46)	18% ¹	3%	18% (incorrect counterbalancing)
Total N = 96			
Experiment 2A (N=38)	25%	13%	--
Total N = 61			
Experiment 2B (N=60)	20%	11%	--
Total N = 87			
Experiment 3 (N=38)	41% suspicious ² of manipulation; 12% aware of manipulation	N/A	--
Total N = 82			
Experiment 4 (N=31)	47% suspicious of manipulation; 11% aware of manipulation	N/A	--
Total N = 72			

\$50 bill from an envelope whereas in the other version it could only be seen that she took something from the envelope without the item being visible to the viewer (see Table 2 for a full list of the critical details).

¹ Exclusion percentages are based on the total initial sample size

² Corresponds to the categorization of subjects as either suspicious or aware in Experiments 3 and 4

Table 2

Critical Details Seen vs. Not Seen in Each Version of the Video and Counterbalancing of Witness Reports

Video	Version 1				Version 2			
Seen	Adidas logo	Accounting sign	iPod	Coffee mug	\$50 bill	Wristwatch	Skull & crossbones tattoo	Bumper sticker
Not Seen	\$50 bill	Wristwatch	Skull & crossbones tattoo	Bumper sticker	Adidas logo	Accounting sign	iPod	Coffee mug

Counterbalancing of Witness Reports	V1N1	V1N2	V2N1	V2N2
Suggested invisibility 1	Adidas logo	iPod	\$50 bill	Skull tattoo
Suggested invisibility 2	Accounting sign	Coffee mug	Wristwatch	Bumper sticker
Control 1	iPod	Adidas logo	Skull tattoo	\$50 bill
Control 2	Coffee mug	Accounting sign	Bumper sticker	Wristwatch
Actually invisible 1	\$50 bill, Skull tattoo	\$50 bill, Skull tattoo	iPod, Adidas logo	iPod, Adidas logo
Actually invisible 2	Wristwatch, Bumper sticker	Wristwatch, Bumper sticker	Coffee mug, Accounting sign	Coffee mug, Accounting sign

Session 2: Simulated witness narratives and memory test. Subjects returned to the lab after a 2-day delay. They were provided with written and verbal instructions encouraging them to imagine themselves as an investigator who had been called to read handwritten narratives provided by three different witnesses about the events depicted in the video from Session 1 (see Appendix A for a sample written report). Because the narratives included erroneous suggestions, as part of a cover task to distract subjects from noticing the suggestions subjects were told to evaluate each narrative for level of detail

and thoroughness on a 7-point Likert scale. In Experiments 1 and 2A, subjects were informed that the narratives were from other subjects from an earlier study who viewed the same video and then immediately provided a written summary about the video. In Experiment 2B, subjects were informed that they would be reading the three longest narratives provided by subjects from an earlier study who viewed the same video and then immediately provided a written report about the video. We amended the rationale for the witness narratives in Experiment 2B because many subjects from prior experiments expressed disbelief in the plausibility of the narratives (e.g., believing them to be too long and detailed and unlikely to have been produced by other “students” two days after having seen the video). Following the narratives and upon completion of an unrelated filler activity for 10-minutes, subjects completed a final memory test, which will be described in more detail below.

Simulated witness narratives. Narratives were handwritten by the experimenter and two other research assistants to increase plausibility that they were provided by other subject-witnesses. Each narrative varied in its length and description of the target event, but included four critical items of the following types: (1) suggested invisibility and (2) control items. Suggested invisibility items erroneously suggested that two critical items could not be clearly seen in the video (when they had been clearly displayed). For example, for some subjects the target event showed the thief steal an iPod from a backpack. However, in the testimonies, the subjects read that the thief “came out from under the desk and stole something from the guy’s bag and put it in her sweater pocket – but you couldn’t get a clear view of what it was.” Control items mentioned the critical items in broad, generic terms. For example, the iPod as a control item was mentioned in

the testimonies as “the thief then came out from under the desk and stole something from the guy’s bag and put it in her pocket.” This approach was intended to serve as a baseline with which to compare the report rate of suggested invisibility items. All critical items were fully counterbalanced across the suggested invisibility and control item types (see Table 2 for the complete counterbalancing design).

Memory test. In Experiment 1, subjects first completed a free recall memory test that encouraged them to freely report the sequence of events and details as they transpired in the video from Session 1. Subjects then completed a 12-item cued-recall memory test. Of these, four questions pertained to filler items shown in the video (e.g., “Please indicate what you can recall about what the two guys were doing inside the building.”); four questions pertained to items not visible in the video and not mentioned in the testimonies (items that were seen versus not seen were counterbalanced across the two versions of the videos); and four questions pertained to each of the suggested invisibility and control items mentioned in the testimonies (e.g., “Please indicate what you can recall about the logo that appeared on the black baseball cap”).

In Experiment 2A, subjects completed both a free recall memory test and a *modified cued-recall memory test*; in Experiment 2B, subjects only completed the modified cued-recall memory test. We removed the free recall test in Experiment 2B because subjects from prior experiments had expressed suspicion about the purpose of the study. Specifically, during debriefing subjects commented on the brevity and lack of depth of their own narrative (while completing the free recall task) as compared to the lengthy and detailed (simulated) witness narratives. In addition to the same cued-recall questions as mentioned above, for each cued-recall question on the modified cued-recall

questionnaire subjects also indicated their beliefs about having seen a critical item by choosing one of the following three options: (a) I believe X³ was not visible in the video I saw, (b) I believe I did see X, but I have no idea what it was, or (c) I believe I saw X and it was ____: (with subjects being instructed to fill in the blank for the detail they thought they saw). Subjects were also asked to make a subjective confidence judgment accompanying their initial beliefs on a 3-point memory rating scale by choosing from one of the following: (a) “I have a fairly clear memory of my answer so I am confident that it is correct,” (b) “I don’t have a clear memory of my answer, but I have a feeling that it is correct,” or (c) “I am completely following a hunch and I have little or no confidence in my answer.”

Results

Experiment 1. Results from the free recall memory test showed that there was not a statistically significant difference between control and suggested invisibility items (.47 vs. .39, respectively), $F(1, 45) = 2.54$, $d = .26$, 95% CI (-.07, .60) $p = .12$. However, suggested invisibility was obtained on the cued-recall memory test. The proportion of critical items correctly reported was significantly higher in the control relative to suggested invisibility, .67 (95% CI .60, .75) vs. .52 (95% CI .41, .63), respectively, $F(1, 45) = 5.08$, $d = .48$, 95% CI (.05, .93), $p = .03$.

Experiment 2A. Differences did not emerge between the control and suggested invisibility items on the free recall test (.54 vs. .54), $F(1, 37) < 1$. On the *modified cued-recall memory test* subjects indicated their beliefs about having seen a critical item by

³ “X” referred to the critical item being queried on the cued-recall questionnaire.

rating their confidence level for each cued-recall question. Separate repeated measures ANOVAs were conducted with the modified test to examine the proportion of suggested invisibility versus control items attributed to the different responses (did not see in video vs. saw in video, but forgot vs. correct report vs. confabulation). Significant differences did not emerge between suggested invisibility and control items attributed to the four responses, $F(1, 37) < 1$, see Figure 1 below.

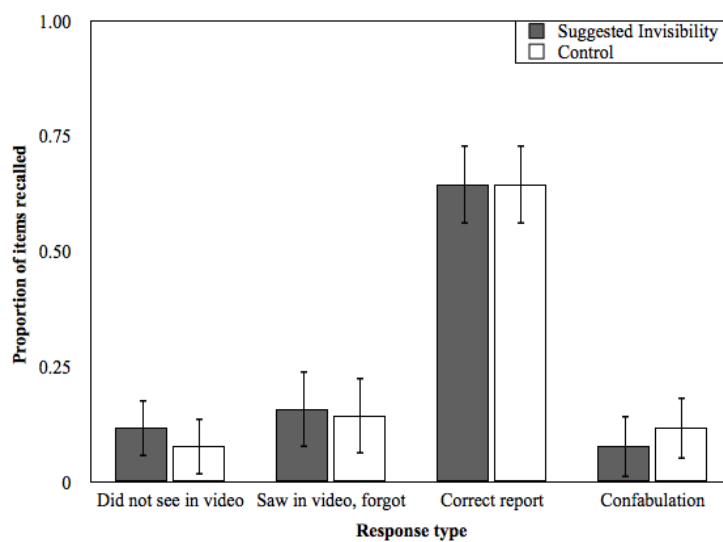


Figure 1. Proportion of items recalled on the modified cued-recall memory test as a function of item and response type in Experiment 2A. Error bars represent 95% within-subjects confidence intervals (Loftus & Masson, 1994).

Subjects were also asked to make a subjective confidence rating accompanying their initial beliefs on a memory rating scale by choosing from one of the following: (a) “I have a fairly clear memory of my answer so I am confident that it is correct,” (b) “I don’t have a clear memory of my answer, but I have a feeling that it is correct,” or (c) “I am completely following a hunch and I have little or no confidence in my answer.”

Subjects' categorical ratings were converted to numerical ratings on a 3-point scale such that response option (a)/high confidence received a score of 3, response option (b)/medium confidence received a score of 2, and response option (c)/low confidence received a score of 1. Confidence ratings were averaged across critical details to yield a mean confidence memory rating score for each subject. Figure 2 below depicts the mean conditionalized confidence ratings across subjects for reported critical details.

Conditionalizing confidence ratings on reported critical details yields unequal sample sizes and as a result the general pattern of results are depicted and described from herein. Based on the figure below, it is evident that subjective confidence ratings also did not vary by item and response type.

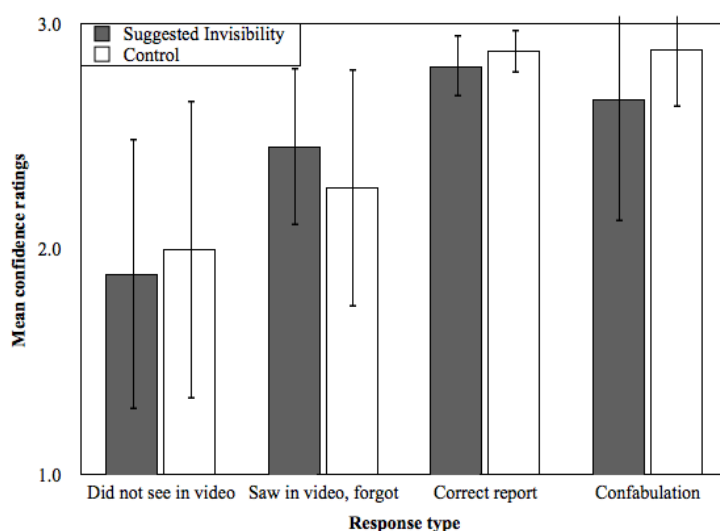


Figure 2. Mean conditionalized confidence ratings on the modified cued-recall memory test as a function of item and response type in Experiment 2A. Error bars represent 95% confidence intervals around each mean (Cumming, 2012).

Experiment 2B. Subjects only completed the modified cued-recall memory test and they were informed that they would be reading the three longest narratives provided

by subjects from an earlier study who viewed the same video and then immediately provided a written report about the video. Similar to Experiment 2A, separate repeated measures ANOVAs were conducted to examine the proportion of suggested invisibility versus control items attributed to the different response types (did not see in video vs. saw in video but forgot vs. correct report vs. confabulation). As per Figure 3 below, a suggested invisibility effect was obtained showing that subjects were significantly less likely to correctly report suggested invisibility items compared to control items (.49 vs. .65, respectively), $F(1, 59) = 7.25$, $d = .55$, 95% CI (.14, .98), $p < .01$. Subjects also had a tendency to claim that suggested invisibility items were not shown in the video (see did not see in video on the x-axis) relative to control items (.12 vs. .06, respectively), $F(1, 59) = 3.40$, $d = -.29$, 95% CI (-.60, .02), $p = .07$. This trend also continued for items claimed to have been visible in the video but forgotten (see saw in video, forgot on the x-axis), with subjects more often claiming that suggested invisibility items had been forgotten compared to control items (.24 vs. .15, respectively), although this tendency fell just short of the conventional alpha, $F(1, 59) = 3.61$, $d = -.33$, 95% CI (-.68, .02), $p = .06$. Confabulation refers to the report rate of guessing items other than the critical items on the memory test (e.g., reporting Nike instead of Adidas). There were no significant differences in the confabulation rate between suggested invisibility and control items, $F < 1$.

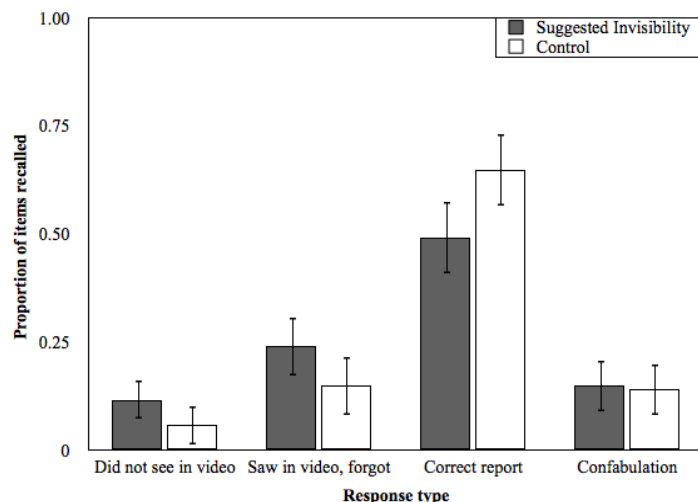


Figure 3. Proportion of items recalled on the modified cued-recall memory test by item and response type in Experiment 2B. Error bars represent 95% within-subjects confidence intervals (Loftus & Masson, 1994).

Similar to Experiment 2A, subjects' subjective confidence ratings were contingent on their responses to cued-recall items and, as such, the mean conditionalized subjective confidence ratings are reported. As can be seen in Figure 4, mean confidence ratings were very similar across the different responses between the suggested invisibility and control items. However, when subjects claimed to not have seen an item in the video the accompanying mean subjective confidence ratings tended to be somewhat higher for suggested invisibility than for control items (2.27 vs. 1.86, respectively), suggesting greater confidence that the suggested invisibility item was not visible when it was clearly shown in the video.

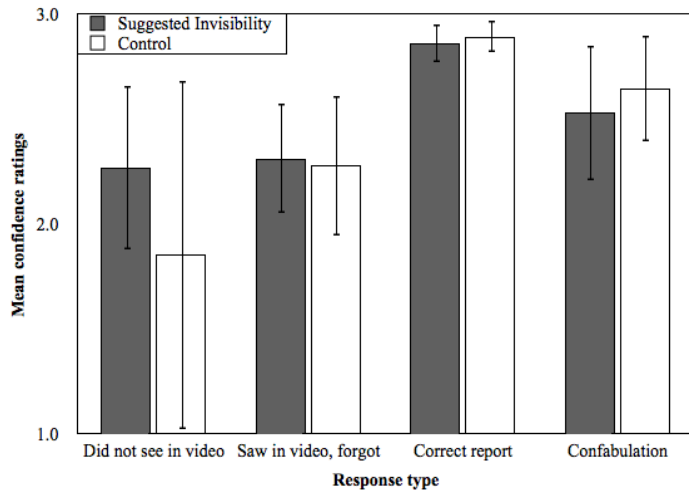


Figure 4. Mean conditionalized subjective confidence ratings on the modified cued-recall memory test as a function of item and response type in Experiment 2B. Error bars represent 95% confidence intervals around each mean (Cumming, 2012).

Chapter 3: Experiment 3

Although Experiments 1 and 2B produced a reliable effect of suggested invisibility, a couple of limitations warrant attention. First, during debriefing many of our subjects figured out the purpose of the witness narratives and did not believe the narratives to be genuine (such subjects were excluded from the data analysis). This would render difficult in detecting any effects of suggested invisibility on memory if the manipulation was too salient for most of our subjects. Second, robust effects of suggested invisibility in our experiments may also have been dampened by the nature of the cued-recall questions on the modified cued-recall memory test. Cued-recall questions likely presuppose the presence of an item (e.g., “please describe the logo that appeared on the baseball cap”). This may create a demand to respond with a specific answer and also fluently cue the perceived item, especially since memories of perceived events are typically rated to be high on perceptual attributes (e.g., Johnson et al., 1988).

To address the aforementioned limitations, in Experiment 3, subjects watched the same mock crime video as the one used in Experiments 1-2B. However, after the 2-day delay, subjects were provided with three hand-written simulated *cued-recall reports* rather than the hand-written witness narratives used in Experiment 1-2B. In the simulated cued-recall reports, subjects viewed point-form answers to specific cued recall questions provided by supposed “other” subjects. Since subjects from the prior experiments had expressed disbelief in the authenticity of the testimonies, the aim of the cued-recall reports was to plant the suggested invisibility items in a more plausible manner, i.e., in response to specific questions rather than spontaneously mentioning in a narrative that an item was not clearly visible. It was predicted that reading suggested

invisibility details (that details could not be clearly viewed) in the context of specific, cued-recall questions would render the erroneous suggestions to be more plausible and less suspicious relative to written narratives. Furthermore, to reduce the discrepancy between suggested invisibility and control details, Experiment 3 also included four additional control details in the testimonies that could not actually be seen in the video. It was predicted that the inclusion of details not actually visible in the video would further reduce any suspicions about the suggested invisibility items. Experiment 3 also improves on the prior memory test implemented in Experiments 2A and 2B by modifying the cued-recall questions to not presuppose the presence of critical details in the video. Instead, the memory test in Experiment 3 provided subjects the opportunity to (a) first indicate if a critical detail can be remembered without suggesting the presence of a detail and (b) then rate the subjective phenomenology accompanying their initial belief regarding the presence of critical details. It was predicted that removing the assumption that critical details appeared in the video may lessen the pressure to respond and may also not readily cue subjects' memory of the critical details, thereby allowing subjects to consider at test if a suggested invisibility detail was actually perceived.

Method

Subject Characteristics. Eight two subjects were University of Victoria undergraduates (about 70% women) who participated for optional bonus points in psychology courses. Participation was open to all students in the pool.

Materials and Procedure

Session 1: Viewing eyewitness event. As in Experiments 1, 2A, and 2B, subjects viewed the same eyewitness video and then immediately provided a written description of the perpetrator.

Session 2: Simulated witness cued-recall reports, memory test, and debriefing questionnaire. Subjects returned to the lab after a 2-day delay. They were provided with written and verbal instructions encouraging them to imagine themselves as an investigator who had been called to read eyewitness reports provided by three different witnesses about the events depicted in the video from Session 1. Subjects were informed that the reports were from other subjects from an earlier experiment who viewed the same video and then one-day later answered questions about specific details in the video. To enhance the authenticity of the witness reports, each report attached a photo to the top corner to supposedly depict the subject who provided the report. The photos were randomly chosen from a previously created face database and included one male and two female subject-witnesses. Similar to the previous experiments, a cover task was implemented to distract subjects from noticing the suggested invisibility items in the cued-recall reports by having them evaluate each report for level of detail on a 7-point Likert scale and also provide a single rating of the general consistency of all three reports. Since all three reports were similar, the other aim of the consistency rating was for subjects to note the similarity of the reports and hence believe in their accuracy. Following the reports and then completion of an unrelated filler activity for 10-minutes, subjects completed a final memory test, which will be described in more detail below.

Simulated cued-recall reports. Each cued-recall report included 16 cued-recall questions, eight of which were filler items and the remaining eight were critical items.

Filler items in the report queried about items that appeared naturally in the video (such as a scene showing a couple walking with a baby stroller). Such items in the report were not part of the overall experimental design and were intended to cue subjects' memories for other visible details in the video and responses to these items also served to minimize suspicions about the inclusion of suggested invisibility items. Most of the cued-recall questions in the report first provided a brief description of the scene being queried (to cue subjects' memory) and then asked (mock) subjects to describe the detail in question. For example, for some subjects the video shows the thief wearing a baseball cap with an Adidas logo across the front of the cap. Each cued-recall question in the report describes the general scene in which the baseball cap is shown and then asked subjects to provide a description of the cap in as much detail as possible. Critical items were of the following three types: (1) suggested invisibility items, (2) control items, and (3) actual invisible items. Suggested invisibility items erroneously suggested that two critical items could not be clearly seen in the video when they had been clearly displayed. In the report, when the insignia on the baseball cap is a suggested invisibility item, some subjects read that the baseball cap was "black, with a flat brim, something on the front but it wasn't big enough to tell what it was." Control items mentioned the critical items in broad, generic terms. When the logo on the baseball cap was a control item, some subjects read "black, flat rim, something on the front." Control items were intended to serve as a baseline with which to compare the report rate of suggested invisibility items. Actual invisible items were items in the video that could not be seen and such items were correctly mentioned in the simulated report as not having been visible. When the logo of the baseball cap was an actual invisible item (i.e., it was not originally shown in the video), some subjects read

“black, flat brim, couldn’t see front.” All critical items were fully counterbalanced across the suggested invisibility, control, and actual invisible item types.

Subjects read reports from three “other” witnesses, which were actually reports written by the experimenter (as was done in Experiments 1-2B). Responses to the cued-recall questions for some of the filler items for the first and third witness contained “I don’t know/I didn’t notice” responses to further plausibility and decrease any suspicion about the simulated reports. The remaining responses to the filler items for the first and third witness reports were accurate to ensure consistency. The second witness’s report was similar to the other two reports to maintain consistency across the reports and this witness’s report was embedded in between the first and third witness reports. All simulated responses were hand-written by three different research assistants to ensure plausibility. Subjects viewed each printed cued-recall report once and in sequential order (see Appendix B for sample cued recall reports).

For each report subjects evaluated the level of detail by rating the report on a 7-point Likert scale from 1 (not very detailed) to 7 (very detailed). At the end of all three reports, subjects evaluated the consistency of all three reports using a 7-point Likert scale from 1 (not very consistent) to 7 (very consistent) and also identified the report they believed to have provided the most complete account of the crime video. All subjects then completed an unrelated printed filler activity for 10-minutes, which was followed by the final memory test.

Memory test. In the previous memory test in Experiments 1, 2, and 2A, the cued-recall questions assumed and suggested the visibility of critical items in the video. For

example, the question “please indicate what you can recall about the logo that appeared on the black baseball cap” implies the presence of a logo and as such may have cued subjects about the logo on the baseball cap; this may have potentially dampened or negated the effect of suggested invisibility on memory reports in the prior experiments. In Experiment 3, to avoid having subjects assume the presence of critical items in the video the cued recall questions were modified to first inquire whether the critical items were seen in the video by asking subjects if they remember the item in question (e.g., “do you remember if a logo appeared on the front of the cap?”). Then, similar to the previous memory test, subjects were provided with three options to choose from to indicate their beliefs about having seen a critical item: (a) No, I believe I did not see X⁴ in the video, (b) Yes, I believe I did see X, but I have no idea what it was, or (c) Yes, I believe I did see X and it said ____: (with subjects being instructed to fill in the blank for the detail they thought they saw). Subjects were also asked to indicate the subjective experiences accompanying their initial belief on a memory rating scale by choosing from one of the following responses: (a) “I have a fairly clear memory so I am confident that my answer is correct,” (b) “I don’t have a clear memory, but I have a feeling that my answer is correct,” or (c) “I am completely following a hunch and I have little or no confidence in my answer.” The memory test was presented to subjects on a computer using the E-prime software.

Debriefing questionnaire. All subjects were asked to briefly describe the purpose of the experiment followed by nine debriefing questions assessing the extent to which subjects were aware of the purpose of the research (see Appendix C). The questions were

⁴ “X” refers to the critical item being queried on the cued-recall questionnaire.

designed to begin with broad queries about the experiment (e.g., “what did you think was the purpose of viewing the witness testimonies) and end with specific queries, such as unveiling the actual purpose of the research and asking whether subjects identified the purpose of the research. The experimenter read each question aloud to the subject and recorded each subject’s response on paper.

Results

Exclusion Criteria

Filler Item Accuracy. Subjects’ performance on seven filler items on the memory test completed in Session 2 was scored as either correct or incorrect to determine overall memory accuracy for the video. One filler item was excluded due to the ambiguity of the correct response. Figure 6 below shows the frequency of correct responses to filler items. Using this criterion no subject was excluded given the normally distributed pattern of correct responses to filler items.

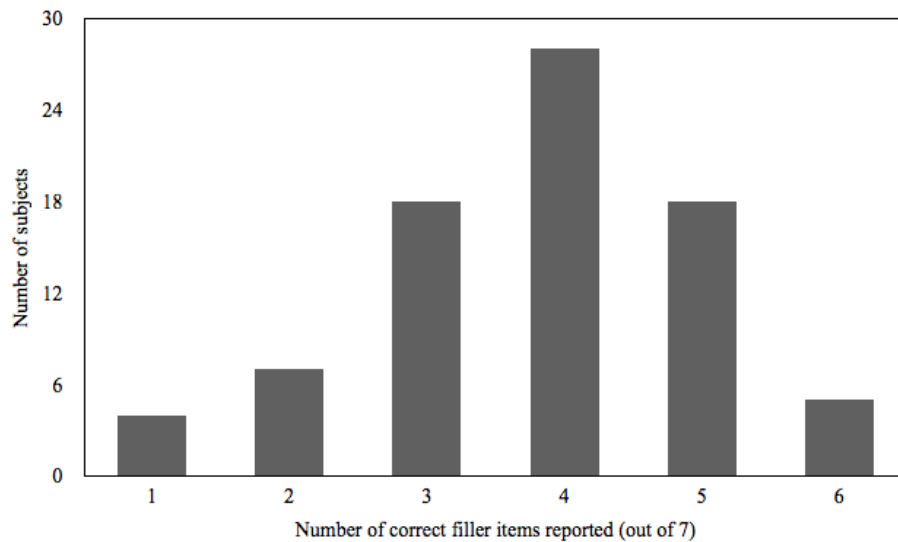


Figure 5. Frequency of subjects’ correct filler item responses in Experiment 3.

Responses to Debriefing Questions. Subjects' responses to the debriefing questionnaire were categorized into three a priori created clusters: naïve, suspicious, and aware. Three raters independently categorized subjects' responses to one of the clusters and all discrepancies were resolved by discussion (Cronbach's $\alpha = .82$). Subjects who were identified as naïve ($N = 38$) were not aware of the purpose of the experiment and did not notice any discrepancies between their memory for the video and the simulated cued-recall reports. Subjects who were identified as suspicious ($N = 34$) were also not aware of the purpose of the experiment, but reported a discrepancy for at least one of the suggested invisibility items between their memory for the video and the simulated cued-recall reports. Subjects who were identified as aware reported the purpose of the experiment and/or mentioned the possibility of having viewed different videos ($N = 10$). Analyses pertaining to all subjects (naïve, suspicious, and aware) and only naïve subjects will be reported, as the results combining the suspicious and naïve subjects were nearly identical to all subjects.

Analyses with All Subjects. Four separate one-way repeated measures ANOVAs were conducted to examine the proportion of suggested invisibility, control visible and actually invisible critical items attributed to each of the four responses (did not see in video vs. saw in video, but forgot vs. correct report vs. confabulation). Follow-up planned comparisons were conducted to specifically examine differences between control and suggested invisibility items in the rate of attributing items to the different responses. Follow-up comparisons with actually invisible items were not conducted since they are not the primary measures interest, however, those results can be viewed with the overall results shown in Figure 6. The first analysis showed a significant effect

of item type (suggested invisibility vs. control visible vs. actually invisible) on the proportion of “did not see in video” responses, $F(2, 162) = 20.62, p < .001$. No significant differences emerged between suggested invisibility ($M = .20$) and control items ($M = .23$), $F(1, 81) < 1, d = .11, 95\% \text{ CI } (-.16, .39), p = .43$. The second analysis also showed a significant effect of item type on the proportion of “saw in video, but forgot” responses, $F(2, 162) = 8.60, p < .001$. Follow-up comparisons did not show a significant difference between suggested invisibility and control items (.21 vs. .18, respectively), $F(1, 81) = .44, d = -.10, 95\% \text{ CI } (-.40, .20), p = .51$. The third analysis did not show any significant differences on the proportion of confabulations as a function of item type, $F(2, 162) = 1.75, p = .18$. The fourth analysis revealed a significant difference in the rate of correct reports as a function of item type, $F(1.77^5, 143.07) = 61.99, p < .001$, however, a suggested invisibility effect was not obtained as the rate of correct reports for suggested invisibility and control items was similar (.46 vs. .47, respectively), $F(1, 81) < 1, d = .04, 95\% \text{ CI } (-.27, .34), p = .81$.

For each cued-recall question on the memory test subjects also indicated the subjective confidence accompanying their beliefs about having seen a critical item (see Figure 7). Similar to the pattern shown in Experiment 2A, mean conditionalized confidence ratings did not vary with item and response type.

⁵ Values based on applying a Greenhouse-Geisser correction to address violation of the sphericity assumption for the one-way ANOVA for correct reports as a function of item type. Although violations of sphericity increase Type I errors, there is typically no risk of Type I errors if the F value associated with the other corrections (e.g., Lower bound and Huynh & Feldt corrections) also remain significant (http://www.upa.pdx.edu/IOA/newsom/da1/ho_wsassump.pdf). Also, focused statistical contrasts were conducted for each response type between suggested invisibility and control items.

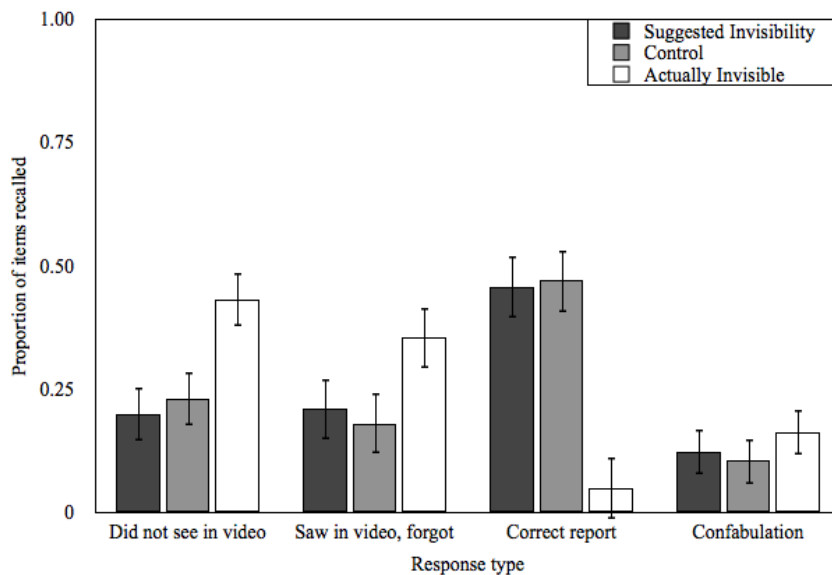


Figure 6. Proportion of items recalled by item and response type in Experiment 3 for all subjects group. Error bars represent 95% within-subjects confidence intervals using the MSE from the one-way ANOVA (Loftus & Masson, 1994).

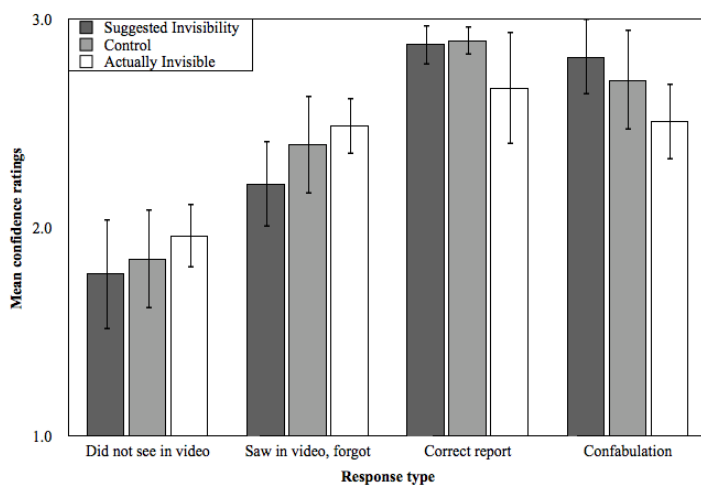


Figure 7. Mean conditionalized confidence ratings for all subjects group in Experiment 3 by item and response type. Error bars represent 95% confidence intervals around each mean (Cumming, 2012).

Analyses with Naïve Subjects. Similar to the previous analyses with all subject groups, four separate one-way repeated measures ANOVAs were conducted to examine the proportion of suggested invisibility, control visible and actually invisible critical items attributed to each of the four responses (did not see in video vs. saw in video, but forgot vs. correct report vs. confabulation). All four analyses are graphed in Figure 8. The first analysis showed a significant effect of item type (suggested invisibility vs. control visible vs. actually invisible) on the proportion of “did not see in video” responses, $F(2, 74) = 12.17, p < .001$. No significant differences emerged between suggested invisibility and control items (.21 vs. .29, respectively), $F(1, 37) < 1, d = .29$, 95% CI (-.09, .66), $p = .14$. The second analysis also showed a significant effect of item type on the proportion of “saw in video, but forgot” responses, $F(1.71^6, 63.28) = 4.99, p < .05$. Follow-up comparisons revealed a significant difference between suggested invisibility and control items (.30 vs. .13, respectively), $F(1, 37) = 5.76, d = -.55$, 95% CI (-1.02, -.08), $p = <.05$. The third analysis did not show any significant differences on the proportion of confabulations as a function of item type, $F(1.69^7, 62.35) < 1, p = .89$. The fourth analysis revealed a significant difference in the rate of correct reports as a function of item type, $F(1.59^8, 58.68) = 24.41, p < .001$. Although directionally a suggested invisibility effect is evident, the difference in the rate of correct reports for suggested invisibility and control items was not statistically significant (.36 vs. .45, respectively), $F(1, 37) = 1.51, d = .29$, 95% CI (-.18, .76), $p = .23$. A correct report for actually

⁶ Values based on Greenhouse-Geisser correction.

⁷ Values based on Greenhouse-Geisser correction.

⁸ Values based on Greenhouse-Geisser correction.

invisible items indicates a correct guess, which only occurred for the iPod because this critical item on the memory test can be easily inferred as the stolen item based on the context in the video.

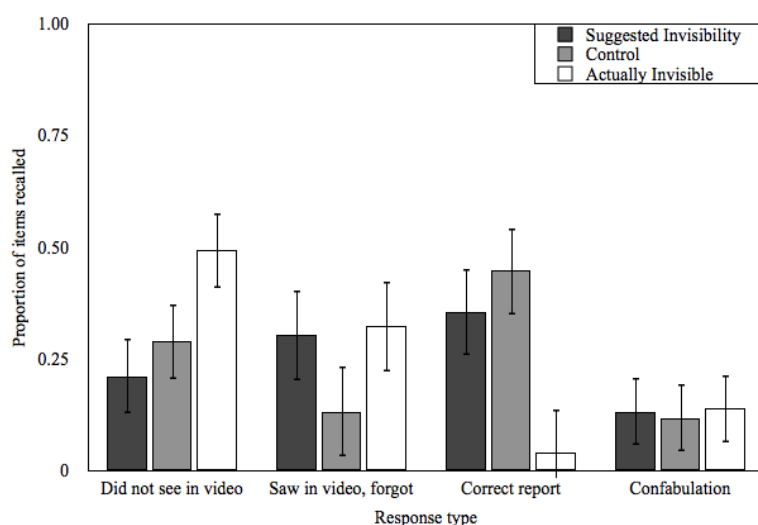


Figure 8. Proportion of items recalled by item and response type in Experiment 3 for naive subjects. Error bars represent 95% within-subjects confidence intervals using the MSE from the one-way ANOVA (Loftus & Masson, 1994).

Figure 9 shows the pattern of results when subjects indicated the subjective confidence accompanying their beliefs about having seen a critical item. Although the mean conditionalized confidence ratings are similar across response and item types, it is interesting to note that subjects' confidence accompanying suggested invisibility items attributed to the response "saw in video, but forgot" is similar to control items. This may suggest that subjects (erroneously) believed with fairly high confidence that previously witnessed details were forgotten when those details were suggested to not have been clearly seen in the simulated cued-recall reports.

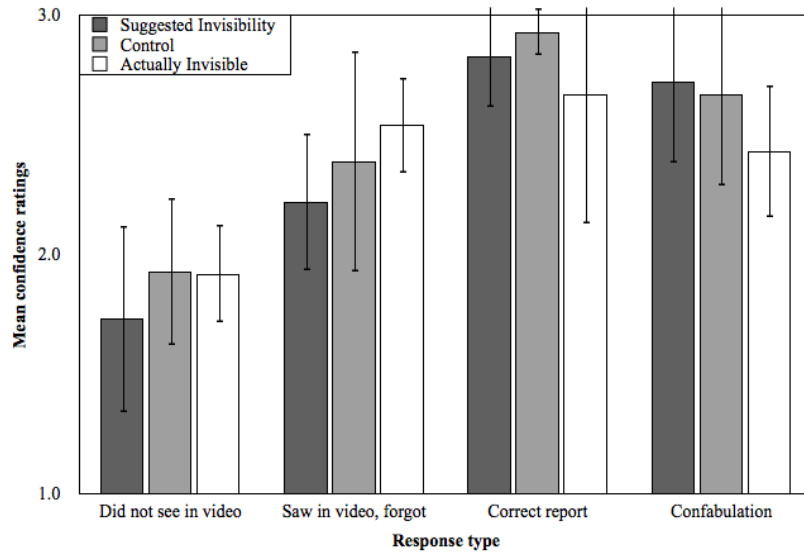


Figure 9. Mean conditionalized confidence ratings for naïve subjects in Experiment 3 by item and response type. Error bars represent 95% confidence intervals around each mean (Cumming, 2012).

Chapter 4: Experiment 4

In Experiment 3, simulated cued-recall reports produced a suggested invisibility effect when data analysis was restricted to naïve subjects but not with all groups of subjects. This effect occurred when (a) subjects claimed “saw in video, but forgot” to previously witnessed suggested invisibility relative to control details and (b) subjects were less likely to correctly report suggested invisibility relative to control details, however, the difference did not yield statistical significance. That the effect occurred with only naïve subjects suggests that the suggested invisibility effect likely varies with the ease of discrepancy detection (Toussignant, Hall, & Loftus, 1986). Subjects who noted a discrepancy between memory for the video and the simulated cued-recall reports appeared to be resistant to the misleading suggestion that previously witnessed details were not visible whereas subjects who did not notice a discrepancy in their memories appeared to have readily accepted the misleading suggestion. Indeed, evidence from prior literature also suggests smaller effect sizes for misinformation effects suggesting the non-occurrence of previously witnessed details relative to misinformation effects suggesting the occurrence of non-witnessed details (Pezdek & Roe, 1997; Wright et al., 2005 but see Merckelbach et al., 2007; Wright et al., 2001, though these studies are low powered). Discrepancy detection in the current experiment may be attributable to *how* suggested invisibility was implemented in the simulated reports. For example, in response to the query regarding the black Adidas baseball cap “please describe the cap in as much detail as you can” subjects read the suggested invisibility statement, “it was black with a brim and something on the front, but couldn’t see what it was because it was small.” Such a statement deviates from conversational norms because it spontaneously

mentions that an aspect of the critical item could not be seen. Consequently, this may have increased the implausibility of the suggestions and may have readily cued subjects' memories to the scene and corresponding visibility of the critical detail in the video, thereby increasing accurate source monitoring. Another issue relevant to discrepancy detection was the roles played by subjects, first as an investigator during the reading of the reports and second, to a witness to a crime video during the memory test. This change in role may have affected how subjects approached the memory test by encouraging them to be more alert as an investigator that may have subsequently benefitted memory performance as a witness. Indeed, several subjects inquired if they should be comparing the reports to their own memories of the video and this may have been a default strategy among most subjects. The change in role from an investigator to a witness is also rather odd, especially since actual investigators would not have witnessed the crime but would gather information from a witness about a crime.

Experiment 4 sought to lessen discrepancy detection and improve the presentation of statements of suggested invisibility to subjects. Subjects watched the same mock crime video as the one used in Experiments 1-3. However, after the 2-day delay, subjects were provided with a written transcript from a single witness rather than cued-recall reports from three different witnesses used in Experiment 1-3. In the single written transcript, subjects read a transcribed interview between a witness and an experimenter in which the experimenter probes the witness about the witnessed crime. Since nearly half of the subjects from Experiment 3 detected a discrepancy between their memory for the video and the cued recall reports, the aim of the single written transcript was to build suggestions of invisibility from general to specific questions to increase the plausibility of

the suggestions. It was predicted that exposure to suggested invisibility in the context of a written transcript would render the erroneous suggestions to be more plausible relative to the cued-recall reports because the suggestions would be mentioned in response to specific queries posed by an experimenter, similar to an actual investigator probing a witness about a crime. Experiment 4 also improves on the prior memory test by modifying the subjective confidence rating scale. In the previous version in Experiment 3 the subjective categorical confidence ratings were transformed to numerical ratings on a 3-point scale (e.g., “I have a fairly clear memory so I am confident that my answer is correct” was scored as a 3). Numerical ratings were then averaged across critical details to produce a mean rating for each subject. This averaging method clouds interpretations regarding people’s subjective states when categorical data are transformed to a rating scale (e.g., a mean rating of 2.0 to suggested invisibility items for the response “did not see in video” suggests that subjects erroneously believed that previously witnessed details were not in the video, even though the average may include scores of 1s and 3s). As such, a numerical confidence rating scale was implemented as an alternative method in Experiment 4.

Method

Subject Characteristics. Seventy two subjects were University of Victoria undergraduates (about 70% women) who participated for optional bonus points in psychology courses. Participation was open to all students in the pool.

Materials and Procedure

Session 1: Viewing eyewitness event. As in Experiments 1, 2A, 2B, and Experiment 3, subjects viewed the same eyewitness video and then immediately provide a written description of the female perpetrator. In previous versions, this task was an open-ended query during which several subjects often mentioned a couple of the critical items, such as the black Adidas baseball cap or the tattoo on the thief's arm. The written description task was modified in Experiment 4 to restrict subjects' descriptions to specific aspects of the perpetrator's physical appearance, such as her hair colour, height, build, weight and clothing.

Session 2: Single written-transcript, memory test, and debriefing questionnaire. Subjects returned to the lab after a 2-day delay. They were provided with written and verbal instructions informing them of the goal of the research project as well as the evaluation task they would complete, both of which served as the new cover stories (see Appendix D for new cover stories). Similar to the previous experiments, a cover story was implemented to distract subjects from noticing the suggested invisibility items in the written-transcript. The new cover story informed subjects that the research seeks to examine how visual cues, such as seeing the face of a witness, might aid people's understanding of a witness's report. The cover story further emphasized that although in real life a witness would not actually read another person's report, witnesses do talk to each other and how a witness understands an event may be influenced by seeing the face of another person. Subjects were then informed that they had been assigned to the faces condition, where they would see the face of the witness who provided the report that they would later read while other subjects in the research would only read the report and would not see the face of the witness. A photo of the supposed

witness was included to enhance the authenticity of the report. The cover story for the evaluation task informed subjects that they would read and evaluate another witness's report of the same video the subject saw 2 days ago (see Appendix E for a sample transcript). Subjects were informed that the witness's report is a transcript of an interview between an experimenter and the witness, and the interview had been conducted one-day after the witness watched the video. Subjects were further informed that during the interview, the experimenter asked the witness questions about specific details and scenes in the video. Subjects viewed a printed colour photo of the female witness, which was chosen from a previously created face database prior to reading the witness's report. Following the report, evaluation task, and then completion of an unrelated filler activity for 10-minutes, subjects completed a final memory test, each of which will be described in more detail below.

Simulated written-transcript. The transcript documented an interview between an experimenter and a supposed witness. The experimenter began the interview with general queries about filler items or scenes, which are items/scenes that appeared naturally in the video (such as a scene when the thief was shown for the first time). Queries about filler items/scenes were not part of the overall experimental design and were intended to cue subjects' memories for other visible details in the video and the witness's responses to these items/scenes also served to minimize suspicions about the inclusion of the suggested invisibility items. Witness's responses to the interview questions conveyed a conversational tone, often including pauses and conversational placeholders such as "um," "uh," or "hmm." The experimenter's queries about filler items/scenes and critical items generally started with broad questions and then gradually

developed into specific questions (e.g., rather than directly asking about a description of the van shown in the opening scenes, the experimenter first asked about the thief's general location and then asked if there were any vehicles nearby; once the witness mentioned a van, the experimenter then asked whether anyone was near or inside the van; once the thief mentioned that no one else was around the experimenter then asked for a description of the van). Similar to Experiment 3, critical items were of the following three types: (1) suggested invisibility items, (2) control items, and (3) actual invisible items. Suggested invisibility items erroneously suggested that two critical items could not be clearly seen in the video when they had been clearly displayed. In the written transcript, the experimenter first asked about the thief's clothing. Once the witness mentioned "she was wearing jeans and a baggy hoodie" the experimenter then asked about the colours of those items. The witness describes the colours after which the experimenter asks if the thief was wearing anything else. The witness then mentions a hat, followed by the experimenter asking about the colour and design of the hat. After the witness describes the hat as a dark-coloured baseball cap, the experimenter then follows up with whether the hat had any images or words. The witness then says that there was something on the front, followed by the experimenter asking if the witness could describe what it was. When the logo on the baseball cap was a suggested invisibility item some subjects read the witness's response as "no, 'cause the front was never shown close-up." Control items mentioned the critical items in broad, generic terms. When the logo on the baseball cap was a control item, some subjects read the witness's response to whether the hat had any images or words as "yeah, there was something on the front." Actually invisible items were items in the video that could not be seen and such items were

correctly mentioned in the transcript as not having been visible. When the logo on the baseball cap was an actually invisible item (i.e., it was not originally shown in the video), some subjects read the witness's response to whether the hat had any images or words as "not that you could see." The transcript was approximately 6-pages in length and was presented to subjects on a computer using the E-Prime software. Subjects also answered 5 multiple-choice questions pertaining to information mentioned in the transcript to gauge their level of attention while reading the transcript (e.g., "what words did the witness use to describe the colour of the thief's jeans?" (a) old and grey, (b) distressed or faded kind, or (c) dark blue). Each of the 5 questions appeared individually throughout the transcript. On the last page of the transcript the experimenter summarized some of key points mentioned by the witness with the aim of reiterating the suggested invisibility, control and actually invisible items since only one eyewitness report was used (see Foster, Huthwaite, Yesberg, Garry, & Loftus, 2012 regarding the role of repeated misinformation with single and multiple witnesses). All critical items were fully counterbalanced across the suggested invisibility, control, and actually invisible item types.

At the end of the transcript subjects evaluated the report, first indicating the gender, ethnicity, and approximate age of the witness. Subjects then rated the witness's report on level of detail, clarity, and whether viewing the photo of the witness aided their understanding of the report on a 7-point Likert scale. Subjects then completed an unrelated filler activity for 10-minutes.

Memory test. All subjects completed a 16-item cued recall memory test similar to the one used in Experiment 3. Subjects were instructed to think back to the video they

viewed from 2-days prior and to imagine an interview scenario with the police in which they are asked questions similar to the ones they read in the witness transcript. For each cued-recall question, subjects were provided with three options to choose from to indicate their beliefs about having seen a critical item: (a) No, I believe I did not see X⁹ in the video, (b) Yes, I believe I did see X, but I have no idea what it was, or (c) Yes, I believe I did see X and it said ____: (with subjects being instructed to fill in the blank for the detail they thought they saw). Subjects were also asked to indicate the confidence accompanying their initial belief on a 6-point Likert rating scale with 1 indicating “I am not very confident” to 6 indicating “I am very confident.” The memory test was presented to subjects on a computer using the E-prime software.

Debriefing questionnaire. Similar to Experiment 3, all subjects were asked to briefly describe the purpose of the experiment followed by nine debriefing questions assessing the extent to which subjects were aware of the purpose of the research. The questions were designed to begin with broad queries about the experiment (e.g., “what did you think was the purpose of viewing the witness testimonies) and end with specific queries, such as unveiling the actual purpose of the research and asking whether subjects identified the purpose of the research. The experimenter read each question aloud to the subject and recorded each subject’s response on paper.

Results

Exclusion Criteria

⁹ “X” refers to the critical item being queried on the cued-recall questionnaire.

Filler Item Accuracy. Similar to Experiment 3, subjects' performance on seven filler items on the memory test completed in Session 2 was scored as either correct or incorrect to determine overall memory accuracy for the video. One filler item was excluded due to the ambiguity of the correct response. Using this criterion no subject was excluded given the normally distributed pattern of correct responses to filler items.

Responses to Debriefing Questions. Two raters independently categorized subjects' responses to the debriefing questionnaire as naïve, suspicious, and aware. Again, analyses pertaining to all subjects (naïve, suspicious, and aware, $N = 72$) and only naïve subjects ($N = 31$) will be reported, as the results combining the suspicious and naïve subjects were nearly identical to all subjects.

Analyses with All Subjects. Four separate one-way repeated measures ANOVAs were conducted to examine the proportion of suggested invisibility, control visible and actually invisible critical items attributed to each of the four responses (did not see in video vs. saw in video, but forgot vs. correct report vs. confabulation). Figure 10 depicts the pattern of results. The first analysis showed a significant effect of item type (suggested invisibility vs. control visible vs. actually invisible) on the proportion of "did not see in video" responses, $F(2, 142) = 18.64, p < .001$. No significant differences emerged between suggested invisibility ($M = .18$) and control items ($M = .20$), $F(1, 71) < 1, d = .07, 95\% \text{ CI } (-.20, .34), p = .61$. The second analysis also showed a significant effect of item type on the proportion of "saw in video, but forgot" responses, $F(2, 142) = 7.00, p < .01$. Follow-up comparisons did not show a significant difference between suggested invisibility and control items (.23 vs. .23, respectively), $F(1, 71) < 1.00, p = 1.00$. The third analysis did not show any significant differences on the proportion of

confabulations as a function of item type, $F(2, 142) < 1.00, p = .76$. The fourth analysis revealed a significant difference in the rate of correct reports as a function of item type, $F(1.68^{10}, 119.29) = 37.08, p < .001$, however, a suggested invisibility effect was not obtained as the rate of correct reports for suggested invisibility and control items was similar (.41 vs. .42, respectively), $F(1, 71) < 1, p = .91$.

For each cued-recall question on the memory test subjects also indicated the subjective confidence accompanying their beliefs about having seen a critical item (see Figure 11). Similar to the pattern shown with all subject groups in Experiment 3, mean conditionalized confidence ratings did not differ greatly with item and response type.

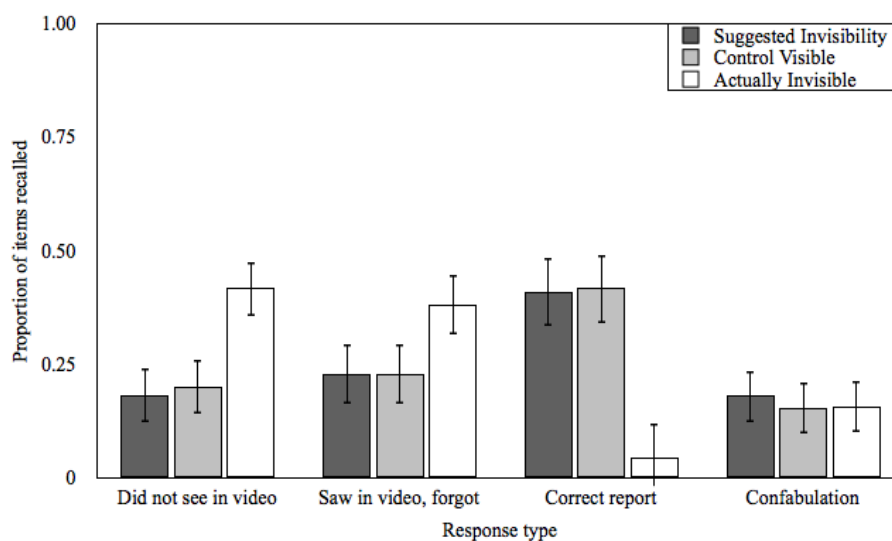


Figure 10. Proportion of items recalled by item and response type in Experiment 4 for all subjects group. Error bars represent 95% within-subjects confidence intervals using the MSE from the one-way ANOVA (Loftus & Masson, 1994).

¹⁰ Values based on Greenhouse-Geisser correction.

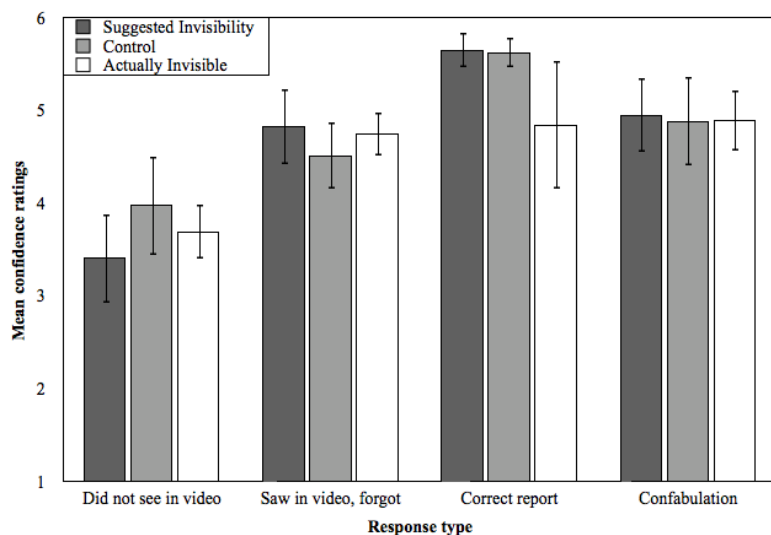


Figure 11. Mean conditionalized confidence ratings for all subjects group in Experiment 4 by item and response type. Error bars represent 95% confidence intervals around each mean (Cumming, 2012).

Analyses with Naïve Subjects. Four separate one-way repeated measures ANOVAs were conducted to examine the proportion of suggested invisibility, control visible and actually invisible critical items attributed to each of the four responses (did not see in video vs. saw in video, but forgot vs. correct report vs. confabulation). Figure 12 below depicts the pattern of results. The first analysis showed a significant effect of item type (suggested invisibility vs. control visible vs. actually invisible) on the proportion of “did not see in video” responses, $F(2, 60) = 4.56, p < .05$. No significant differences emerged between suggested invisibility ($M = .26$) and control items ($M = .24$), $F(1, 30) < 1, p = .80$. The second analysis also showed a significant effect of item type on the proportion of “saw in video, but forgot” responses, $F(2, 60) = 4.00, p < .05$. Follow-up comparisons revealed a significant difference between suggested invisibility and control items (.34 vs. .16, respectively), $F(1, 30) = 5.07, d = -.59, 95\% \text{ CI } (-1.12, -$

.05), $p < .05$, showing that subjects were more likely to claim that suggested invisibility items were seen but forgotten relative to control items. The third analysis did not show any significant differences on the proportion of confabulations as a function of item type, $F(2, 60) < 1.00$, $p = .51$. The fourth analysis revealed a significant difference in the rate of correct reports as a function of item type, $F(1.48^{11}, 44.58) = 17.52$, $p < .001$, and planned comparisons showed a significant suggested invisibility effect, with a lower rate of correct reports for suggested invisibility relative to control items (.21 vs. .47, respectively), $F(1, 30) = 8.33$, $d = .83$, 95% CI (.22, 1.42), $p < .01$.

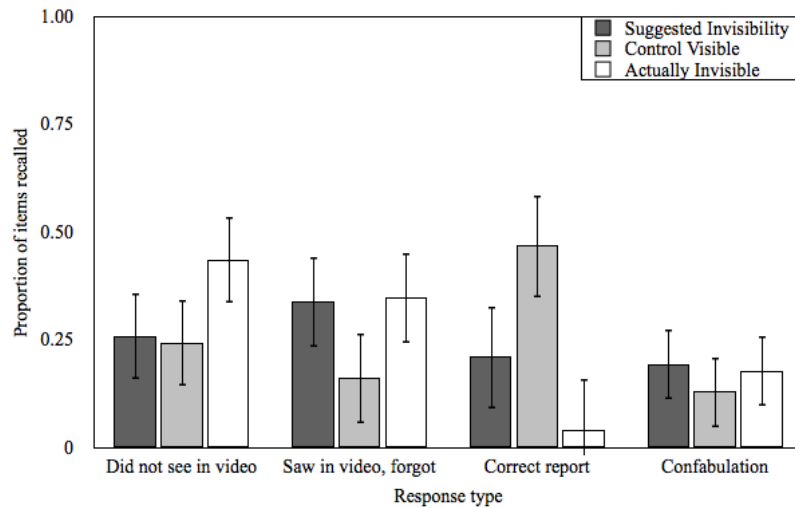


Figure 12. Proportion of items recalled by item and response type in Experiment 4 for naïve subjects. Error bars represent 95% within-subjects confidence intervals using the MSE from the one-way ANOVA (Loftus & Masson, 1994).

Figure 13 shows the pattern of results when subjects indicated the subjective confidence accompanying their beliefs about having seen a critical item. Similar to the

¹¹ Values based on Greenhouse-Geisser correction.

pattern obtained in Experiment 3 with naïve subjects, the suggested invisibility effect obtained with higher responses to “saw in video, but forgot” with suggested invisible relative to control items shows similar levels of confidence. This may suggest that subjects (erroneously) believed with fairly high confidence that previously witnessed details were forgotten when those details were suggested to not have been clearly seen in the simulated cued-recall reports.

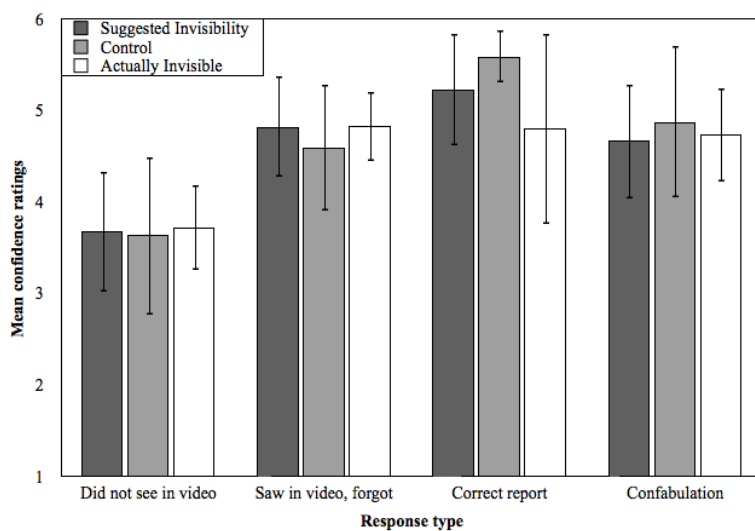


Figure 13. Mean conditionalized confidence ratings for naïve subjects in Experiment 4 by item and response type. Error bars represent 95% confidence intervals around each mean (Cumming, 2012).

Chapter 5: General Discussion

The experiments reported in this dissertation were designed to empirically examine the extent to which people's memories for witnessed event details may be prone to suggestions that certain event details could not have been witnessed even though they were clearly visible. The approach taken to address the research question departed from methodology in prior research examining this memory phenomenon (e.g., Merckelbach et al., 2007; Wright et al., 2005). While the evidence varied in its strength of support, and methodological problems remain with the current paradigm, collectively, four of the five experiments produced the suggested invisibility effect. The findings from these experiments also showed that, a small proportion of the time, subjects who claimed to not have witnessed previously seen details (falsely) experienced high confidence in their claim. In the following sections, the findings of the research are discussed in terms of the SMF as well as other related memory phenomena, followed by limitations and suggestions for future research.

Suggested invisibility as a source misattribution. Verbal misinformation regarding a witnessed event, given in written narratives (Experiments 1 and 2B), cued-recall reports (Experiment 3), and a single witness's interview transcript (Experiment 4), established the finding that people were less likely to correctly report witnessed event details when they had been erroneously suggested to not be clearly visible. Lower correct report rates means that details were attributed to the other responses. Indeed, people more often attributed suggested invisibility details to the response, "saw in video, but forgot" relative to control details (Experiments 2B, 3, & 4). Experiment 2B also

showed higher response rates to “did not see in video” but this pattern did not replicate in the subsequent experiments.

That the suggested invisibility effect occurs mostly as “saw in video, but forgot” suggests that subjects were rarely experiencing illusory memories of not seeing but rather experienced illusory beliefs. From the perspective of the SMF, memory errors occur when a memory originating from one source resembles features that are typical of another source. With erroneous suggestions, people misattribute memories of erroneous suggestions mentioned in a witness report to memories of the original experience. In the standard misinformation effect, a suggestion of the *presence* of a non-witnessed detail is mistakenly attributed to memory of an event. This may occur if the suggestion evokes a vivid image of the (non-witnessed) detail and this image is interpreted as evidence of an original experience. In the suggested invisibility effect, the suggestion of the *absence* of a witnessed detail is mistakenly attributed to memory of an event. However, rather than the suggestion evoking an image of a non-witnessed detail, this time the suggestion may encourage a hazy or unclear image of the witnessed detail. People may correctly remember the witness narratives mentioning the suggested invisibility detail and imagine *how* the detail may not have been clearly visible, e.g., ‘the witness report mentions the logo was too small to be clearly seen on the thief’s baseball cap and now that I think about it, the logo that I thought I saw on the hat must’ve not been big enough to clearly see’. At test, if the constructed image or related thoughts associated with the suggestion comes to mind readily but lacks vividness and clarity then it may be interpreted as evidence of an original experience (i.e., that the logo was not visible even though it was witnessed). The source confusion then becomes interpreting the (unclear) memory of the

constructed image associated with the suggestion as evidence that the detail was *not* actually perceived, since it does not have vivid perceptual-like features that are typically associated with memories of genuine experiences (Johnson et al., 1988; Johnson et al., 1993; Lindsay, 2008, 2014).

Prior research shows that repeated exposure to misinformation relative to single exposure increases the likelihood of falsely remembering misinformation (Henkel & Carbuto, 2008; Zaragoza & Mitchell, 1996; Mitchell & Zaragoza, 1996). From a SMF perspective, repeated exposure enhances the mental representation of the misinformation because each exposure serves to increase its perceptual qualities as well as ease of retrieval, thereby rendering the characteristics of the representation similar to memories of perceived experiences. When queried about the misinformation at test, subjects may easily misattribute the misinformation to the witnessed event because the imagined representation of the misinformation comes to mind fluently and with enhanced perceptual qualities – so, the representation “feels” like a memory based on an actual experience (see also Suengas & Johnson, 1988, regarding the role of imagery and memory).

How might repeated exposure influence the suggested invisibility effect? In Experiments 2B and 3, subjects read three different statements about the witnessed event and were exposed to all of the critical items three times, in particular, the suggested invisibility items. With each exposure to the suggestions subjects may have spontaneously created an accompanying mental image. Each subsequent exposure to the suggestions may have embellished the lack of clarity of the image as well as the veracity of the suggestions since each repetition of the suggestion differed slightly (e.g., in the

cued recall reports in Experiment 3, one witness's report describes the stolen \$50 bill as "saw thief take something from envelope, but hand covered the item she took so you couldn't see it" whereas the other witness's report states "maybe she nicked something folded in paper but it was too fast to tell what it was"). Consequently, in response to queries about the suggested invisibility details at the time of the memory test, the created image and accompanying thoughts and beliefs may have been retrieved fluently - that is, subjects may have had a fuzzy recollection of the detail as well as remembered the witness reports converging on its lack of clarity. In this way, the SMF provides a means to think about how mental contents arise from multiple sources and become interleaved in one's thought to sometimes contribute to source monitoring errors.

A potential issue with the aforementioned SMF interpretation is understanding why subjects would more often report "saw in video, but forgot" rather than "did not see in video" if the assumption is that subjects construct an image of the suggestion's non-occurrence. Yet, this prediction is complicated by the fact that the SMF also assumes memories of relatively recent experiences to be rich in perceptual content (Johnson et al., 1988), suggesting that subjects should have a memory of the original event details. This assumption also renders some difficulty with the notion of conjuring an image of "not seeing" previously witnessed event details. Furthermore, the current paradigm did not implement techniques aimed at encouraging illusory recollections of not seeing (e.g., by using imagery and/or a longer delay, Drivdahl & Zaragoza, 2001). In these regards, the SMF would not predict subjects to more often err in their reports by choosing "did not see." The SMF certainly has its limitations in predicting the likelihood of source

misattributions in complex situations and suggested invisibility is a rich and complex avenue to further test the assumptions of this framework.

Alternative explanations. Another plausible explanation of the suggested invisibility effect occurring as “saw in video, but forgot” pertains to effortless retrieval (Fiona Gabbert, personal communication). In reading other witness statements suggesting the non-occurrence of certain details subjects may have been less motivated to search their memory for the witnessed details, thereby leading them to easily accept others’ misinformation. A potential factor contributing to effortless retrieval is the narrative. In the standard misinformation paradigm, a narrative offers a rich summary of the witnessed event that serves to encourage subjects to actively reconstruct the event alongside the embedded misinformation. In the suggested invisibility paradigm, although a narrative still provides a detailed account of the event it may not necessarily encourage active reconstruction of the event to the same degree. In this regard, subjects may be less willing to try to remember event details that lead them to adopt a lax response criterion and engage in effortless source monitoring independent of any actual memory impairment. This effortless retrieval may also relate to informational influence to produce suggested invisibility, in which subjects believed in the accuracy of the witness narratives above their own memory (again, because they may have been less inclined to search their own memory for the event details). Indeed, recent empirical research by Mazzoni, Clark, and Nash (2014) examined the impact of compelling informational influence to affect belief in the occurrence and not memories of autobiographical events. Their findings showed that people were swayed to falsely believe that previously performed actions had not been performed despite having intact recollections for those

actions. In short, both effortless retrieval and information influence offer compelling alternative explanations to the suggested invisibility effect and raise intriguing queries for future research regarding the fate of the originally witnessed event details.

Subjective confidence ratings. The subjective confidence ratings accompanying people's reported memories showed some intriguing patterns. In Experiment 2A, the suggested invisibility effect was not produced and confidence ratings associated with suggested invisibility and control items were nearly identical across the different response categories. In Experiment 2B, however, where the suggested invisibility effect was produced, subjects' confidence ratings were directionally higher (though not statistically) for suggested invisibility relative to control items when items were claimed to have not been seen in the video. Caution is warranted when interpreting such low-power findings because they may suggest that (a) a small proportion of the time subjects were genuinely confident in not having witnessed previously seen event details after exposure to suggestions of invisibility in the witness narratives, or (b) subjects were recalling the narratives' mentioning of suggestions of invisibility and judging confidence ratings on that basis - in other words, subjects may not have rendered decisions regarding confidence ratings on a personal subjective level but rather on their memories of the witness reports. As previously acknowledged, the mean confidence data reported in Experiments 2B and 3 cloud the pattern of subjective categorical confidence responses associated with each response type. Although differences did not emerge in these mean confidence ratings differences may appear in the categorical ratings. Figure 14 below shows the frequency of the conditionalized subjective categorical ratings in Experiment 3 with naïve subjects. The pattern remains fairly similar across suggested invisibility and

control items, but it is interesting to observe that when subjects attributed suggested invisibility items to the response “saw, but forgot,” the accompanying subjective rating was primarily illusory feelings of knowing that previously witnessed details had not been seen relative to control items. Again, caution is exerted when interpreting such findings given the unequal and small sample sizes in each cell of the subjective categorical ratings and response type.

What the subjective confidence data using the revised paradigms in Experiments 3 and 4 do show, however, is that the type of detail (i.e., suggested invisibility, control, actually invisible) does not affect confidence but rather the type of response (i.e., did not see, saw but forgot, correct report, confabulation) elicits a certain confidence. That is, the response “did not see” generally elicits low confidence, “saw, but forgot” generally elicits medium confidence with correct reports eliciting the highest confidence. This pattern appears to be a consistent finding, as it is evident with both naïve and all subject groups.

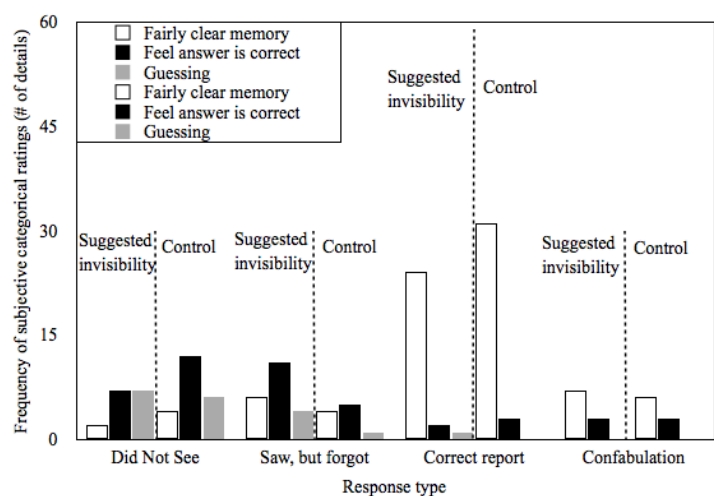


Figure 14. Conditionalized frequency of subjective categorical ratings as a function of item and response time with naïve subjects in Experiment 3.

Relationship to other memory phenomenon. The suggested invisibility effect may be reminiscent of other memory phenomenon under the purview of forgetting. For example, in the retrieval practice paradigm (Anderson et al., 1994) subjects are first presented with various lists of category-exemplar pairs to study (e.g., fruit-orange, drinks-scotch, fruit-banana). Second, subjects undergo a retrieval practice session during which they complete cued stem recall tests (e.g., fruit-or__) on half of the exemplars from half of the categories presented during the first phase (e.g., practicing the fruit category but retrieving only orange, not banana). Each category-exemplar pair is practiced three times to enhance the effect of the practiced exemplars. A final cued recall test includes all of the category-exemplar pairs from the first phase (e.g., fruit-or__ and fruit-ba__). Subjects show impairment in recollection of unpractised exemplars in the same category as the practiced exemplars (e.g., banana) relative to exemplars from unpractised categories (e.g., Scotch). This robust and replicable phenomenon, mentioned in the Introduction, is referred to as the RIF phenomenon, which occurs when recalling some information from memory that was previously retrieved leads people to forget related information that was previously studied but not retrieved. Inhibition has been proposed as the dominant account of RIF (see Anderson, 2003). According to this account, forgetting of previously studied yet unpractised exemplars (e.g., fruit-banana) occurs because those exemplars are inhibited during retrieval practice. When a category cue (e.g., fruit-or__) is presented during retrieval practice, most exemplars associated with the category are activated and compete for retrieval (e.g., banana, orange, apple). The competing exemplars are suppressed during practice to reduce their interference and

to activate correct retrieval of the studied exemplar (e.g., orange). Those not retrieved are inhibited.

RIF has been examined in complex events such as eyewitness memory (e.g., Shaw, Bjork, & Handal, 1995), including research examining the influence on memory of omitting previously witnessed event details on memory (e.g., Williams et al., 2002; Wright et al., 2001). To briefly reiterate the omission procedure in Wright et al. (2001), subjects viewed a storybook comprising a series of scenes depicting a couple going out on a date and were also asked to re-draw each scene. One of the critical scenes showed a waitress taking the couple's order. One-week later some subjects viewed another person's drawings of the storybook intended to recap the original story from a week prior, which is akin to a retrieval practice phase. Importantly and unbeknownst to subjects, the "other" person's version of the storybook omitted the critical waitress scene, which is akin to the unpractised exemplars. When memory was tested, people were generally less likely to recall or recognize a previously witnessed scene (e.g., of a waitress taking a couple's order) if it had been omitted from the recap phase. This finding is attributed to RIF because recalling an event with a critical detail omitted strengthens the activation of the non-omitted details and suppresses access to the omitted detail.

The suggested invisibility effect is likely not the result of RIF. The misinformation paradigm producing suggested invisibility does not actually omit witnessed details; rather, the paradigm explicitly *suggests* the absence of previously witnessed details as a means to foster source misattributions with two memory representations, one for the witnessed event and the other for the suggested event. The

extent to which source misattribution occurs in the retrieval practice paradigm is unclear. It may be assumed that source misattribution does not occur in this paradigm because people are led to not think about a previously witnessed detail by omission of that detail. During retrieval practice, the non-omitted details are retrieved and activated, and this is suggested to inhibit memory of the omitted detail. This supposed inhibition might lead people to not spontaneously image the omitted detail because its memory representation is assumed to be inaccessible.

A memory phenomenon that may be more reminiscent of suggested invisibility than RIF is directed forgetting (DF). In a DF paradigm, subjects typically study a list of items with instructions to the *remember group* to remember the items for a later memory test and to the *forget group* to forget the items. A second list of items is then presented to both groups with instructions to remember the items, followed by a memory test to recall all of the studied items (including those items that the forget group were instructed to forget). People generally show *directed forgetting*, i.e., relative to the remember group, the forget group show impaired memory for the first list but better memory for the second list (see MacLeod, 1998, for a review). A context-change account by Sahakyan and Kelley (2002) is now the dominant explanation for directed forgetting (see also Mulji & Bodner, 2010). By this account, instructions to forget encourage people to mentally shift the context under which the first list was encoded to a new mental activity to distract attention away from the first list. Context refers to the thoughts, emotions, experimental environment, and other associations accompanying the experience of studying the list. The proposed shift in mental activity reduces access to the first list's contextual cues and also serves as a buffer to separate the two lists. Impairment occurs in the forget group for

the first list because the final memory test is most similar in mental context to the second relative to the first list. A secondary component to the context-change account explains the benefit observed in memory performance for the second list in the forget group compared to the remember group. This benefit is observed because the cue to forget prompts the forget group to engage in elaborate encoding strategies when studying the second list relative to the remember group.

The suggested invisibility and directed forgetting paradigms differ considerably and thus drawing analogies between the two poses some difficulty. However, the suggested invisibility effect may resemble directed forgetting by virtue of the misinformation serving as an implicit cue to “forget” the (witnessed) critical detail. If exposure to misinformation in the witness report(s) encourages subjects to “forget” the suggested details then those details ought to be reported less frequently compared to control details and this pattern has been observed in four of the five experiments here. Invoking the context-change account, if the misinformation acted as a cue to “forget” then this may have prompted subjects to change the mental context associated with the witnessed details such that, at test, subjects may not have had access to the original context cues. Control details would not be predicted to undergo any changes in mental context (because most of these details did not co-occur with suggested details and appeared in different scenes) and as such access to these details at test would not be affected. Whether a source misattribution account or mechanisms related to directed forgetting produces the suggested invisibility effect is unclear and is a potential query for future research. However, the two accounts need not be mutually exclusive. That is, it is possible that suggestions of invisibility may have prompted subjects to “forget” the

witnessed details by envisioning the scenario mentioned in the witness report(s). At test, subjects may not have accessed the original contextual cues because features of the imagined scenario were easily retrieved.

Limitations. One important limitation of the memory phenomenon examined in this research is that the suggested invisibility effect is sensitive to people's knowledge of the experimental manipulation, as was evident with the null effects obtained in Experiment 2A and in the analyses with both aware and suspicious subjects in Experiments 3 and 4. Indeed, prior research points to similar challenges with suggestions of misinformation regarding the absence of previously witnessed details (e.g., Otgaar et al., 2010b; Pezdek & Roe, 1997). The null effects in Experiments 2A, 3, and 4, arose due to subjects having memories of both the witnessed details in the video and memories of the (erroneous) suggestions mentioned in the report(s). There are a number of characteristics of our materials and procedure that likely worked against suggestions of not seeing previously witnessed details in the current experiments. First, most of the critical items shown in the video were sufficiently salient to be attended, encoded, and subsequently reported when cued at test. The video was originally designed for a study to produce the standard misinformation effect. In the current paradigm the saliency of the critical items in the video may have backfired by encouraging a stringent criterion for reports of *not* remembering previously witnessed items (as per Schacter, Israel, & Racine's, 1999, distinctiveness heuristic; cf. Bodner & Lindsay, 2003). Second, suggestions of invisibility were embedded in a detailed narrative, which may have negated robust effects if the narrative acted as cues to remember the items prior to the presentation of the actual suggestions.

Another possibility is that the suggestions in the witness reports may have been quite memorable and distinctive (this point is different from item saliency mentioned above because it specifically pertains to the suggested statements rather than the critical items in the video). Indeed, the plausibility of statements of suggestions of invisibility for some critical items relative to others may have reduced the likelihood of misattributing those items to the video. For example, the bumper sticker on the thief's car was clearly visible when the camera paused and zoomed in on the back of the car, but the witness reports suggested that it could not have been clearly seen since the thief had walked in front of the bumper sticker. In hindsight, such a suggestion is not realistic when the critical item was clearly perceivable in the video. Such saliency likely heightened discrepancy detection (Tousignant et al., 1986) that promoted accurate source monitoring during recollection at the time of test. Furthermore, it may be that subjects sometimes consciously noted that they had a vivid recollection of seeing a detail when the reports mentioned not seeing a previously witnessed detail, strengthening their memory for the detail they retrieved and questioning the witness report(s). In addition, source confusion may have been averted if statements of suggested invisibility in the witness reports were not vividly imagined (Johnson et al., 1993). The reports may have rarely facilitated spontaneous imagining or elaboration of the suggestions (see Drivdahl & Zaragoza, 2001) for subjects in Experiment 2A and those who were categorized as aware and suspicious in Experiments 3 and 4.

Another limitation to consider is the design of the control condition. In general, the aim of the control condition was to broadly cue the critical item without increasing or decreasing correct memory performance (e.g., "she took something and put it in her

pocket” as a cue regarding the stolen iPod). However, during debriefing subjects sometimes flagged control items as being puzzling - did the witness not remember the critical item or is this part of the experimental manipulation? This may have inadvertently decreased correct reports of control details that may have consequently lessened the difference in the rate of reports between suggested invisibility and control items.

Future directions. The boundaries of the suggested invisibility effect demonstrated in the current experiments are not necessarily conclusive. As such, future research should seek to address some of the methodological challenges outlined above with modifications to the current paradigm. As a first step is a new mock crime video to strike a balance between critical item saliency and detecting a suggested invisibility effect, such that the perceived items are not too jarring to be easily dismissed as not having been witnessed. Second, a revision is needed to the cover story to further conceal the purpose of the research, for example, by implementing additional procedures such as the Red Herring Technique that deceptively and strongly suggest to subjects a different purpose of the research by disguising its truth (e.g., Laney, Kaasa, Morris, Berkowitz, Bernstein, & Loftus, 2008). Third, reading another person’s witnessed report may naturally encourage people to adopt an evaluative strategy. In generating future suggestions of invisibility, a more robust suggested invisibility effect may be demonstrated if the suggestions are posed as leading questions (e.g., “when the thief walked across the bumper sticker that couldn’t be clearly seen, she was the only one in the parking lot at the time, correct?”) rather than as embedded statements in a report. Prior research has observed that leading questions produce larger misinformation effects than misinformation embedded in a narrative because the former encourages active

mental reconstruction of the event with the misinformation in mind (Zaragoza & Lane, 1994).

Finally, Hyman and Kleinknecht (1999) discussed a three-phase route to the creation of false memories that bears relevance to the suggested invisibility effect (see also Scoboria, Mazzoni, Kirsch, & Relya, 2004, regarding a nested model for false memories of autobiographical events). The first phase posits that the (falsely) suggested item or event must be plausible. In suggested invisibility, if the suggestion that an item could not be seen because of an implausible reason then the suggestion is much less likely to be accepted as true. As previously noted, implausibility of the erroneous suggestions in the current experiments may have contributed to the likelihood of detecting the suggested invisibility effect. As a future direction, suggestions of invisibility mentioned in a witness's report should be softened to convey some realism as to the reason(s) for the item's lack of perceived clarity. Hyman and Kleinknecht's second phase concerns memory construction. Once plausibility of the suggested event or item is established, an accompanying mental representation of the suggestion must be constructed, either by encouraging people to deliberately remember through imagery instructions or by having the suggestion itself foster imagery. The third phase necessitates a source misattribution error in which the constructed mental representation of the suggestion is misattributed to memory of the witnessed event. That is, the person must claim the mental image to be a personal memory. Various factors influence the extent to which a source misattribution error will occur (see Zaragoza et al., 2001) and although all of the phases linearly contribute to the formation of false memories, each phase is also independently influenced by a host of factors (Hyman & Kleinknecht,

1999). In this way, all of the phases should be considered for future improvements to the suggested invisibility paradigm.

In conclusion, our findings indicate that misinformation is not limited to adding erroneous details to memory for a witnessed event but can be extended to reduce reports of witnessed details. Of course, continued methodological improvements to the suggested invisibility paradigm are highly desirable. This is a fascinating research avenue that is beginning to emerge in the misinformation literature to further our theoretical understanding of memory. Continued research on suggested invisibility also bears important legal implications (e.g., pertinent information not being reported by witnesses to law enforcement officials) as well as general applied implications regarding various relational disputes, such as those occurring in professional, marital or family situations (e.g, denial by a perpetrator to childhood sexual abuse).

References

- Ackil, J. K., & Zaragoza, M. S. (1998). Memorial consequences of forced confabulation: Age differences in susceptibility to false memories. *Developmental Psychology, 34*(6), 1358-1372. doi:10.1037/0012-1649.34.6.1358
- Anderson, M. C. (2003). Rethinking interference theory: Executive control and the mechanisms of forgetting. *Journal of Memory and Language, 49*(4), 415-445. doi:10.1016/j.jml.2003.08.006
- Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting: Retrieval dynamics in long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*(5), 1063-1087. doi:10.1037/0278-7393.20.5.1063
- Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. London: Cambridge University Press.
- Betz, A., Skowronski, J., & Ostrom, T. (1996). Shared realities: Social influence and stimulus memory. *Social Cognition, 14*(2), 113-140.
- Brady, T. F., Konkle, T., Alvarez, G. A., & Oliva, A. (2008). Visual long-term memory has a massive storage capacity for object details. *Proceedings of the National Academy of Sciences of the United States of America, 105*(38), 14325-14329. doi:10.1073/pnas.0803390105

- Brewer, W. F. (2000). Bartlett's concept of the schema and its impact on theories of knowledge representation in contemporary cognitive psychology. In A. Saito (Ed.), *Bartlett, culture and cognition* (69-89). Guildford: Psychology Press.
- Brewer, W. F. & Nakamura, G. V. (1984). The nature and functions of schemas. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (119–160). Hillsdale, NJ: Erlbaum.
- Brewer, W. F., & Treyens, J. C. (1981). Role of schemata in memory for places. *Cognitive Psychology*, *13*(2), 207-230. doi:10.1016/0010-0285(81)90008-6
- Candel, I., Hayne, H., Strange, D., & Prevoo, E. (2009). The effect of suggestion on children's recognition memory for seen and unseen details. *Psychology, Crime & Law*, *15*(1), 29-39. doi:10.1080/10683160802084850
- Chen, E., Zeltzer, L. K., Craske, M. G., & Katz, E. R. (1999). Alteration of memory in the reduction of children's distress during repeated aversive medical procedures. *Journal of Consulting and Clinical Psychology*, *67*(4), 481-490. doi:10.1037/0022-006X.67.4.481
- Drivdahl, S. B., & Zaragoza, M. S. (2001). The role of perceptual elaboration and individual differences in the creation of false memories for suggested events. *Applied Cognitive Psychology*, *15*(3), 265-281. doi:10.1002/acp.701
- Foster, J. L., Huthwaite, T., Yesberg, J. A., Garry, M., & Loftus, E. F. (2012). Repetition, not number of sources, increases both susceptibility to misinformation and

confidence in the accuracy of eyewitnesses. *Acta Psychologica*, 139(2), 320-326.
doi:10.1016/j.actpsy.2011.12.004

Frenda, S. J., Nichols, R. M., & Loftus, E. F. (2011). Current issues and advances in misinformation research. *Current Directions in Psychological Science*, 20(1), 20-23.
doi:10.1177/0963721410396620

Frost, P. (2000). The quality of false memory over time: Is memory for misinformation "remembered" or "known"? *Psychonomic Bulletin & Review*, 7(3), 531-536.
doi:10.3758/BF03214367

Frost, P., Ingraham, M., & Wilson, B. (2002). Why misinformation is more likely to be recognised over time: A source monitoring account. *Memory (Hove, England)*, 10(3), 179-185. doi:10.1080/09658210143000317

Gabbert, F., Memon, A., & Allan, K. (2003). Memory conformity: Can eyewitnesses influence each other's memories for an event? *Applied Cognitive Psychology*, 17(5), 533-543. doi:10.1002/acp.885

Gabbert, F., Memon, A., & Wright, D. B. (2006). Memory conformity: Disentangling the steps toward influence during a discussion. *Psychonomic Bulletin & Review*, 13(3), 480-485. doi: 10.3758/BF03193873

Gardiner, J., & Java, R. (1993). Recognition memory and awareness: An experiential approach. *European Journal of Cognitive Psychology*, 5(3), 337-346.
doi:10.1080/09541449308520122

- Henkel, L. A., & Carbuto, M. (2008). How source misattributions arise from verbalization, mental imagery, and pictures. In M. Kelley (Ed.), *Applied memory* (pp. 213-234). Hauppauge, NY: Nova Science Publishers.
- Henkel, L. A. (2004). Erroneous memories arising from repeated attempts to remember. *Journal of Memory and Language, 50*(1), 26-46.
doi:10.1016/j.jml.2003.08.001
- Howe, M. L. (2011). The adaptive nature of memory and its illusions. *Current Directions in Psychological Science, 20*(5), 312-315. doi:10.1177/096372141141416571
- Hyman, I. E., Husband, T.H., & Billings, F.J. (1995). False memories of childhood experiences. *Applied Cognitive Psychology, 9*(3), 181-197.
doi:10.1002/acp.2350090302
- Johnson, M. K., Bransford, J. D., & Solomon, S. K. (1973). Memory for tacit implications of sentences. *Journal of Experimental Psychology, 98*(1), 203-205.
doi:10.1037/h0034290
- Johnson, M. K., Foley, M. A., Suengas, A. G., & Raye, C. L. (1988). Phenomenal characteristics of memories for perceived and imagined autobiographical events. *Journal of Experimental Psychology: General, 117*(4), 371-376.
doi:10.1037/0096-3445.117.4.371
- Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114*(1), 3-28. doi:10.1037/0033-2909.114.1.3

- Jonker, T. R., Seli, P., & MacLeod, C. M. (2013). Putting retrieval-induced forgetting in context: An inhibition-free, context-based account. *Psychological Review*, *120*(4), 852-872. doi:10.1037/a0034246
- Lane, S. M., & Zaragoza, M. S. (1995). The recollective experience of cross-modality confusion errors. *Memory & Cognition*, *23*(5), 607-610. doi:10.3758/BF03197262
- Lane, S. M., & Zaragoza, M. S. (2007). A little elaboration goes a long way: The role of generation in eyewitness suggestibility. *Memory & Cognition*, *35*(6), 1255-1266. doi:10.3758/BF03193599
- Lindsay, D.S. (2014). Memory source monitoring applied. In T.J. Perfect & D.S. Lindsay (Eds.), *The SAGE handbook of applied memory* (59-75). London: Sage Publications.
- Lindsay, D. S. (2008). Source monitoring. In H. L. Roediger, III (Ed.), *Cognitive psychology of memory. Vol. 2 of learning and memory: A comprehensive reference*, (325-347). Oxford: Elsevier.
- Lindsay, D. S., & Read, D. J. (2001). The recovered memories controversy: Where do we go from here? In G. Davies & T. Dalgleish (Eds.), *Recovered memories: Seeking the middle ground* (71-94). London: Wiley
- Lindsay, D.S., & Read, J.D. (1994). Psychotherapy and memories of childhood sexual abuse - a cognitive perspective. *Applied Cognitive Psychology*, *8*(4), 281-338. doi:10.1002/acp.2350080403

- Lindsay, D. S. (1990). Misleading suggestions can impair eyewitnesses' ability to remember event details. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *16*(6), 1077-1083. doi:10.1037/0278-7393.16.6.1077
- Lindsay, D. S., & Johnson, M. K. (1989). The eyewitness suggestibility effect and memory for source. *Memory & Cognition*, *17*(3), 349-358. doi:10.3758/BF03198473
- Loehr, J. D., & Marche, T. A. (2006). Omitting details from post-event information: Are true and false memory affected in the same way? *Memory*, *14*(1), 17-26. doi:10.1080/09658210444000467
- Loftus, E. F. (2005). Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory*, *12*(4), 361-366. doi:10.1101/lm.94705
- Loftus, E. F. (2003). Our changeable memories: Legal and practical implications. *Nature Reviews Neuroscience*, *4*(3), 231-234. doi:10.1038/nrn1054
- Loftus, E. F., & Pickrell, J.E. (1995). The formation of false memories. *Psychiatric Annals*, *25*(12), 720-725.
- Loftus, E. F., Miller, D. G., & Burns, H. J. (1978). Semantic integration of verbal information into a visual memory. *Journal of Experimental Psychology: Human Learning and Memory*, *4*(1), 19-31. doi:10.1037/0278-7393.4.1.19

- Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, *13*(5), 585-589. doi:10.1016/S0022-5371(74)80011-3
- Loftus, G. R., & Masson, M. E. (1994). Using confidence intervals in within-subject designs. *Psychonomic Bulletin & Review*, *1*(4), 476-490. doi:10.3758/BF03210951
- Marsh, R. L., Cook, G. I., & Hicks, J. L. (2006). Gender and orientation stereotypes bias source-monitoring attributions. *Memory*, *14*(2), 148-160.
doi:10.1080/09658210544000015
- Mazzoni, G., Clark, A., & Nash, R. A. (2014). Disowned recollections: Denying true experiences undermines belief in occurrence but not judgments of remembering. *Acta Psychologica*, *145*, 139-146, doi:10.1016/j.actpsy.2013.11.007
- Merckelbach, H., van Roermund, H., & Candel, I. (2007). Effects of collaborative recall: Denying true information is as powerful as suggesting misinformation. *Psychology, Crime & Law*, *13*(6), 573-581. doi:10.1080/10683160601160679
- Mitchell, K. J., & Zaragoza, M. S. (1996). Repeated exposure to suggestion and false memory: The role of contextual variability. *Journal of Memory and Language*, *35*(2), 246-260. doi:10.1006/jmla.1996.0014
- Newman, E. J., & Garry, M. (2014). False memory. In T.J. Perfect & D.S. Lindsay (Eds.), *The SAGE handbook of applied memory* (110-126). London: Sage Publications.

- Newman, E. J., & Lindsay, D.S. (2009). False memories: What the hell are they for? *Applied Cognitive Psychology*, 23(8), 1105-1121.
- Otgaar, H., Candel, I., Smeets, T., & Merckelbach, H. (2010b). 'You didn't take Lucy's skirt off': The effect of misleading information on omissions and commissions in children's memory reports. *Legal and Criminological Psychology*, 15(2), 229-241. doi:10.1348/135532509X471951
- Otgaar, H., Meijer, E. H., Giesbrecht, T., Smeets, T., Candel, I., & Merckelbach, H. (2010a). Children's suggestion-induced omission errors are not caused by memory erasure. *Consciousness and Cognition: An International Journal*, 19(1), 265-269. doi:10.1016/j.concog.2009.09.015
- Pezdek, K., & Roe, C. (1997). *The suggestibility of children's memory for being touched: Planting, erasing, and changing memories*. *Law & Human Behavior*, 21(1), 95-106 doi:10.1023/A:1024870127516
- Roediger, H.L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21(4), 803-814. doi:10.1037/0278-7393.21.4.803
- Roediger, H L., Meade, M. L., & Bergman, E. T. (2001). Social contagion of memory. *Psychonomic Bulletin & Review*, 8(2), 365-371. doi:10.3758/BF03196174

- Scoboria, A., Lynn, S. J., Hessen, J., & Fisico, S. (2007). So that's why I don't remember: Normalizing forgetting of childhood events influences false autobiographical beliefs but not memories. *Memory (Hove, England)*, *15*(8), 801-813.
- Scoboria, A., Mazzoni, G., Kirsch, I., & Relyea, M. (2004). Plausibility and belief in autobiographical memory. *Applied Cognitive Psychology*, *18*(7), 791-807.
doi:10.1002/acp.1062
- Suengas, A. G., & Johnson, M. K. (1988). Qualitative effects of rehearsal on memories for perceived and imagined complex events. *Journal of Experimental Psychology: General*, *117*(4), 377-389. doi:10.1037/0096-3445.117.4.377
- Some comments and definitions related to the assumptions of within-subjects ANOVA. (2013). Retrieved from http://www.upa.pdx.edu/IOA/newsom/da1/ho_wsassump.pdf.
- Tousignant, J. P., Hall, D., & Loftus, E. F. (1986). Discrepancy detection and vulnerability to misleading postevent information. *Memory & Cognition*, *14*(4), 329-338. doi:10.3758/BF03202511
- Tulving, E. (1985). Memory and consciousness. *Canadian Psychology*, *26*(1), 1-12.
- Wade, K. A., Garry, M., Read, J. D., & Lindsay, D. S. (2002). A picture is worth a thousand lies: Using false photographs to create false childhood memories. *Psychonomic Bulletin & Review*, *9*(3), 597-603. doi:10.3758/BF03196318

- Wright, D. B., Self, G., & Justice, C. (2000). Memory conformity: Exploring misinformation effects when presented by another person. *British Journal of Psychology*, *91*(2), 189-202.
- Wright, D. B., Loftus, E. F., & Hall, M. (2001). Now you see it; now you don't: Inhibiting recall and recognition of scenes. *Applied Cognitive Psychology*, *15*(5), 471-482. doi:10.1002/acp.719
- Wright, D. B., Mathews, S. A., & Skagerberg, E. M. (2005). Social recognition memory: The effect of other people's responses for previously seen and unseen items. *Journal of Experimental Psychology: Applied*, *11*(3), 200-209. doi:10.1037/1076-898X.11.3.200
- Zaragoza, M. S., & Koshmider, J. W. (1989). Misled subjects may know more than their performance implies. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *15*(2), 246-255. doi:10.1037/0278-7393.15.2.246
- Zaragoza, M. S., & Lane, S. M. (1994). Source misattributions and the suggestibility of eyewitness memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*(4), 934-945. doi:10.1037/0278-7393.20.4.934
- Zaragoza, M. S., & Mitchell, K. J. (1996). Repeated exposure to suggestion and the creation of false memories. *Psychological Science*, *7*(5), 294-300. doi:10.1111/j.1467-9280.1996.tb00377.x

- Zaragoza, M. S., Mitchell, K. J., Payment, K., & Drivdahl, S. (2011). False memories for suggestions: The impact of conceptual elaboration. *Journal of Memory and Language*, 64(1), 18-31. doi:10.1016/j.jml.2010.09.004
- Zaragoza, M. S., Belli, R. S., & Payment, K. E. (2006). Misinformation effects and the suggestibility of eyewitness memory. In M. Garry & H. Hayne (Eds.) *Do justice and let the sky fall: Elizabeth F. Loftus and her contributions to science, law, and academic freedom* (35-63). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Zhu, B., Chen, C., Loftus, E. F., He, Q., Chen, C., Lei, X., & Dong, Q. (2012). Brief exposure to misinformation can lead to long term false memories. *Applied Cognitive Psychology*, 26(2), 301-307. doi:10.1002/acp.1825

Appendix A: Sample written report (Experiments 1 & 2)

A young Caucasian female is shown lurking around a building at the UVic campus. She is about 5 feet, 3 inches tall, dirty blonde hair, wearing a cream coloured hoody and jeans. **She was wearing a baseball cap, but you couldn't clearly see what was on the front of the cap.** She goes inside the Cornett Building and walks around for a bit before walking down a hallway. She stops in front of a door and unlocks it with the yellow handled screwdriver that she takes out of her backpack. **I'm pretty sure there was a sign beside the door, but you couldn't read the small writing on it.** Once she was inside the office, she searched through some of the piles of paper on the desk and the contents of the drawers in the filing cabinet near the door. Then a guy stopped in front of an office door and that's when the thief hid under a desk when she heard someone with keys. Once the guy was inside the office, he emptied out a bunch of things from his pants pocket, like his cell phone, some loose change, a light blue iPod, a USB key and put them all in his bag. can't believe he didn't notice that the thief was in the room the entire time! Then the thief came out from under the desk and *stole something from the guy's bag and put it in her pocket.* She peered out of the room to see if anyone was in the hallway. *Then she put her bag down on a chair to get a drink from the bag.* She left the building and got inside what looked to be a dark coloured, 4-door Suzuki. You couldn't see her open the door to the car with any key so I'm assuming it's her car that she left unlocked. I think all of this happened late in the afternoon, as there was a clock that showed the time at one point but I don't think the camera focused on it that long to know the exact time.

Note: Suggested invisibility items are in bold while control items are in italics

Appendix B: Sample cued-recall report (Experiment 3)

1. The first scene showed a couple walking with a baby stroller. Just before the thief entered the building, there was a van that was parked outside of the building. Please describe the van in as much detail as you can.
 - white with green logo
 - electrical services van
 - ladder on top of van

2. Then, the thief was shown. She was standing outside wearing a baseball cap. Please describe the cap in as much detail as you can.
 - black
 - flat brim
 - something on the front, but it wasn't big enough to tell what it was**(Suggested Invisible item)**

3. The thief then walked up a few steps to go inside a building. Two men were shown inside that building. Please describe what the men were doing in as much detail as you can.
 - one man doing something constructionish on the wall
 - second construction worker on ladder

4. In the next scene, the thief walked down the hallway and entered a room. Please describe, in as much detail as you can, any signs that may have indicated what room the thief entered.
 - Printed paper sign with arrow
 - but words were too blurry to read **(Suggested Invisible item)**

5. The thief opened the office door with an object; please describe the object in as much detail as you can.
 - Screw driver with yellow handle
 - Small size

6. In the office, the thief opened some drawers in the filing cabinet. Please describe any item she may have taken from the cabinet in as much detail as you can.
 - Saw thief take something from envelope
 - couldn't see what

7. While the thief was in the office, she may have left her fingerprints on objects other than the filing cabinet. Please describe anything on the desk the thief may have touched in as much detail as you can.

-drawer of desk (handle)

8. In the next scene, a male wearing a black sweater and light blue jeans was shown heading toward his office and opening the door with a key. Please describe anything (other than the key) that he may have held in his hand while he unlocked the door in as much detail as you can.

-Couldn't see what he was holding (**Actually Invisible item**)

9. The man walked down the hallway with a bag on his shoulder. Please describe the bag in as much detail as you can.

-black bike bag with side shoulder strap
-Two compartments on bag
-Small zip pocket

10. In the scene after the man left the office, the thief went up to the bag that was on the desk. Please describe anything the thief may have taken from the bag in as much detail as you can.

-She took something and put it in her sweater pocket (**Control item**)

11. Please describe the thief's hair colour and length in as much detail as you can.

-don't know

12. Just before the thief left the office, she pushed up her sleeves which exposed her forearms. Please describe any markings she may have had on her forearms in as much detail as you can.

-some sort of marking
-didn't see fully

Appendix C: Manipulation Check questions (Experiments 3 & 4)

1. a) What do you think was the purpose of showing you the witness testimonies?
 - b) While you were reading the testimonies, did you think about why you were seeing the testimonies? At the time, what did you think was the purpose of viewing them?
2. Did you notice anything unusual about any of the testimonies? (**look for explicit mentions of detail being said to not have been clearly seen/visible**) Did anything jump out to you as strange or unusual?
3. *Have you learned anything about eyewitness testimony/false memory research?*
4. What did you think was the purpose of the Spot-the-difference task?
5. Did you notice any differences between the testimonies and your own memory? What details do you think were different?
6. Why do you think these details were different?
7. a) How believable were the testimonies?
 - b) While you were reading the testimonies, did you think about whether they were real witness reports? Did you believe they were real?
8. a) Did you recognize any of the people in the photos that were attached to the testimonies?
 - b) What do you think was the purpose of seeing the photos?
9. Some of the details in the testimonies in session two were different from the video you saw. The witness reports indicated that items you saw had not been visible. Did you know that this was the purpose of the study? (*If yes, ask when they first thought this.*)

Appendix D: Revised cover story and evaluation task

Goal of research project: Research has shown that visual cues can aid people's understanding of a description of an event. We are interested in applying this finding to situations involving eyewitness testimony. Specifically, witnesses who see another witness's face might be better able to understand that witness's description of the event compared to witnesses who don't see a face. In real life, witnesses would not actually read each other's testimonies; but witnesses to a crime do talk to each other and how a witness understands an event may be influenced by seeing the face of another person. We are simulating such a scenario with photos of faces. We think that seeing the faces of witnesses should aid people's understanding of witness testimonies. Some participants will see the face of a witness who provided testimony and others will not see the face. You have been assigned to the faces condition.

Instructions: Your task is to read and evaluate another participant-witness's report of the video you saw 2 days ago. The eyewitness report was originally conducted as an interview between an experimenter and a participant-witness. That interview was audio-recorded and transcribed verbatim to produce as a typed report for you to read and evaluate (*please note that pauses during the interview are marked as "...*"). The experimenter's interview with the participant-witness was conducted one day after watching the video and the experimenter asked the participant-witness to answer questions about specific details and scenes in the video.

The report is divided into sections and at the end of each section you will be asked a question pertaining to information in the report.

After reading the report you will complete your evaluation using the Participant-Witness Evaluation Form. Using the form, please rate the participant-witness's report for its thoroughness (i.e., level of detail). Please begin the task by carefully viewing the photo of the participant-witness. At the end, please consider how viewing the photo of the participant-witness helped your understanding of his/her report.

Appendix E: Sample written transcript (Experiment 4)

Experimenter: Ok, let's start with the opening scene. Could you describe the scene when the thief was shown for the first time?

Participant-Witness: Well, it was outside... um, it looked like somewhere on campus, uh maybe Uvic, but I'm not sure... there was a couple walking with a stroller... and, the thief was walking towards a building.

Experimenter: Were there any vehicles nearby?

Participant-Witness: Um, there was a van near the building.

Experimenter: Was anyone inside or standing near the van who may have seen the thief?

Participant-Witness: Um, I didn't see anyone around it so probably there wasn't anyone who saw her... like, um, it wasn't moving or anything, it was just parked.

Experimenter: Okay. Could you please describe the van for me in as much detail as you can?

Participant-Witness: It was white and um it had a company name on it... Um, I think it was some kind of electrical services van.

Experimenter: Okay. Let's talk about the thief. Could you please describe what she was wearing?

Participant-Witness: Oh yeah, she was wearing jeans and a baggy hoodie.

Experimenter: Did you notice what colours the jeans and the hoodie were?

Participant-Witness: Uh...the jeans were lightish, I think... the distressed or faded kind, you know? And the sweater was beige.

Experimenter: Was she wearing anything else?

Participant-Witness: Umm yeah a hat.

Experimenter: Could you please describe the hat in more detail, such as the color and design?

Participant-Witness: Oh, sure, it was a baseball cap. Black or dark blue actually, but something dark for sure... um, let's see it had a brim and was pretty simple - the sporty-type not the gangsta-type, you know?

Experimenter: Ok, were there any images or words anywhere on the hat?

Participant-Witness: Yeah, there was something on the front.

Experimenter: Could you describe what it was?

Participant-Witness: No, 'cause the front was never shown close-up. (**Suggested Invisible item**)

Experimenter: Okay. Let's talk about what happened when the thief was inside the building. She opened the doors, walked inside. Was there anyone inside?

Participant-Witness: Wait, I just remembered! When she was inside she took off her hat and I think she dropped it on the floor.

Experimenter: Okay, thank you for mentioning that. So, she dropped the hat on the floor. Was there anyone in the hall when the thief walked in?

Participant-Witness: Uh, yeah, I remember seeing two men inside. Um, one was working on the wall with a ladder so I'm assuming they were both construction workers.

Experimenter: Okay, do you think they noticed the thief?

Participant-Witness: Like, when she walked in or when she dropped the hat? Hmm...uh no, I don't think so... I think she left quickly when she saw them because she was walking down a hallway after that.

Experimenter: Ok. Did it look like she knew where she was going when she was in the hallway?

Participant-Witness: Sort of... like she did seem to know where she was going, but then... hmmm... I guess not really because she checked a couple of doors to see if they were unlocked.

Experimenter: Do you recall seeing any signs in the hallway that may have indicated what room the thief entered?

Participant-Witness: Let me see...um, yeah there was a makeshift sign.

Experimenter: Do you recall what was on the sign?

Participant-Witness: No, it wasn't clear enough to read. (**Suggested Invisible item**)

Experimenter: Ok, let's talk about the room the thief went to. How did she enter the room?

Participant-Witness: She unlocked the door with a screwdriver.