Does Mental Context Reinstatement Mitigate Retrieval Induced Forgetting in Eyewitnesses?

by

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The above committee determined that the thesis is acceptable in form and content and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate during an oral examination. A signed copy of the Certificate of Approval is available from the School of Graduate and Postdoctoral Studies.

ABSTRACT

The current study sought to examine Retrieval Induced Forgetting (RIF) as it may occur within an investigative setting, while also assessing Mental Context Reinstatement (MCR) as a tool to mitigate this forgetting. Various methodological shortcomings of similar past research were addressed and systematically altered to better replicate the procedures of a real investigation. Participants were exposed to a mock-crime involving two offenders. Subsequently, half of the participants received follow-up questioning regarding 5 of 10 possible characteristics for one offender, all participants completed a distractor task, before finally completing a final recall of offender characteristics. Prior to final questioning, half the participants received MCR. While RIF was not observed, MCR was effective in reducing the rate at which forgetting occurred. Results suggest that RIF may not be as problematic in a forensic setting as once thought, and that MCR is an effective memory facilitative tool. Theoretical and practical implications are discussed.

Keywords: RIF; MCR; Memory; Investigation; Forensic Psychology

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I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication. I have used standard referencing practices to acknowledge ideas, research techniques, or other materials that belong to others. Furthermore, I hereby certify that I am the sole source of the creative works and/or inventive knowledge described in this thesis.

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LIST OF ABBREVIATIONS AND SYMBOLS

RIF	Retrieval Induced Forgetting
Rp+	Retrieval practiced items
Rp-	Non-practiced items, from the practiced category
Nrp	Baseline items
Nrp+	Baseline items, corresponding to those practiced
Nrp-	Baseline items, corresponding to those not practiced
MCR	Mental Context Reinstatement
PRMCR	Practice Retrieval and Mental Context Reinstatement (condition)

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Does Mental Context Reinstatement Mitigate Retrieval Induced Forgetting in Eyewitnesses?

It is often assumed that the storage and retrieval of memories is analogous to the recording and playing back of a videotape, in that all experienced events are stored and recalled verbatim. Memory research has consistently indicated that this is not the case, and that errors occur at all stages of the memory process (see Murayama et al., 2014). For example, if one is not paying very close attention during the original encoding process, this may impact what is stored or the quality of what is stored, thus affecting the retrievability and accuracy of the memory. During consolidation, new information from potentially dubious sources could also be integrated into the memory (possibly unknowingly), again reducing the accuracy of memory.

The final step in the memory process (i.e., recollection) is particularly pertinent within a forensic context. The accounts of a crime provided by eyewitnesses are often imperative to the identification and detainment of a guilty offender. In fact, many real-world cases rely solely on eyewitness accounts because little additional evidence exists (Wells & Olson, 2003). Unfortunately, many eyewitness statements may contain mistakes due to the aforementioned issues inherent to memory (Clements, 2007; Shaw et al., 1995). One specific example of this is the finding that the very act of retrieval can reduce the accessibility of other related information in later recall attempts; a phenomenon termed Retrieval Induced Forgetting (RIF; Anderson & Spellman, 1995). RIF has important implications for investigative settings, in that repeated witness interviewing may be an unavoidable component of the investigative process. Given the importance of obtaining true and undistorted witness accounts, if current police practices are negatively influencing witness accounts then alternative questioning methods, or supplemental memory facilitating tactics, should be sought.

The following review seeks to distill the relevant RIF literature before proposing a novel approach that shall be taken in the current study. First, general background information will be provided outlining the RIF paradigm and overarching findings in the area. Next, two theories proposed to account for RIF, along with their core tenets will be assessed, and their strengths and weaknesses discussed. Literature in which RIF has been examined within a forensic framework will then be outlined; including relevant findings and limitations to the generalizability of these studies. Next, the eyewitness interview process will be discussed generally before examining more closely a specific mnemonic device employed in investigative interviews with eyewitnesses. Lastly, the theoretical approach that will be taken in the current study will be outlined before the rationale for the study is provided.

Background

Bjork (1989) suggests that RIF occurs as a by-product of a memory enhancing mechanism. Specifically, Bjork posits that during the recollection process, one specific memory is often targeted for retrieval; however, a variety of associated items may simultaneously activate. This simultaneous activation can obscure the target memory – a process referred to as interference. Interference refers to the undesirable activation of memories related to the targeted item of retrieval (Anderson, 1994). Such interference stymies one's ability to access and correctly retrieve a desired memory. Consider the following example: you visit your usual gym and place your belongings in an available locker before leaving to work out. Once you returned to the locker room, it would not be helpful if the memory for every locker you had ever used simultaneously activated. Rather, it is best to temporarily forget such related information (i.e., interference), so that what is directly relevant is most accessible; in other words, this forgetting enhances your retrieval ability for the targeted item. Interference can be reduced through

practiced retrieval (i.e., the deliberate recall of information for the purpose of strengthening its memory), but not without a cost (Storm et al., 2012). Specifically, this cost is the forgetting of other related, unpracticed information; a finding that has been consistent over the past few decades (Murayama et al., 2014).

Most extant RIF research follows the same four-phase framework – coined the RIF paradigm (Bjork, 1989). The methodological procedures of the RIF paradigm are as follows: participants are presented with a number of categorized wordlists (e.g., *Fruit: Banana, Fruit: Apple, Colour: Red, Colour: Purple).* Half the participants are then presented with a retrieval practice task for half of the items from half the categories (e.g., *Fruit: Ba*_____). All participants then complete a distractor task (e.g., Tetris, anagrams, logic puzzles, etc.). And for a final recall task, participants attempt to recall all items presented in the first phase (Storm et al., 2012). This final recall often uses prompts (e.g., *Fruit: Ba*___).

The RIF literature using this paradigm has consistently demonstrated two findings. The first is that RIF occurs (Murayama et al., 2014). RIF is measured by comparing the accurate recall of non-practiced items (Rp-; e.g., *Fruit: Ap*___) to baseline items (Nrp; *Colour: Pu*____). In other words, RIF refers to the observed discrepancy in accuracy of memory between items that were not practiced but were from the practiced category, compared to items from the non-practiced category. The second consistent RIF relevant finding is that retrieval practice enhances recall ability of the practiced items (Rp+) during the final recall task relative to the baseline items (i.e., the unpracticed category items; Nrp). Such a finding is suggestive of retrieval practice as a useful method of memory fortification (Murayama et al., 2014; Roediger & Butler, 2011). These two findings persist when stimuli include personal traits, actions, events and autobiographical memories (Murayama et al., 2014) and for time periods between practice and test, ranging from

24 hours (Saunders et al., 2009) to a week (Garcia-Bajos et al., 2009). Despite a relatively large literature exploring this issue, there remains uncertainty as to what causes RIF. Two prominent theories shall now be discussed: The Inhibition Account and The Context Account – the former having received great empirical support and the latter only developed recently.

Theory

The Inhibition Account

It has been postulated by Anderson and Bjork (1994) that retrieval practice improves the accessibility of target memories by inhibiting related interfering information. This account proposes interference as the primary obstacle to be overcome in the retrieval process. Moreover, it has been suggested that RIF occurs as a by-product of a facilitative process for memories deemed of importance, as indicated by practiced retrieval (MacLeod, 2002). Core tenets of the inhibition account are: (1) cue independence, (2) retrieval specificity, (3) interference dependence, and (4) strength independence (Anderson & Bjork, 1994; Murayama et al., 2014).

Cue Independence

Cue independence refers to the reduced accessibility of items related to those practiced regardless of what cue is used as a prompt (e.g., Banana is classified as both *Fruit* and *Yellow* and *Fruit* is a practiced category but Banana is not practiced, therefore it should be inhibited). Regardless of the prompt used, difficulty should arise in producing the inhibited item (e.g., Banana). Meta-analytical results provide support for the cue independence tenet (Murayama et al., 2014).

There are, however, some studies suggesting that covert cuing (i.e., the use of the original cue, rather than an independent cue) by participants results in RIF being substantially diminished or negated. In order to account for these findings, Anderson (2003) posited the Masking

Hypothesis: Some items that are not inhibited, or undergo lesser inhibition, may be able to be retrieved through increased or compound cuing (for a more in-depth review, see Weller, Anderson, Gómez-Ariza, and Bajo, 2012).

Retrieval Specificity

Retrieval specificity suggests the discrepancy in memorability of Rp- and Nrp items is a consequence specific to the process of retrieval, and thus would not occur had other forms of processing been engaged in (e.g., studying). A meta-analysis conducted by Murayama et al. (2014) assessed this tenet and found mixed findings. For example, a study conducted by Ciranni and Shimamura (1999) found that a re-study rather than a retrieval condition failed to produce RIF, a finding thought supportive of retrieval specificity. However, a later study found that a study condition was sufficient to cause RIF (Jonker et al., 2013); a finding seemingly directly contradicting the retrieval specificity claim.

Interference Dependence

Interference dependence suggests that the degree of inhibition for Rp- items is dependent on the relatedness of the interfering memories to the category. Specifically, as relatedness between category and interfering memories increases, so too does the degree of inhibition observed for the interfering item. Consider the following: the category was Sports and two unpracticed items were Soccer and Cricket. Soccer would likely suffer greater inhibition than Cricket because Soccer likely possesses a stronger association to the category Sports than Cricket for most North American participants. Relatedly, interference dependence seems to be mediated by the taxonomic frequency of the items. Items of low taxonomic frequency (e.g., Sports: Cricket) are less likely to be inhibited because their association to the practiced category is weaker (Anderson & Bjork, 1994). When controlling for output interference, research suggests

that when taxonomic frequency is low RIF fails to achieve significance (Murayama et al., 2014).

Strength Independence

Lastly, the degree to which practiced items are strengthened is not indicative of the level of inhibition for unpracticed items. Studies which have used feedback to further strengthen the memory of practiced items have provided evidence in favour of the strength independence property of RIF, but only when the order in which participants recall information in the final phase is controlled (Murayama et al., 2014). Contrarily, it has also been demonstrated that practice tasks of increased difficulty result in a greater degree of RIF than that observed when an easier practice task is used (Storm et al., 2006). The contradictory findings in regards to the tenets posited in the Inhibition Account have provided an opportunity for researchers to develop alternative theories regarding RIF, one of which being the Context Account.

The Context Account

A more recent theory developed by Jonker and colleagues (2013) posits that RIF occurs because of contextual shifts between phases, and a natural tendency to reinstate the practice phase context during the final retrieval phase. This reinstatement is beneficial for Rp+ items, but detrimental to Rp- items, thus creating the disparity in memory that is RIF. Participants' tendency to reinstate the practice context rather than the initial study context is a result of the practice phase being more recent and elaborate than the study phase (Jonker et al., 2013). The contexts on which the theory is founded refer to both internal (e.g., how one is feeling, what one is thinking, etc.) and external contexts (e.g., sensory and environmental stimuli). According to Jonker, the context account relies on the following two tenets: (1) there must be a clear and significant contextual change between the study phase and the retrieval practice phase, and (2)

the final phase must contextually resemble the practice phase more so than the initial study phase.

To test this theory, Jonker et al. (2013) conducted an experiment in which participants viewed wordlists superimposed on a background depicting a fountain or an elevator. Half the participants then viewed half the study material on a novel background (windmill) or the background that was initially presented with the wordlist (i.e., fountain or elevator). When participants were presented with the original backgrounds for both wordlists in the final phase, RIF was observed. However, when participants received the novel background in the practice phase, but received only the original backgrounds in the final recall phase, no RIF was observed. This was interpreted as participants reinstating the context of the original study phase (as prompted by the backgrounds presented) and thus the detrimental effect to unpracticed items was negated. The researchers went on to replicate these findings when the practice retrieval phase was substituted with a study practice phase. This finding was of particular importance because this directly contradicts the retrieval specificity principal posited in the Inhibition Account of RIF. Though this theory seemed initially promising, various subsequent attempts to replicate findings were unsuccessful (Buchli et al., 2016; Soares et al., 2016).

Due to the failures to replicate findings, a questioning of this theory is warranted. The various failures to replicate findings were interpreted as providing evidence contrary to the Context Account but congruent with the Inhibition Account. For example, in the study conducted by Buchli et al. (2016), context was manipulated through the use of a technique where participants were instructed to imagine a place far (e.g., a vacation destination) and a place near (e.g., the participants' home). Regardless of the context reinstated by participants in the final recall phase, RIF failed to occur. Similar findings were obtained in a study conducted by Soares

et al. (2016). The researchers involved in both studies construed these findings to refute the Context Account but support claims of the Inhibition Account.

Despite the replication issues for the Context Account, context has been considered an important factor as related to memory for decades (Godden & Baddeley, 1975; Smith & Vela 2001). This is outlined clearly through the effectiveness of a multitude of memory enhancement techniques which incorporate some form of context reinstatement (Smith & Vela 2001). Nevertheless, the Context Account alone is not sufficient to entirely account for RIF. As is often the case in psychology, it seems likely that no one theory can account for all findings and it may be best to take a theoretically eclectic approach (Murayama et al., 2014).

Context and Memory

It is proposed that the disparate findings in regards to the Context Account of RIF are a result of methodological differences between the various studies and underspecified tenets put forth in the original theory. For Jonker et al. (2013) to disregard other RIF theories and claim that contextual shifts and reinstatements are the principal reason for RIF's occurrence was premature, especially when considering the abundance of literature that has accumulated in support of the Inhibition Account. Though inadequate as a sole theory to account for RIF, the Context Account remains insightful and potentially beneficial for future research.

In the current study a novel approach incorporating ideas from both discussed accounts shall be taken. Specifically, I suggest that although inhibitory mechanisms are the primary cause of RIF, context does play a role, and if the subsequently outlined tenets are met, context reinstatement can allow for the successful retrieval of what should be inhibited items of information. The necessary tenets are as follows:

1) There must be a unique or novel association between the to-be-remembered stimuli and

the context in which it is presented.

2) All subsequent contexts must differ significantly from that accompanied by the original stimuli.
3) The reinstatement in the final phase must include both the internal and external context relevant to the experience of the original stimuli.
4) Participants must be allowed sufficient time to effectively reinstate the appropriate context and refer to it prior to completing questions.

To reduce any ambiguity that may remain surrounding the four tenets put forth, further explication shall now be provided. What constitutes a unique association between the stimuli and the context is not each of the aforementioned factors in isolation, but rather how they are combined. Consider the Jonker et al. (2013) study. The stimuli (wordlists) and the context (backgrounds of: windmill, elevator, fountain) are both common independently, but their combination is presumably perceived as fairly uncommon by most participants, thus a unique and novel association is formed. Such a claim is further substantiated by research in which Prediction Error (PE) has been assessed. Van Kesteren et al. (2012) found that when an item is found in its appropriate context (e.g., loaf of bread in a bakery), it is unlikely to provoke any sort of PE and thus the likelihood of the item being converted to memory is low. However, when PE is high, such as when an item is incongruent with its surrounding context (e.g., gun in a bakery), PE will likely be high, as will the likelihood of this item being converted to memory; this has been referred to as the novelty effect.

As for the second tenet, if the first is fulfilled, it should not be difficult to avoid a scenario which would be disruptive to the originally formed memory of the unique association. However, the more distinct the study and practice phases are (see Jonker et al., 2013, experiment 1 for an

example), the easier participants will be able to distinguish between the two memories and correctly reinstate the study context. For Mental Context Reinstatement (MCR) to be effective, context must supplant the category name as the key determinant in the retrieval process. To circumvent potentially strong relations between items and the category they belong, MCR must allow participants to "mentally time travel" (Tulving, 2002) to the original source of the information. To best facilitate this, the most immersive form of MCR should be utilized (e.g., a version of MCR that has been empirically validated and includes relevant internal and external contexts). Finally, given that restricting the time participants have to answer questions has been found to hinder their ability to fully utilize the reinstated context (Dando et al., 2009; Fisher & Geiselman, 1992; Milne & Bull 1999), a generous amount of time to answer questions should be allotted to participants.

Of the existing studies directly refuting the Context Account, none have complied with the four tenets that have been laid out. In the study by Buchli et al. (2016), for example, it can reasonably be assumed that the association between the context imagined by participants and the wordlists was weak, if not non-existent. Furthermore, in regards to the second tenet noted, the imagination tasks differed significantly in what was being imagined; however, the processes to generate these images was essentially the same (e.g., the use of identical mental processes with similar instructions; i.e., identical internal contexts). In the Soares et al. (2016) study, similar issues arise. Moreover, both studies restricted the time participants had to recall information in the final phase, which likely did not allow participants sufficient time to refer to the reinstated context (Dando et al., 2009; Fisher & Geiselman, 1992; Milne & Bull 1999). To ensure a successful context reinstatement, which incorporates both external and internal contexts, an

empirically validated method of doing so should be sought, such as the method of context reinstatement employed within the Cognitive Interview.

The question remains: how could context effectively mitigate RIF while simultaneously adhering by the various theoretical principles outlined within the Inhibition Account? The answer appears to be twofold. First, as previously discussed (see Cue Independence in the Inhibition Account section above) the Masking Hypothesis (Anderson, 2003) outlines that compound cuing can effectively allow for the retrieval of memories that have undergone little or no inhibition, but rather may have been rendered inaccessible due to the use of poor probing cues or weak encoding (Weller, Anderson, Gómez-Ariza, And Bajo, 2012). Second, because there is presumably little to no semantic relation between physical characteristics and the person they belong to, the strength of association between various physical features and their offender should be low. Based on the Strength Dependence tenet postulated within the Inhibition Account, these physical characteristics should undergo little inhibition. Therefore, compound cuing through the use of context should allow for the successful retrieval of multiple items which otherwise would be inaccessible.

Mental Context Reinstatement

A prominent technique within the field of investigative interviewing which incorporates the use of context reinstatement is the Cognitive Interview (CI). The CI in its original form employs four separate mnemonic techniques in an effort to enhance witnesses' memory of a crime. These four techniques include: in-depth reporting (i.e., "report everything"), reporting the event from different perspectives, varying the temporal sequence in which the events are reported, and mental reinstatement of the relevant personal and physical contexts (Fisher & Geiselman, 2010). The CI has been the subject of scientific rigor for decades, and is used by

police agencies all around the world (Fisher & Geiselman, 2010). A meta-analysis conducted by Memon et al. (2010) indicates that the use of CI allows investigators to gain significantly more information overall than other interviewing methods.

The greatest drawback of the CI, as reported by frontline officers, is how time consuming the method can be (Memon & Bull, 1991). As a result, various modifications have been made to the CI by attempting to remove some of the four techniques to reduce the time it takes to complete the interview. Almost all variations have been tested in terms of combinations of the various mnemonics and what has consistently been found is that Mental Context Reinstatement (MCR) is the tactic most effective in improving memory (Memon et al., 2010). In all CI variations deemed effective in improving memory, MCR has been included (Memon & Bull, 1991; Memon et al., 2010). Moreover, an assessment employing each of the mnemonics in isolation demonstrated MCR as the superior mnemonic of the four. Though MCR was designed to improve memory when question administration is that of free recall, it is still beneficial when cued or closed-ended questions are used (Dietze et al., 2010). Considering this, it seems that MCR is an appropriate method to use within the RIF paradigm, especially as applied within a forensic setting.

RIF within a Forensic Context

To procure the greatest quality and quantity of information, it is not uncommon for eyewitnesses to be subjected to multiple rounds of questioning from various agents (Garcia-Bajos et al., 2012; Macleod, 2002), with each instance likely involving the probing of an eyewitness to retrieve information relating to the crime. Recall that the act of retrieval can be beneficial to the memorability of information being retrieved but detrimental to other non-retrieved information (Bjork, 1989). Investigations are a unique and dynamic process, and as

new information presents itself, the direction of a case can change. This could result in details that may not have seemed important in the early stages of an investigation later becoming crucial to successfully apprehending a suspect. However, if a witness has undergone repeated questioning in regards to other related characteristics, the newly realized crucial details may have been rendered inaccessible due to RIF (Garcia-Bajos et al., 2012; Macleod, 2002). To assess RIF within forensic contexts, the RIF paradigm underwent various modifications. The nuances and findings of forensic RIF studies shall now be discussed.

As earlier noted, wordlists are the stimuli most frequently operationalized within the RIF literature in general (Murayama et al., 2014). However, forensic studies have typically opted for alternative forms of stimuli, such as videos (Garcia-Bajos et al., 2009; Migueles & Garcia-Bajos, 2007), slideshows (MacLeod, 2002; Shaw et al., 1995), or written passages (MacLeod & Saunders, 2006). In Macleod's (2002) study, participants viewed a slideshow of photographs taken inside a home, completed retrieval practice booklets, engaged in a distractor task and were then instructed to recall what had been taken. The MacLeod and Saunders (2006) study followed a near-identical procedure, with the exception of the initial stimulus being a written passage outlining a crime. In all aforementioned studies, RIF was observed (i.e., Rp- < Nrp).

Separately, Migueles and Garcia-Bajos (2006) examined RIF using a stimulus of a video recorded robbery. Interestingly, RIF was found for offender characteristics, but not for the offender actions, a finding that persisted over 24 hours. Subsequently, Garcia-Bajos et al. (2012) endeavored to elucidate these findings through examining RIF in relation to schemata, specifically script conformity. Schemata refers to the expected structure of a course of events that is contained within the brain, and scripts are a form of schema that refer specifically to the behavioural sequences expected in a given event (Markus, 1977). Various components of a

recorded crime were broken down and separated into high typicality (conform to script; i.e., expected) vs. low typicality (do not conform to script; i.e., unexpected). In this study, participants were instructed to pay close attention to the video because they would later be tested on its contents. After viewing the video, half of the participants completed a written retrieval task of either high-typicality or low-typicality actions within the event and the other half practiced retrieving world capitals; all participants then completed a distractor task for five minutes. Next, half of the participants completed a final recall of actions from the video, whereas the other half attempted to recall actions from a movie they had watched recently and then one week later completed a recall task of the relevant video. What they found was that RIF was only observed for items deemed of low typicality but not items of high typicality, regardless of time of recall (Garcia-Bajos et al., 2012). This was interpreted as an observed high-typicality action being integrated within a script of interwoven causal events, thus its recollection requires less time, faces less interference, and the potential for these items or associated items to suffer from inhibition is reduced (Garcia-Bajos et al., 2012). Similar observations have been made in non-forensic RIF studies using wordlist stimuli; if the categories are organized in a meaningful fashion, then RIF can be negated (Anderson & McCulloch, 1999).

A noteworthy finding obtained by Camp and colleagues (2012) indicated that RIF can also occur for characteristics of an involved, but unquestioned about, offender. To determine this, the baseline items (i.e., characteristics of the non-questioned about offender) were divided into two separate groups: characteristics that corresponded to those (Rp+) that were the subject of questioning for the questioned about offender (Nrp+) and those (Rp-) that were not (Nrp-). Based on the outlined literature it appears that RIF may have serious negative implications in the context of interviewing eyewitnesses, but before generalizations can be made, various

methodological concerns must be addressed.

Methodological Issues of Past Forensic RIF Research

Though findings obtained in previous forensic RIF literature are interesting, the ecological validity in which these results have been found is questionable, and as a result, how these findings may translate into an applied eyewitness interview setting remains unknown. Some of the more prominent methodological issues shall now be discussed. First, the stimuli initially presented to participants has in some studies lacked realism. For example, for various previous studies a crime has been "witnessed" through stimuli such as slideshows and written passages (MacLeod, 2002; MacLeod & Saunders, 2006; Shaw et al., 1995). Though this theoretically could occur in real-world cases, its likelihood and therefore generalizability of the findings, are both low. However, more recent forensic RIF studies have addressed this issue by opting for a more realistic stimulus in that of a video (Camp et al., 2012; Migueles & Garcia-Bajos, 2007). Second, in all studies assessing RIF within an eyewitness paradigm, the practice and final recall phase have required written completion (Garcia-Bajos et al., 2009; MacLeod, 2002; Migueles & Garcia-Bajos, 2007; Shaw et al., 1995). Again, although this is possible during a real-life investigative process, it is much less likely than verbal questioning of witnesses. No forensic study examining RIF to date has used verbal question administration. Witness accounts provided verbally have been found to supply significantly more detail than written (Sauerland & Sporer, 2011), but how or if this impacts RIF remains unknown.

Third, previous studies' question composition also poses ecological validity issues. Many of the questions used in prior studies have possessed knowledge that would otherwise be unknown to an investigator at the time of questioning (e.g., As they leave, one of the robbers tells the people not to ____; MacLeod, 2002; Migueles & Garcia-Bajos, 2007; Shaw et al.,

1995). Fourth, participants' response times for individual questions in the final recall phase have consistently been reduced to durations of only seconds (Camp et al., 2012; Migueles & Garcia-Bajos, 2007). Though investigations are often under temporal pressure, to restrict the time an eyewitness has to answer specific questions would be nonsensical. Last, and possibly most problematic, all but one (i.e., Camp et al., 2012) forensic RIF study failed to control for output interference. Output interference refers to the tendency of participants to mention first what they remember best. When not controlled for, output interferences further reduces the accessibility of Rp- items and ultimately obfuscates the effect of RIF. It is recognized that not all issues discussed are applicable to each individual study mentioned; nonetheless, no study has made a systematic effort to address each issue either. Before eyewitness findings related to RIF can be generalized to real eyewitness settings, all mentioned limitations must be addressed.

Current Study

The current study seeks to build upon the current RIF literature, while providing information on the consequences of – and how to improve – repeated questioning of eyewitnesses. The current study addresses the realism issue of past studies by using a video as the stimulus. Also, questioning of participants was done verbally, to best replicate that of a real investigative interview. Furthermore, all questions used for the current study have been created so as not to include any information which would be unknown to an investigator. Additionally, to reduce the potential effects of output interference, the order in which participants recall information on the final task was controlled and sequenced so that participants could not recall information at their own discretion. Controlling for output interference has consistently been found to reduce the effect of RIF; however, it does not reduce it such that it is no longer significant. By addressing the issues contributing to the low ecological validity of prior studies,

more concrete conclusions regarding the effect of RIF in an investigative interviewing setting may be drawn.

Research Hypotheses

Based on the reviewed literature, and the criticisms that have been raised, the following are the hypotheses for the current study:

1. For the groups that do not receive MCR, practiced items (Rp+) will be recalled significantly more accurately than corresponding non-practiced items (Nrp+)
2. For the groups that receive MCR, no significant differences in recall will exist between practiced items (Rp+) and corresponding baseline items (Nrp+)
3. For the groups that do not receive MCR, unpracticed items from the practiced category (Rp-) will be remembered significantly less accurately than corresponding baseline items (Nrp-)
4. For the groups that receive MCR, there will be no significant difference in memory of unpracticed items (Rp-) relative corresponding baseline items (Nrp-)
5. For the groups that do not receive MCR, unquestioned items that correspond to those questioned (Nrp+) will be remembered significantly more accurately than unpracticed items distinct from those practiced (Nrp-)

Method

Participants and Design

Participants for the current study consisted of 84 undergraduate students of Ontario Tech University. While the original research plan called for 120 participants, in-person data collection was interrupted due to the COVID-19 pandemic, thus resulting in a smaller than ideal sample size. There were 27 females (32.1%) and 57 males (67.9%); an analysis of participant

demographic characteristics (gender, ethnicity, year of study) indicated that no significant differences between groups existed. Participants were randomly assigned to one of four conditions: (1) Control, (2) Retrieval Practice, (3) Mental Context Reinstatement (MCR), or (4) Retrieval Practice with MCR (PRMCR). The current study conducted 3 separate 4 (interview condition; between-subjects) x 2 (item type: Rp+, Rp-, Nrp+, and Nrp-; within-subjects) mixed Analyses of Variance (ANOVAs).

Material

The stimulus used in the current study was a mock crime video. The video depicts a scenic tour through a public park from a first-person perspective. Next, a black screen is shown with the following message "After walking around the park, you decide to sit down when you witness the following." Next, a person sitting at a picnic table talking to a young (standing) male is shown. While a conversation between these two individuals is occurring, a third person (another young male) comes into the frame. This third person sneaks up behind the person sitting at the picnic table and takes his knapsack before walking in the opposite direction. Once the thief nears the outer perimeter of the frame, the screen goes black and the video concludes.

Participants were asked a series of questions pertaining to physical characteristics of the offenders involved in the incident (see Appendix 1). Characteristics which did not overlap between the two offenders were preferred for questioning. However, some characteristics which both offenders had in common were included (e.g., facial hair, head-wear). All questions were designed to elicit one of two possible answers (e.g., yes/no, oval/circle, light/dark). There were 10 different questions in total and to ensure consistency, the same questions were asked in regards to both offenders; thus, 20 questions were asked in the final phase for each participant.

Procedure

Upon arrival to the laboratory, participants were seated in a waiting room. Next, the participant was guided by the researcher to a computer where the consent form was presented electronically (see Appendix 2). The researcher then left the room so the participant could read the form in private. All participants in the current study agreed to the terms of the electronic consent form. However, if any participant had not agreed, they would have then been automatically presented with the debriefing form and would have been free to leave at that time. Following the review of the consent form, participants were then presented with a brief demographic questionnaire. Upon completion of the questionnaire, a screen stating the researcher will return shortly to facilitate the next part of the study was displayed. Upon reentry, the researcher guided the participant's attention to a TV in order to watch a brief video depicting a non-violent offense. Upon conclusion of the video, all participants were escorted by the researcher to a different room. The researcher then instructed half of the participants to begin a distractor task in the form of anagrams (see Appendix 3). The other half of the participants were verbally questioned by the researcher (see Appendix 4) regarding half (5 of 10) of the characteristics for half (1 of 2) of the suspects from the video. Once questioning had finished, participants then engaged in the same distractor task as the others. Lastly, after participants engaged in the distractor task for 7-10 minutes (7 for those who received follow up questioning and 10 for those who did not), they were escorted to a room different from those previously used, again by the researcher, to complete a final verbal recall task. In the final recall phase, half of the participants from each condition (follow-up questions vs. none) were instructed by the researcher to mentally reinstate the context of the video prior to questioning and the other half received no such instructions. The MCR procedure involved asking participants to close their eyes if they felt comfortable and having them imagine: how they were feeling when they watched the video,

what they saw, what they heard, etc. (for the full reinstatement script see Appendix 4). All participants were then asked to attempt to recall and state verbally ten specific characteristics of each suspect. This questioning followed a question/answer format (i.e., the researcher asked a question about a characteristic, the participant answered; repeat). After the final recall, participants were provided with a debriefing form indicating the conclusion of the study for that participant (see Appendix 5).

Results

The average success rate during final recall was 53.30% (*SD* = 2.70%; see Table 1). The analyses conducted for the current study included three separate mixed design ANOVAs, while the independent variable (i.e., condition) remains constant for each, the dependent variables do not. For all three ANOVAs conducted, no significant main or interaction effects were observed (i.e., $p > .05$ for all analyses). How this information relates to each specific hypothesis proposed shall now be discussed.

Retrieval Practice

The first ANOVA examined if retrieval practice was in fact facilitative to memory. The effect of condition on the ability to recall accurately practiced items (Rp+) compared to corresponding baseline items (Nrp+) was assessed. Recall that it was hypothesized that there would be a significant difference between Rp+ (practiced) items and Nrp+ (corresponding baseline items) for those who received follow-up questioning but did not receive MCR, compared to the control group. Support for this hypothesis was not obtained. Specifically, there was no main effect of condition on memory for item type $F(3,80) = 1.57$, $p = .20$. Though planned analyses were intended, they were deemed unnecessary due to no main effect being present.

Table 1. *Overall recall accuracy values for each condition: Control, Practice Retrieval (PR), Mental Context Reinstatement (MCR), and Practice Retrieval and Mental Context Reinstatement (PRMCR). Also present is the Cohen's d for each condition relative to the Control group.*

Condition	Follow-up Questions	MCR	Mean % answered correctly (*SD*)	Cohen's *d*
1. Control	No	No	52.10 (2.58)	
2. PR	Yes	No	52.35 (2.54)	.019
3. MCR	No	Yes	52.00 (2.43)	.007
4. PRMCR	Yes	Yes	56.55 (3.24)	.303

The second hypothesis in the current study suggested that the difference between practiced (Rp+) items and corresponding baseline items (Nrp+) would not be significant for the group who received follow-up questioning as well as MCR. An ANOVA was conducted and no significant differences amongst groups were observed F (3,80) = 1.57, p = .20 (see Figure 1); therefore, we failed to reject the null hypothesis, as was predicted by hypothesis 2. These results suggest that regardless of condition, retrieval practice did not significantly facilitate ability to remember accurately the practiced items compared to those that were not practiced in the final recall phase.

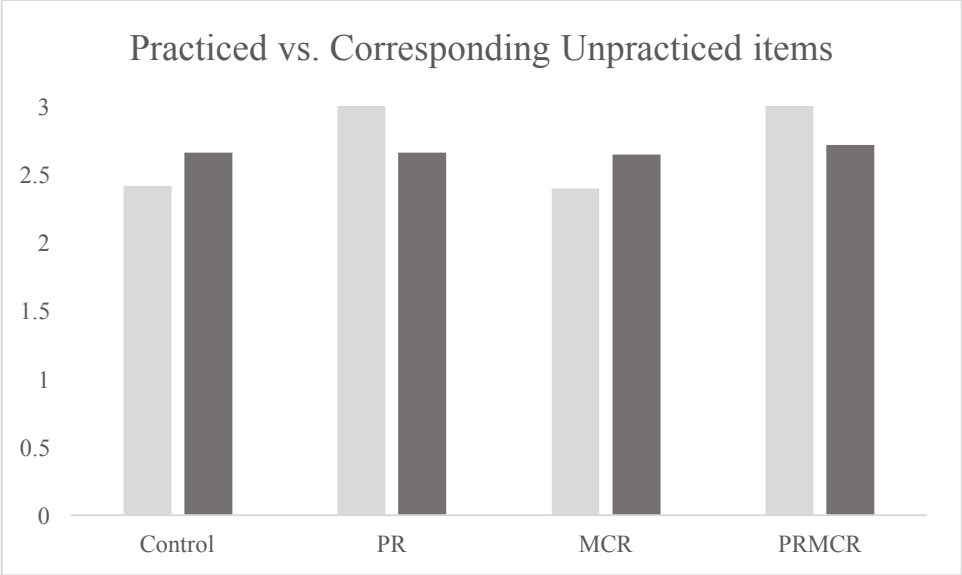


Figure 1. *Recall accuracy in final phase for practiced items from the practiced category (Rp+) and corresponding baseline items (Nrp+) for all conditions: Control, PR, MCR and PRMCR.*

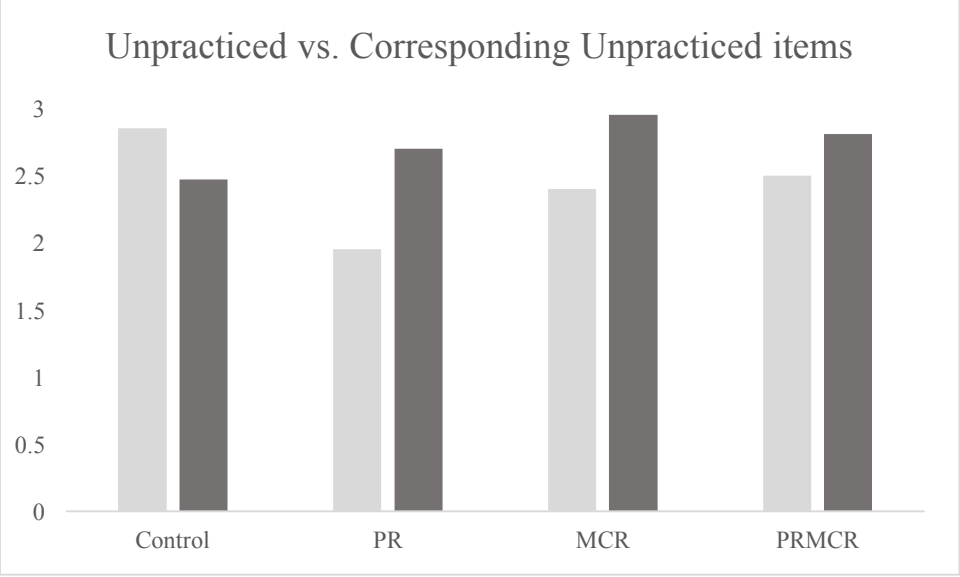
Retrieval Induced Forgetting

A second mixed design ANOVA was conducted to assess if follow-up questioning affected participants' ability to recall items that were not the subject of the follow-up questions. Specifically, the effect of the presence or absence of follow-up questioning and MCR on the accuracy of recall for unquestioned characteristics from the questioned about category compared to corresponding baseline items was assessed. It was hypothesized that items that were not questioned about but were from the questioned about category (Rp-) would be remembered significantly worse than the corresponding baseline items (Nrp-) for those who did not receive MCR, relative to the control group. However, results of the ANOVA indicated that condition did not have a main effect on memory for item type F (3,80) = 2.39, p = .08, and thus, Hypothesis 3 was rejected. Again, although planned analyses were intended they were deemed superfluous due to an absence of a main effect. However, based on a visual assessment of Figure 2, we believed that the way the data were trending warranted an assessment of relevant effect sizes. Specifically,

the effect size for the difference in memory between non-practiced items from the practice category and baseline items for the PR group was $d = .70$, while the effect size for this same difference for the PRMCR group was $d = .27$.

It was also hypothesized that the difference between Rp- and Nrp- would be statistically negligent for those who received MCR compared to the control group. An ANOVA indicated that condition did not have a main effect on memory of item type (F (3,80) = 2.391, $p = .075$), and thus, we failed to reject the null hypothesis, as was predicted in hypothesis 4. Based on the results of the second conducted ANOVA, condition did not significantly impact ability to recall unpracticed items from the practiced category (Rp-) relative to those items' counterpart in the unpracticed category (Nrp-).

Figure 2. *Comparison of unpracticed items from the practiced category (Rp-) to corresponding baseline items (Nrp-) for all conditions: Control, PR, MCR and PRMCR.*



A third and final mixed design ANOVA was conducted to determine if retrieval practice influenced participants' ability to remember accurately the items that corresponded to those

practiced (Nrp+) compared to those that did not (Nrp -). It was hypothesized that retrieval practice would significantly negatively affect participants' ability to recall items that did not correspond to those practiced. However, due to no main effect being observed, F (3,80) = .410, p = .745, this hypothesis was rejected (see Figure 2). Based on these results it appears that retrieval practice does not significantly impact the ability to recall characteristics of the suspect that were not the subject of follow-up questioning.

Discussion

A primary focus of the current study was to examine Retrieval Induced Forgetting (RIF) within a more realistic forensic investigative setting than had been used in previous research. Due to methodological shortcomings (e.g., unrealistic questioning, written completion of questions, etc.) of past studies examining this phenomenon, I believed the ecological validity of these studies was limited and thus further examination was warranted. The current study systematically addressed many of these shortcomings through the implementation of various procedural alterations to create a better fit with real-world conditions (e.g., realistic question composition, verbal question administration). Additionally, the current study endeavoured to examine the effectiveness of Mental Context Reinstatement as a tool to mitigate RIF. A study conducted by Jonker et al. (2013) in which it was demonstrated that context may play in an integral role in the RIF process in combination with a series of studies outlining the importance of context in memory (Godden & Baddeley, 1975; Memon et al. 2010; Smith & Vela 2001), specifically the retrieval process, provided the impetus for the examination of MCR as a potentially useful tactic to overcome memory faults that may be due to RIF. Specifically, four tenets were developed to accomplish these goals: (1) a novel association between stimuli and context must be formed; (2) the original context must differ significantly from those

subsequently used; (3) internal and external context must be reinstated prior to final questioning; and (4) participants must be allowed sufficient time to recall stimuli.

In the present study there were five hypotheses; however, support was only observed for two (and both of these hypotheses predicted a null effect). Specifically, it was hypothesized that practiced characteristics (Rp+) would be remembered significantly better than corresponding baseline characteristics (Nrp+). This hypothesis was not supported. This finding contradicts previous literature assessing RIF in which it has been demonstrated that practiced retrieval is a useful method of improving recall ability for practiced items (Murayama et al., 2014). While the differences between conditions did not achieve significance, the data were trending in the expected direction. The groups that did not receive follow up questioning (Control, MCR) showed very little difference between the two item types, as would be expected. For the other two groups (PR, PRMCR) the practiced items were remembered more accurately than the corresponding baseline items. In much of the previous literature assessing RIF, cues are provided to participants during the practice retrieval phases (e.g., Colour; R__; Murayama et al., 2014). Moreover, some research assessing RIF has provided participants with feedback during this phase (Murayama et al., 2014). While neither of these practices should cause greater forgetting for the items that were not practiced, they will allow for participants to remember more accurately the items that received practice.

Of interest in the current study was RIF as it may occur within an investigative setting, and given that the answers to the questions asked of eyewitnesses are almost always unknown to the interviewer, the current study provided no cues or feedback during the follow-up question phase. Contrarily, the questions used were specifically designed to not include any information that would be unknown to the interviewer (as would be the case in an investigative interview).

During the follow-up question phase if participants answered a question incorrectly, they often provided this same answer during the final recall phase. Thus, although these memories may have in fact been strengthened through practiced retrieval, which also may have reduced accessibility to other related information, they were still coded as incorrect if they were inaccurate. Therefore, while there may have in fact been a difference between these items in retrievability during the final recall, this may not have been captured in the current study due to incorrect answers being coded as such regardless of if these were the same answers that were provided during the follow-up question phase. While it is unfortunate that this effect may have gone undetected, it is worth noting that this could similarly occur in an investigative setting. As mentioned, the veracity of information provided by eyewitnesses is often unknown to the interviewer, and based on current observations, a willingness of an eyewitness to provide the same answer more than once should not necessarily be interpreted as an indication of this statement's accuracy.

Furthermore, given that the detail provided by an eyewitness can be crucial to an investigation (Clements, 2007; Wells & Olson, 2003), it is imperative that this information be accurate. To innocuously indicate this to participants, prior to the final questioning they were instructed not to guess or make anything up; if they did not know the answer they should simply state just that. This resulted in a reluctance of participants to provide answers they were not certain of, as indicated by multiple participants suggesting that they thought they knew the answer, however were unsure, and thus decided to opt for "I don't know". Moreover, the average amount of "I don't know" responses was 4.32; had the participants guessed correctly in some of these cases, detecting an effect may have been more likely. This, in conjunction with the study being underpowered likely contributed to no effect being detected for this analysis.

The second hypothesis suggested that the difference between practiced (Rp+) and corresponding baseline items (Nrp+) for the group who received MCR would be negligible; this was supported. However, given that hypothesis one was not supported this finding should be interpreted with caution. Through a visual assessment of Figure 1 it appears that the difference in memory for the separate item types (i.e., Rp+ v. Nrp+) was very similar for the PR and PRMCR groups; both of which were trending in a direction opposite to the Control group. It thus appears the MCR had little impact in terms of negating the difference between these two item types. The practiced items were remembered better regardless of whether the group received MCR; therefore, despite hypothesis two being supported, MCR does not seem to improve the memory of unpracticed items at a rate similar to practiced retrieval.

The third hypothesis stated that unpracticed characteristics from the practiced category (Rp-) would be remembered significantly more accurately than corresponding baseline characteristics (Nrp-) for the PR group (i.e., RIF will occur). While results for this analysis were trending in the expected direction, support for this hypothesis was not obtained. There are a few factors that distinguish the current study from similar studies in the past that may have contributed to this finding. For example, output interference (i.e., the tendency to state first what is remembered best and last what is remembered worst) was controlled for. Controlling for output interference has been demonstrated to reduce the effect of RIF; however, in the majority of past literature, such control was insufficient to render the effect non-significant (Murayama et al., 2014). The current study being underpowered, combined with controlling for output interference likely contributed to RIF not being observed. Furthermore, the modality of questioning in the current study was verbal, compared to written, which has been used in the majority of the literature assessing RIF generally (Murayama et al., 2014) and all extant literature

assessing RIF in a forensic context (e.g., Garcia-Bajos et al., 2009; MacLeod, 2002; Migueles & Garcia-Bajos, 2007; MacLeod & Saunders, 2006; Shaw et al., 1995). Given no previous research assessing RIF in a forensic setting had questioned participants verbally, it was unknown if this may impact results. In a study conducted by Sauerland and Sporer (2011) they observed that that central perpetrator details were significantly more accurate in accounts that were provided verbally compared to in written format; therefore, it cannot be ruled out that question modality may have also contributed to RIF failing to achieve significance.

It was fourthly hypothesized that there would not be a significant difference between unpracticed characteristics from the practiced category (Rp-) and corresponding baseline characteristics (Nrp-) for the group who received follow-up questioning, but also received MCR prior to questioning (i.e., PRMCR). This hypothesis was supported. While RIF may have failed to occur at a statistically significant level, the Cohen's d for the difference between item types for the PRMCR condition was .27 (r = .13), relative to the Cohen's d for the PR condition (d = .70, r = .38), the difference is substantial. This difference in effect sizes demonstrates clearly that MCR reduced the disparity in memory between item types. Given that RIF failed to occur at a statistically significant level, it cannot be stated based on the current study, that MCR is effective in mitigating the phenomenon. However, when participants are exposed to follow-up questioning, MCR clearly reduces the rate at which information related to that questioned about is forgotten. Current findings thus add to the abundance of already existing literature suggesting that MCR is an effective memory facilitative tool, while also strengthening claims that it can be useful when utilized in an investigative context.

It was lastly hypothesized that unquestioned items that correspond to those questioned (Nrp+) will be remembered significantly more accurately than unpracticed items distinct from

those practiced (Nrp-; i.e., RIF would similarly occur for characteristics of the unquestioned offender). This hypothesis was not supported. It appears that only one study (e.g., Camp et al., 2012) has assessed this; in this study RIF was in fact observed for the offender that was not the subject of follow-up questioning. There were many similarities between the current study and that conducted by Camp et al. (2012; e.g., controlled output inference, stimulus of video depicting crime committed by two offenders), and thus, such a hypothesis was warranted. However, as noted, support was not obtained. Given that no other studies have assessed this question, it is difficult to know if such a finding is unique to Camp et al.'s (2012) study or if a failure to replicate is due to limitations or factors specific to the current study. Future research should assess if RIF extends to characteristics of an offender who was not the subject of follow-up questioning.

Limitations and Future Directions

There are a number of limitations in the present study that are worth noting. First and most saliently is the sample size. Though two hypotheses were supported, it cannot be ascertained if this was due MCR being effective in mitigating RIF or the study was simply underpowered. Further, it is difficult to determine if the failure to gain support for the other hypotheses is due to there truly being no effect, factors discussed (e.g., question modality, question composition, etc.) or the study being underpowered. Future research should continue a similar line of research but with a greater sample size. Such research would allow for more concrete conclusions to be drawn regarding RIF as it occurs in a realistic investigative setting, as well as if RIF can in fact be mitigated through the use of MCR.

Within the present study all tasks relevant to the assessed phenomenon were conducted verbally. As alluded to previously, this method was chosen to most accurately emulate that

which would occur in real-life investigative setting. However, due to failure to achieve significance for RIF, it is worth exploring further if question modality is impactful in this regard. Future research may consider examining if question/answer modality influences the degree to which RIF occurs through comparing written to verbal formats. Furthermore, it is unknown if the current findings are unique to the questions or stimulus used. While the video presented to participants clearly contained two offenders, they did bear a resemblance to one another. To best distinguish between these offenders for the purpose of asking questions specific to the individual offender, questions were developed so that they pertained to characteristics that did not overlap. This was done so that participants could not accidentally remember a questioned characteristic from the wrong offender and have it be coded as correct. Unfortunately, this led to some questions pertaining to rather specific and arguably irrelevant details (e.g., was the offender wearing a watch? Was the offender using a cellphone?). These two questions specifically were often answered incorrectly by participants, which may have potentially obscured the findings obtained. Similarly, due to the aforementioned reasons, a limited amount of questions could be developed for the purposes of the current study, which may have also influenced the results.

The Mental Context Reinstatement (MCR) procedure used in this study conformed to the tenets developed in the current thesis as well as by the standards outlined in the Cognitive Interview (Memon et al., 2010). However, the degree to which participants in these conditions engaged with the reinstatement process was variable. Participants were instructed to close their eyes or look at the floor/wall as this may facilitate the process, but only if they felt comfortable doing so. Many participants in these conditions abided by neither of these suggestions, others did in the beginning but ceased once questioning started, and a few maintained eye-closure or a soft focus on a plain surface for the duration of the interview. It has been found that eye closure can

in fact significantly improve memory for witnessed events (Vredeveldt & Penrod, 2013). Future research should examine the effectiveness of MCR in mitigating RIF with clearer and more stringent instructions regarding eye closure both during the reinstatement process and throughout the interview.

As noted earlier, participants of the current study were instructed to say "I don't know" when they did not know an answer, rather than guessing or making something up. The use of this instruction was chosen because it is often included in real-life investigative interviews (Memon et al., 2010). Past forensic RIF literature (e.g., Garcia-Bajos et al., 2009; MacLeod, 2002; Migueles & Garcia-Bajos, 2007) has not provided such an instruction. Given that on average, over one fifth of total responses provided by participants of the current study consisted of "I don't know," it is reasonable to assume this may have contributed to current findings being distinct from those of the past. Future research may consider examining the difference in RIF when participants receive an explicit instruction regarding what to do in cases when they are unsure or do not know an answer, compared to when not. Finally, the most salient limitation present in the current study was the sample size. The appropriate sample size ($N = 120$) as indicated by the G*power analysis conducted prior to data collection could not be attained due to a mandatory stoppage of in-person data collection as a result of the COVID-19 pandemic. Once restrictions are lifted, and in-person data collection becomes possible again, data collection will resume until an adequate sample size is achieved.

To build on findings of the current study, it may be worth further examining RIF in a setting that closely matches that of a real investigation. This would allow for a better understanding of if RIF is not as problematic within an investigative context as once thought, or if these results are unique to the current study. Future research may also consider examining the

effectiveness of other mnemonic strategies (e.g., report everything instructions, varying the temporal sequence in which information is provided) in overcoming flaws inherent to memory relative to MCR. Also, given that it is recommended that police allow eye-witnesses to first provide a free-recall account of an event of interest before more direct questions are asked, future research should assess how or if this affects the potential subsequent occurrence of RIF.

Conclusion

The goal of the current research was to examine RIF within a forensic context, while also assessing MCR as a tool to mitigate this effect. Contrary to previous literature (e.g., Garcia-Bajos et al., 2009; MacLeod, 2002), RIF failed to occur within the current study. Of the literature examining this phenomenon, the present study emulated most closely that which would occur in a real investigative setting, and therefore, results indicate that under these circumstances RIF may not be as problematic as previously believed. Although a failure of RIF to achieve statistical significance in the current study compromises the ability to draw theoretical conclusions, there are still important practical implications. There was a substantial reduction in the effect size for the forgetting of items Rp- compared to Nrp- for the group who received MCR after receiving follow-up questioning (d = .27) compared to the group who did not (d = .70). Based on this observation it is clear that MCR is facilitative to memory and reduces the amount of potentially valuable offender related information that is forgotten, and is therefore a useful tool for investigators to incorporate into the investigative process.

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Appendices

Appendix 1

Questions

Order of questioning: First or Second

Distractor Order of questioning: First or Second	Correct	Incorrect/I don't know
1. Was he wearing shorts or pants?	Shorts	
2. Was his legwear dark or light coloured?	Light	
3. Did he have facial hair?	Yes	
4. Would you describe his face shape as more circle or oval-shaped?	Oval	
5. Was he using a cellphone?	No	

Distractor Order of questioning: First or Second	Correct	Incorrect/I don't know
1. Did he have any visible tattoos?	Yes	
2. Was he wearing a watch?	Yes	
3. Was he wearing any headwear?	No	
4. Was his t-shirt dark or light coloured?	Light	
5. Did his t-shirt have any designs on it?	Yes	

Order of questioning: First or Second

Thief Order of questioning : First or Second	Correct	Incorrect/I don't know
6. Was he wearing shorts or pants?	Pants	
7. Was his legwear dark or light coloured?	Dark	
8. Did he have facial hair?	Yes	
9. Would you describe his face shape as more circle or oval-shaped?	Circle	
10. Was he using a cellphone?	Yes	

Thief Order of questioning: First or Second	Correct	Incorrect/I don't know
6. Did he have any visible tattoos?	No	
7. Was he wearing a watch?	No	
8. Was he wearing any headwear?	No	
9. Was his t-shirt dark or light coloured?	Dark	
10. Did his t-shirt have any designs on it?	No	

Appendix 2

Consent Form

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

RESEARCH ETHICS BOARD
OFFICE OF RESEARCH SERVICES

Title of Research Study: Assessing the Influence of Follow-Up Questioning on Eyewitness Memory.

You are invited to participate in a research study entitled Assessing the Influence of Follow-Up Questioning on Eyewitness Memory. This study has been approved by the UOIT Research Ethics Board REB [insert REB # assigned] on [insert date].

Please read this consent form carefully, and feel free to ask the Research Assistant any questions that you might have about the study. If you have any questions about your rights as a participant in this study, please contact the Research Ethics Coordinator at 905 721 8668 ext. 3693 or researchethics@uoit.ca.

Researcher(s): Dr. Joseph Eastwood and Quintan Crough
Departmental and institutional affiliation(s): Faculty of Social Science and Humanities, University of Ontario Institute of Technology.
Contact number(s)/email: joseph.eastwood@uoit.ca; 905-721-8668 ext. 5971; quintan.crough@uoit.ca

Purpose and Procedure:
The current research project is designed to assess if repeated witness questioning can lead to Retrieval Induced Forgetting (RIF; i.e., increased forgetting of related information) in subsequent interviews. Also assessed will be how mentally reinstating the context of the video influences the forgetting of related information. The duration of the session will be approximately 30-40 minutes. The study consists of watching a brief video of a non-violent offense, completing a short cognitive task and answering questions regarding the video. In the video you will witness a perpetrator distract a victim in a park, while another perpetrator steals an item belonging to the victim.

Potential Benefits:
The results from this study will help add to the literature on Retrieval Induced Forgetting in a forensic context and inform police agencies on the risks of repeated questioning and potential strategies to improve eyewitness memory.

Potential Risk or Discomforts:
The probability and magnitude of possible harms due to your participation in the research is no greater than those you may encounter in the aspects of your everyday life. However, if you feel

uncomfortable at any stage of the study procedure, please know that you can stop the study at any point without any consequences. Please just notify the Research Assistant if you have any concerns or wish to discontinue your participation at any time. The Research Assistant will be available at all times to answer any of your questions or concerns and provide any further information that you would like regarding the study.

Storage of Data:
All the raw data that is collected will be stored on Dr. Eastwood's password-protected cloud storage system. Note that none of the resulting data will have identifying information associated with it, and the aggregrate data will be stored indefinitely for research publication purposes.

Confidentiality:
Your privacy shall be respected. Confidentiality will be provided to the fullest extent possible by law, professional practice, and ethical codes of conduct. All of the data gathered in this study will be kept anonymously. Only members of the research team will have access to your raw data. Aggregate data may be shared with other researchers for the purposes of future group studies (e.g., meta-analyses) and to ensure transparency in the research process. Any published details of the study will only include aggregate data with no identifying information included.

Right to Withdraw:
Your participation is voluntary, and you may answer only questions you are comfortable with answering. As outlined above please note that you can withdraw at any time from the study and this will not influence your compensation or have any consequences for you. If you withdraw from the research project at any time prior to leaving the lab today, any data that you have contributed will be removed from the study and you need not offer any reason for making this request. If you wish to withdraw and not have your data included in the study, you may withdraw at anytime during the study. However, upon completion of the study the data you provide will be stored alongwith data from all other participants. Given the unidentifiable nature of participant's unique data, extraction of your specific data will be impossible. Thus, if you do not want your data included in the study, you must indicate so prior to completion of the session.

Compensation:
Compensation for participating in this component of the study will consist of your being provided with 1% course credit towards your overall mark in your related undergraduate psychology course.

Debriefing and Dissemination of Results:
The results of the study, which will be based on aggregate data and contain no identifying information, will be presented at academic conferences and submitted for publication in an academic journal. If you wish to be informed of the results of the study please provide your email address to the Research Assistant who will record it on a file in Dr. Eastwood's password-protected cloud storage system. Once you are provided with the results of the study your email address will be deleted. You can also email Dr. Eastwood directly at joseph.eastwood@uoit.ca to obtain the details of the study results.

Participant Concerns and Reporting:
If you have any questions concerning the research study, please contact the researcher Dr. Joseph Eastwood at 905-721-8668 ext. 5971 or joseph.eastwood@uoit.ca. Any questions regarding your rights as a participant, complaints or adverse events may be addressed to Research Ethics Board through the Research Ethics Coordinator – researchethics@uoit.ca or 905.721.8668 x. 3693. By consenting, you do not waive any rights to legal recourse in the event of research-related harm.

Consent to Participate:

1. I have read the consent form and understand the study being described;
2. I have had an opportunity to ask questions and my questions have been answered. I am free to ask questions about the study in the future;
3. I freely consent to participate in the research study, understanding that I may discontinue participation at any time without penalty. A copy of this Consent Form has been made available to me.
4. I understand that aggregate data from the current study will be kept and may be shared with other researchers for future studies.
5. I understand that once I submit my study data, withdrawal of my data is not possible.

By clicking to continue the study, I understand that I am providing my consent to participate in this study.

Appendix 3

Anagram Task

Below are a number of words. Please rearrange the letters of each word to generate a new word.

1. turned
2. recede
3. potion
4. untidy
5. untied
6. uppers
7. vector
8. verses
9. vetoed
10. viewer
11. vowels
12. arising
13. cocaine
14. disease
15. framing
16. infests
17. joiners
18. kitchen
19. lasting
20. layover
21. lessons
22. lookout
23. manures
24. marcher
25. marital
26. markers
27. martial
28. mobbing
29. outlook
30. painter
31. postman
32. praised
33. present
34. printer
35. rebuild
36. recital
37. refills
38. reheats
39. relayed
40. rental

Appendix 4

Mental Context Reinstatement Script

In order to help with the remembering process, I have some techniques that I'd like to try if you're comfortable. When you have a clear picture of the event in your mind, I will begin asking questions pertaining to characteristics of the suspects witnessed in the video, I ask that you please do your best to answer as accurately as possible. Please note that offenders will be identified by their role in the offense; Distractor or Theft, does this make sense to you? *[MCR]* As I talk to you, I would like you to think about each of the things I say, as I say them. Closing your eyes or looking at the floor may help you focus, if you feel comfortable. To begin, I would like you to try to think back to when you saw the video. Try to picture yourself back in the room where you watched the video. Try to think about your mood at the time when you were watching the video... think about your reaction to the video… think about how it made you feel. Now I would like you to focus on the video itself… think about what you saw… think about what you heard… think about the people in the video. I will now begin asking questions about the _____ from the video. Feel free to keep your eyes closed or stay looking at the floor as we go through the questions.

Appendix 5

Debrief Script

We would like to thank you for participating in this study. Your time and effort are greatly appreciated! We would like to remind you that your information will remain confidential and upon session completion, submitted responses cannot be deleted (due to the anonymous nature of the participation).

This study was designed to assess if repeated, closed-ended questioning can lead witnesses to forget information that is not the subject of questioning. Also assessed was if Mental Context Reinstatement (MCR) could mitigate this potential forgetting.

To examine this issue you were exposed to a mock crime, then you may have been asked various questions pertaining to the characteristics of one of the offenders from the video before completing a mental distractor task or you immediately began a mental distractor task. After completion of the distractor task you were then asked to recall and state verbally 10 characteristics of each offender from the video, or you were asked to mentally reinstate the context of the video and then attempt to recall and state verbally 10 characteristics of each offender from the video.

We expect to find that repeated questioning can lead to greater rates of forgetting of related non-questioned about information, and the use of MCR can overcome this issue. The current study has important implications for the police. If repeated questioning negatively affects witnesses' recollection of an event, then alternative methods of questioning, or supplemental techniques such as the MCR must be sought.

If you wish to discuss this research further feel free to contact Dr. Joseph Eastwood at 905-721-8668 ext. 5971 or joseph.eastwood@uoit.ca or Quintan Crough at quintan.crough@uoit.ca.

Any questions regarding your rights as a participant, complaints, or adverse events may be addressed to Research Ethics Board through the Research Ethics Coordinator (researchethics@uoit.ca or 905-721-8668 x 3693).

This study has been approved by the UOIT Research Ethics Board REB [insert REB # assigned] on [insert date]."