A Comparison of Accuracy in Old Versus New Memory Reports Across Interview Techniques: Which Technique Elicits the Most Accurate Reports?

by

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Abstract

The present study was designed to investigate reports of old and new memories with eye-closure and mental context reinstatement interview techniques. Seventy-eight undergraduate students were asked to recall a scene from a movie that they had seen two years ago and from a movie they had seen up to one week ago. Memory reports were coded for narrative breadth details, general and specific details, and accuracy. Results indicated that in comparison to new reports, old reports contained proportionately fewer conversation details, fewer object details, and proportionately more setting/circumstance details. New reports contained proportionally more specific details than old reports. Old reports were also shown to be generally accurate overall, however, less accurate in comparison to new reports. Mental context reinstatement was helpful in enhancing accuracy for old memory reports, while no effects were found for eye-closure.

Keywords: Long-term memory; Interview techniques; Mental context reinstatement; Eye closure; Accuracy

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Chapter 1.

Introduction

In the early 2000s, Ariel Castro kidnapped three women in Cleveland, Ohio and held them captive for 11 years (Mclaughlin & Brown, 2013). These women suffered sexual and physical abuse until one of them escaped and called for help. Because the abuse of these women continued for such a lengthy period of time, when this crime was reported, investigators were faced with reports of events that had happened both recently and several years ago. Often, especially after a delay, eyewitness accounts are the only available evidence. Obtaining details from witnesses may be difficult and investigators must be careful to conduct interviews that elicit the most accurate memory reports. Most research on interview techniques and the accuracy of eyewitness memory reports is done with a short delay from the event to the interview. Little research has explored a lengthy delay between the event and the interview with respect to accuracy. Without a body of literature to support particular techniques that could be used for interviews after a delay, researchers rely on techniques tested on timely interviews to determine if similar techniques are helpful after a delay.

It is important to investigate interview techniques for old memories, specifically, in relation to new memories. In comparison to new memories, old memories may be more difficult to recall because of the nature of forgetting as well as the amount of interference that could occur between the time of the event and the retrieval time. For the purposes of this research, an old memory report is defined as a memory report for an event that took place two or more years ago. A new memory report is defined as a memory report for an event that occurred within one week of the memory test.

1.1. Long-Term Memory

Episodic memories are typically described as ‘episodes’ in one’s life and are contained within long-term memory (McDermott & Roediger, 2016; Tulving, 1983).

Memory for a witnessed crime can be considered memory for an episode. Therefore, a verbal memory report of an episodic memory is the central means investigators have to gather evidence from witnesses. Episodic memories are not always easy to recall and may not necessarily lead to a complete report of the event in question. Forgetting will occur after an event has happened and as more time passes, more is forgotten (Rubin & Wenzel, 1996). The forgetting curve of episodic long-term memory has been described as a power function, indicating that most details in the memory will be forgotten shortly after the event has occurred (Rubin & Wenzel, 1996). As time progresses, the absolute amount of forgetting slows (Ebbinghaus, 1964; Rubin & Wenzel, 1996). Rubin and Wenzel (1996) observed that for specific episodes, most forgetting occurs within the first few years after the initial event. When reporting an episodic memory, not only will completeness of the report change as time passes, but the nature of the memory report may also change. Specifically, fuzzy trace theory posits that the general meaning (generic details) of an episodic memory is likely to be remembered whereas the specific details (episodic details) will be forgotten relatively quicker (Reyna, 2012; Thompson, 2014). Thus, fuzzy trace theory suggests that an old episodic memory report will contain more generic details when compared to a newer episodic memory report. It is also expected that there will be fewer episodic details in old episodic memory reports in comparison to new episodic memory reports (Reyna, 2012; Thompson, 2014). Further, generic details refer to overall meaning of an episodic memory report whereas episodic details refer to specific details about an episodic memory report.

Because the accuracy of old memory reports is often impossible to assess without a clear documentation of the event in question, research is often focused on the consistency of old memory reports (Bauer et al., 2014; Fivush et al., 2004; Grünhagen, Dorsch, & Wollan 2008; Larkina, Merrill, & Bauer, 2017; Thomsen et al., 2015). When asked to report one's earliest memory, interviewees are typically consistent in reporting the same memory across multiple interviews (Bauer et al., 2014). Memory reports are often inconsistent in that details reported in the first interview are unreported in the next, potentially because of forgetting (Larkina et al., 2017). Research has indicated that details can be reported with consistency (Thomsen et al., 2015), but consistency may decrease if

an event has occurred long ago compared to a more recent event (Grünhagen et al., 2008).

Studies conducted on the accuracy of memory reports after a delay in a non-lab setting are sparse. Those that have been conducted suggest that memory reports of witnessed crimes can be highly accurate after varying delays (Christianson & Hübinette, 1993; Odinot, Wolters, & van Koppen, 2009; Yuille & Cutshall, 1986). For instance, Odinot et al. (2009) interviewed a small group of eyewitnesses to a robbery after a 3-month delay. Odinot et al. (2009) were able to verify participant reports with security camera footage of the robbery. Participants' reports were parsed and scored as either correct or incorrect with the exception of audio-related details as the security footage did not contain audio. Odinot et al. (2009) concluded that participants were highly accurate in their memory reports (84%).

At a 5-month delay, Yuille and Cutshall (1986) found that memory reports of a shooting were highly accurate (80%) when witnesses were asked to recall the actions during the incident and details about the perpetrator. Christianson and Hübinette (1993) found that after varying delays of 4-5 months, participants were highly accurate in their memory reports of a witnessed bank robbery. After verifying participants' reports with police records of the crime, Christianson and Hübinette (1993) concluded that their participants were surprisingly accurate in describing episodic details about the crime (e.g., clothing, weapon used).

Memory reports specific to crimes immediately after the crime has been reported have also been shown to be highly accurate (Woolnough & MacLeod, 2001). Woolnough and MacLeod (2001) found that a group of witnesses' and victims' memory reports (police statements) for an assault were highly accurate (96%) immediately after the instance. Although some studies (Christianson & Hübinette, 1993; Odinot et al., 2009; Yuille & Cutshall, 1986; Woolnough & MacLeod, 2001) found that old and new memory reports were each "highly accurate", without a comparison group within each study, it is difficult to interpret what "highly accurate" means. A direct comparison of accuracy

across old and new memory reports can contribute to a better understanding of relative accuracy.

Further, a better understanding of the types of details present or absent in old memory reports may help to develop interview techniques that cater to the likely content of old memories. One method to study the content of narratives is to analyze the frequency of reported details of interest. For example, based on a coding model of narrative coherence (Reese et al., 2011), Bauer et al. (2014) used categories "who", "what-object", "what-action", "when", "where", "how" and "why" to describe participants' reports of their earliest memory. The "who", "what" and "where" aspects of old memories were likely to be reported in comparison to other types of details such as "why" or "how" (Catal & Fitzgerald, 2004; Gardner, Vogel, Mainetti, & Ascoli, 2012; Wells, Morrison, & Conway, 2014). Other researchers have categorized details in memory reports as persons, setting, actions, and conversations (Leins, Fisher, Pludwinski, Rivard, & Robertson, 2014). Leins et al. (2014) focused on recall for family events over a one year period and found that the largest proportions of reported details were person and action details. Although the focus of family may be the reason for a high proportion of person details, a high proportion of person details aligns with Bauer et al.'s (2014) research showing that 'who' and 'what' details were reported after a lengthy delay. It may be that person and action details are well-remembered and can be reported in high volume in comparison to other detail types regardless of a lengthy delay.

1.2. Interview Techniques

Researchers have spent considerable time investigating what types of interview techniques are the most effective for eliciting accurate and complete memory reports. One extensively researched interview technique that has been recommended for use in practice is the cognitive interview (e.g., Geiselman, Fisher, MacKinnon, & Holland, 1986; Köhnken, Milne, Memon, & Bull, 1999; Memon, Meissner, & Fraser, 2010). The cognitive interview is a package of interview techniques that are designed to increase the volume and accuracy of memory reports (Fisher, Geiselman, Raymond, & Jurkevich, 1987). Techniques used in the cognitive interview involve mental context reinstatement,

rapport building, open-ended questions, requests to recall the event from another person's perspective, as well as prompts requesting that witnesses report everything no matter how insignificant it seems. The cognitive interview was designed to align with some cognitive theories; The encoding specificity principle and the multi-component memory trace theory. The encoding specificity principle posits that if the context of the current event parallels the context of the target event, the interviewee should be able to recall information in higher accuracy and volume (Tulving & Thomson, 1973). The multi-component memory trace theory assumes that memory traces for an event are not holistic representations of the event, but instead are complex fragmented presentations of the target event (Köhnken et al., 1999). Further, differing memory traces related to the same target event can be retrieved with differing retrieval techniques or cues.

Although shown to result in more details reported compared to other interview styles with non-trained interviewers (Geiselman et al., 1986; Memon et al., 2010), many police officers perceive the cognitive interview as complex and time consuming (Wheatcroft, Wagstaff, & Russell, 2014). Police may not have the time to conduct the full cognitive interview with all witnesses. The cognitive interview is typically evaluated in its entirety, but researchers also focus on the aspects of the cognitive interview that may be effective to include as stand-alone techniques.

1.2.1. Mental context reinstatement

One technique that plays an important role in the efficacy of the cognitive interview is mental context reinstatement (MCR). MCR has been shown to be useful in aiding memory retrieval and involves a mental recreation of the context (Bramão, Karlsson, & Johansson, 2017). MCR involves asking interviewees to think about the day of the event in question, who was there, what the interviewee did that day, what smells or voices were heard, and what was happening around the time of the event. Placing an interviewee back in the mental context of the event is thought to help with recall because of an overlap between the retrieval context and the context of the event (feature overlap). Feature overlap is theorized to help recall (Geiselman et al., 1986).

MCR has been shown to improve accuracy of memory reports at one week delays (Drohan-Jennings, Roberts, & Powell, 2010; Emmett, Clifford & Gwyer, 2003), and two week delays (Dietze et al., 2012). MCR has not yet been tested as a way to help witnesses recall old memories. It is possible that there are certain conditions (e.g., a long delay) under which MCR may not be an advisable technique. For example, when testing MCR with children for memory of repeated events, Woiwod (2018) found that mental context reinstatement was detrimental to children's reports of a specific instance. Woiwod (2018) suggested that for memory of a repeated event, the context of each instance is forgotten and therefore asking children to try to remember forgotten context negatively impacts their report of the instance.

Another condition in which the context may no longer be available for recall is when the target event occurred several years prior to the interview. Certain aspects of context may be too peripheral to be remembered (e.g., what happened before and after the event in question, smells), or contextual details may blur with contextual information about similar events. Thus, asking witnesses to mentally reinstate a context that they have forgotten could be an impossible task. We cannot be sure what the result of this potentially impossible or difficult task might be; perhaps a witness may remember context from a similar, but separate event. Retrieval of the wrong context may lead to the reporting of details that align with the wrong event and not the event the interviewer is attempting to target. Further, attempting to remember a context that has been forgotten may use cognitive resources that could otherwise have been used to retrieve the event in question. Alternatively, MCR may work similarly for old memory reports as it has been shown to work for new memory reports. As suggested by research focused on detail types (Bauer et al., 2014; Leins et al., 2014), some types of details focused on by the MCR technique may not be forgotten quickly, such as who was present during the event.

1.2.2. The eye-closure interview

A seemingly easy way to improve the accuracy of memory reports is to ask witnesses to close their eyes during the interview (Vredeveldt & Penrod, 2013; Vredeveldt et al., 2015a). With eyes closed, it is thought that witnesses can ignore the

current environment and therefore easily visualize the target event (Vredeveldt, Hitch, & Baddeley, 2011). Research suggests that eye-closure improves accuracy for new memory reports (Perfect et al., 2008; Vredeveldt & Penrod, 2013; Vredeveldt, Tredoux, Kempen, & Nortje, 2015b). Vredeveldt et al. (2015b) found that after viewing a video of a crime, participants who had their eyes closed reported more correct details, but not more incorrect details, than did those who had their eyes open. Even with a one week delay it has been shown that being interviewed with eyes closed can increase the number of correct details reported without inflating reports of incorrect details (Vredeveldt, Baddeley, & Hitch, 2014). Although not yet tested, it is possible that the eye-closure interview might increase accuracy of old memory reports.

Alternatively, the eye-closure interview may increase the amount of incorrect details reported for old memories. Engaging in excessive visualization can lead to recall of incorrect details (Garry, Manning, Loftus, & Sherman, 1996). Because of memory decay, the eye-closure interview may increase the likelihood of visualization of details that seem likely to have happened as opposed to details that are actually remembered. It is important to test the eye-closure interview with old memory reports where the ground truth can be verified.

1.2.3. Combining interview techniques

Interview techniques are typically tested in isolation in a lab setting. If MCR and eye-closure are shown to be helpful in isolation, it is reasonable to think that combining the two techniques may be especially helpful. Alternatively, if MCR and eye-closure are harmful in isolation, combining the two may be detrimental. There is a need to test the combination of interview techniques for old and new memory reports.

1.3. The Present Study

The completeness of a memory report will likely decrease as time passes since the event occurred. However, it is unclear if the accuracy of the reported details that are available in new and old memory reports are comparable because ground truth is rarely known and the research needed to measure the accuracy of old memory reports is

difficult to conduct. For the purposes of the present study, accuracy refers to the correctness of the memory report regardless of its completeness. One way to obtain ground truth without staging an event is to question people who have witnessed a particular event in the past that has been documented. The present study is focused on participants' memory reports of movies viewed up to a week ago and two years ago. Participants were asked to verbally recall scenes from movies and were randomly assigned to interview conditions: eyes closed or open, as well as MCR or no MCR.

The present study compares reports of old versus new memory reports of documented events with different interview techniques. Most importantly, accuracy of these reports is compared. The following hypotheses were developed:

1. Reports of old memories will contain proportionately more generic details than reports of new memories.
2. Eye-closure interviews will enhance accuracy in reports of new memories in comparison to reports of new memories with eyes open.
3. MCR will enhance accuracy in reports of new memories in comparison to reports of new memories with no MCR.

Hypotheses concerning old memories are difficult to develop based on prior literature. The following exploratory analyses were conducted:

1. The proportions of detail types (persons, action, object, setting, and conversations) compared across reports of new and old memories.
2. Accuracy of old memory reports compared across new memory reports.
3. Accuracy of old memory reports compared across eyes closed and eyes open interview conditions.
4. Accuracy of old memory reports compared across MCR and no MCR interview conditions.
5. Accuracy of old and new memory reports with a combination of MCR and eyes open compared to no MCR and eyes closed (a three-way interaction between delay, MCR, and eye-closure).

Chapter 2.

Method

2.1. Design

This was a 2(Delay: old versus new) × 2(Eye-closure: eyes open versus closed) × 2(MCR: present versus absent) mixed model design with delay as a within-subjects variable and the two interview style manipulations as between-subjects variables.

2.2. Participants

A sample of 77 participants, 32 female and 45 male undergraduate students (M_{age}= 19.65, *SD* = 2.08) were recruited for this study through the participant pool at Simon Fraser University. Participants were eligible to participate if they were at least 18 years of age and had seen at least one of the following movies in a movie theatre: *The Revenant (2015), The Martian (2015), Trainwreck (2015), The Big Short (2016), Arrival (2016),* or *La La Land (2016)*.

2.3. Power Analysis

G-power was used to determine the number of participants required to detect a medium effect size. Based on the power analysis, 48 participants were needed to find a medium effect size, f = .25, power = .80.

2.4. Materials and Measures

2.4.1. List of past movies (old memory condition)

An online pilot study was conducted to develop a list of movies released between 2014-2016 which could serve as an old event. Pilot participants were from a similar but not overlapping population to the primary study. A questionnaire was presented to respondents which consisted of demographic questions, as well as a list of 48 movies

(from *boxofficemojo.com*'s list of highest grossing movies) for which participants were asked to indicate where and how many times (if at all) they had seen each of the movies. Movies with sequels/prequels were not included in the list as participants could confuse the sequels or prequels with the target movie. Films without human actors were also excluded as we sought to target memory for lifelike experiences. Participants were entered into a draw to win $50 for completing the pilot study.

Based on responses, we selected six movies that were among the most commonly viewed by our pilot sample to serve as the target movies for the present study. Fifty-eight percent of the pilot sample saw at least one of the selected six movies. A sample size of six movies was selected to balance the challenge of coding with the likelihood of recruiting enough participants.

2.4.2. List of present movies (new memory condition)

A selection of movies from 2018 was chosen for the movie list for the new memory condition: *Ocean's 8, Tag, Hereditary, Skyscraper, A Simple Favour,* and *Crazy Rich Asians*. To make coding manageable and based on movies playing at theatres at the time, participants were given a choice of two movies to view at the theatre. Because the list of past movies were mostly blockbuster hits with well-known actors/actresses, we attempted to select current movies that also contained well-known actors/actresses. We also attempted to avoid sequel/prequels and animated films, but were restricted to what was currently playing. *Ocean's 8* was a part of a series, but contained a new set of actors/actresses for the main characters than seen in previous *Ocean's* films.

2.4.3. Funnel style interview

A funnel style interview was used for both the old and new movie conditions (see Appendix A for the script). The interview began with a general prompt about the specific movie. Next, participants were asked to discuss a scene in the movie that they remembered best. The researcher asked the participant to report everything that they could remember until they stated that they could no longer provide more details. Lastly, participants were asked to identify the most memorable character from the scene that they

chose to discuss, with follow-up questions posed about the character. These questions were meant to capture the types of questions that investigators may ask witnesses (e.g., Did this person have any identifying characteristics? What color were his eyes? Hair?). To assist with coding, participants were asked to report when the scene in question occurred (Did this scene occur in the beginning, middle, or near the end of the movie?).

2.4.4. Mental context reinstatement interview

Before the standard interview instructions provided above, half of participants received the following MCR instructions (from Woiwod, 2018):

> Think about the day you saw that movie in the theatre. (Pause). Think about being in the theatre (Pause), think about what was happening around you (Pause), think about all of the things you felt (Pause), think about what special smells you could smell (Pause), and think of what sounds or voices you could hear (Pause). Think about all of the things you did and all of the people who were there around you. (Pause). (p. 44)

2.4.5. Eye-closure interview

Half of the participants in each MCR condition were instructed to close their eyes when recalling the movies. For those who receive both MCR and eye-closure, the eye-closure instructions were delivered before the MCR instructions. Consistent with Vredeveldt and Penrod's (2013) eye-closure procedure, without giving participants an explanation as to why, participants were asked to close their eyes at the beginning of the interview and keep them closed throughout the interview. All participants followed the instructions throughout the interview and no participants questioned as to why they were asked to close their eyes.

2.4.6. Questionnaire

A short questionnaire was designed for the study to collect demographics and to pose questions to support a cover story (see Appendix B for questionnaire).

2.5. Procedure

2.5.1. Phase one

After coming to the lab, participants signed a consent form (see Appendix C for phase one consent form) which did not describe the true purpose of the study, but detailed the true participation process. To ensure that they did not pay more attention to the movie than they would have otherwise, participants were told that the purpose of the study was to analyze personality types and the impacts of having a relaxing 'night off' on productivity. After signing the consent form, participants were given a brief questionnaire (demographics, cover story). Participants were then given two free movie tickets. Participants were told to pick one of two movies to see at the theatre before returning to the lab approximately one week later for phase two of participation. Participants were told that the selection of movies is limited because of certain personality types of interest to the researcher. Phase one of participation took approximately 15 minutes.

2.5.2. Phase two

Participants returned to the lab and signed a second consent form detailing the true purpose of the study (see Appendix D). After signing the consent form, participants were interviewed about their memory for two movies: the movie they viewed after receiving the free tickets, and one of the movies listed in the eligibility criteria. See Tables 1 and 2 for frequencies of which movies were the focus of participant interviews. All interviews were audio recorded. The order of the interviews (old versus new) was counterbalanced across participants. For the interview style, participants were randomly assigned to MCR or no MCR, and eyes open or closed. Old and new interviews were done in the same interview style for each participant. All interviews were conducted by one of two people: the primary investigator or a trained research assistant.

After both the old and new condition interviews were completed, participants were debriefed and thanked for completing the study. Although participants were told at the beginning of phase 2 about the deception, it was explained again during debriefing

(see Appendix E for debriefing). The total time for participation of phase two was approximately 30 minutes.

2.6. Coding

All interviews were audio recorded and transcribed. No identifying information was included in the transcripts. Recall that participants were asked generally about the movie in question, and then asked to self-select a specific scene. The general question about the movie was intended to refresh participants' memory of the movie. Only the information reported by the participant after the interviewer asked about a specific scene was coded (overall free scene recall questioning). Three coders completed all coding and were blind to the conditions while coding. Two of the three coders were blind to all hypotheses. To avoid potential coding biases, if the coders could not resolve a coding disagreement through discussion, the blind coder's response was chosen as the final code.

2.6.1. Narrative breadth details

Parsing

As recommended by Campbell, Quincy, Osserman, and Pedersen (2013), participant overall free scene recall responses were parsed into details for analysis. A word was parsed from the narrative if it contained any unique piece of information about the scene (e.g., "Leonardo", "went", "into", "boat", "they", "danced", "talked", "hands"). Words that did not contain any substantial information about the scene were not parsed (e.g., "I", "and", "the", "um"). Similarly, words not related to the movie were not parsed (e.g., "I", "bought", "popcorn").

All words parsed for narrative breadth detail analyses represent unique pieces of information. Repetitions of the same words were not counted. For example, if the participant continuously referred to a character as "she", the word "she" would only be counted once. If repetition of a word introduced a new element to the story the second time it was mentioned (e.g., a curling-iron was used first to style Amy's hair but later as a weapon), the word would be counted twice.

Two coders parsed details together for training purposes before parsing independently. Total agreements were divided by agreements plus disagreements to calculate interrater agreement for parsing. The two coders double coded until interrater agreement of at least 80% was established for 20% of the sample. Then, the blind coder parsed the rest of the narratives. When the blind coder was finished approximately one third of the parsing, narratives were double parsed again until interrater of over 80% was established on another 10% of the data. Then, the blind coder finished parsing the remaining narratives.

Sorting

After parsing was completed, each detail was sorted into a narrative breath category. Leins et al.'s (2014) coding categories were used (person, action, setting/circumstances, and conversations), with the addition of object details. See Table 3 for a list of definitions and examples of coding categories.

Kappa interrater of over .80 is considered almost perfect agreement (Landis & Koch, 1977). Kappa of .82 for sorting was established on 10% of the data before two coders double coded all data and resolved all disagreements through discussion. After these details were sorted, proportion scores were calculated by dividing the number of details in the specific category by the total word count. The total word count included all words (coded and non-coded) that the participant reported during the overall free scene recall questioning excluding words that did not refer to the movie (e.g., "I bought popcorn"). Repetitions and filler words (e.g., "the", "and", "um") were included in the total word count. Only responses to the questions about specific scenes were included in the total word count.

2.6.2. Generic versus episodic units of information

Parsing

To capture when participants were reporting generic versus episodic details, units of information were coded as generic or episodic. Participants' narratives were reparsed into larger units of information. A phrase was considered a unit of information if it

contained at least a subject and a verb (e.g., “then she reached towards a hair brush”, “and she told him that she loved him”, “but he did not reply”). Two coders parsed units together for training purposes before parsing independently. Total agreements were divided by agreements plus disagreements to calculate interrater agreement for parsing. The two coders double coded until interrater agreement of at least 80% was established for 20% of the sample. Then, the blind coder parsed the rest of the narratives. When the blind coder was finished approximately one third of the parsing, narratives were double parsed again until interrater of over 80% was established on another 10% of the data. Then, the blind coder finished parsing the remaining narratives.

Sorting

Each unit was then coded as generic or episodic. Directions for generic versus episodic coding were based on Schneider, Price, Roberts, and Hedrick’s (2011) coding scheme. A unit was considered episodic if it referred to a specific time or place (e.g., “After drinking the last sip of her coffee,” “Amy sat in her car in the driveway”, “She asked Nick where his mom was”). A unit was considered generic if it was a summary of an event (or conversation) and did not refer to any specific instance in time (e.g., “they ran up and down the stairs often”, “Amy complained often”, “they talked about Nick’s mom”). Two coders sorted all units of information into generic or episodic. Kappa of .53 was established on 10% of the data before all data were double coded. Kappa of .41- .60 can be considered moderate agreement (Landis & Koch, 1977; Viera & Garrett, 2005). The goal to reach a Kappa value of .80 was not attained for this coding category. Because of the low Kappa value, all the data was double coded and all disagreements were resolved through discussion. If the coders could not agree on a code, the blind coder’s choice was chosen as the final code.

Accuracy

The units of information parsed for the generic and episodic coding were also coded for accuracy. Coders were blind to the generic/episodic code while coding for accuracy. Each unit of information received an accuracy score of either 0 (completely inaccurate), 1 (at least partially accurate), or 2 (completely accurate). One research

assistant watched all the movies and identified the scenes that were the focus of interviews. Two coders watched all the scenes in question and coded all interviews. Kappa of .88 was established on 10% of the data before the coders double coded all data. All disagreements were resolved through discussion.

Participants' overall free scene recall accuracy scores (out of 100) were calculated by summing the accuracy score for each unit of information and dividing by the total possible score. Then, participants' accuracy scores for generic units of information and episodic units of information were calculated in isolation. Therefore, each participant received accuracy scores for: overall free scene recall (all units of information), generic scene recall, and episodic scene recall.

Chapter 3.

Results

Table 4 contains the average number of words and average number of units of information for the scene recall by participants across all conditions. Descriptively, participants provided almost twice as many words and units of information when reporting from new memories compared to old memories. Because the stimuli (movie scenes) varied and were self-selected by participants, stimuli were uncontrolled in the present study. Therefore, raw volume of participants' reports was not analyzed. Rather, all analyzed variables are proportions of participants' reports (proportions are defined in the relevant sections). A series of a 2(Delay: old versus new) × 2(Eye-closure: eyes open versus closed) × 2(MCR: present versus absent) mixed model ANOVAs, with delay as the within subjects variable, were conducted with each coding category as the dependent variable.

3.1. Generic Versus Episodic

It was hypothesized that old memory reports would contain a higher proportion of generic units of information than new memory reports. Proportions were calculated by dividing the total number of generic units of information by the total number of units of information for each participant. Old memory reports (see Table 5 for means and standard deviations) contained higher proportions of generic units of information than new memory reports, $F(1, 70) = 70.48$, $p < .001$, $\eta_{p2} = .50$. There was no 3-way interaction, $F(1, 70) = 0.14$, $p = .714$, $\eta_{p2} = .02$, no Delay × Eye-closure interaction $F(1,70) = 0.00$, $p = .973$, $\eta_{p2} < .00$, no Delay × MCR interaction $F(1, 70) = 0.71$, $p = .328$, $\eta_{p2} = .01$, no MCR × Eye-closure interaction $F(1, 70) = 0.06$, $p = .808$, $\eta_{p2} < .00$, and no main effect of MCR, $F(1, 70) = 2.06$, $p = .155$, $\eta_{p2} = .03$, or eye-closure $F(1, 70) = 0.07$, $p = .792$, $\eta_{p2} < .00$. Because each unit of information was coded as either generic or episodic (the proportions will sum to 1), an ANOVA was not conducted on proportions of episodic units.

3.2. Exploratory Narrative Breadth Analyses

Recall that narratives were re-parsed for the narrative breadth analyses. An ANOVA was conducted to analyze proportions of total unique narrative breadth details (persons, actions, setting, conversations, and objects combined) across conditions (see Table 4 for means and standard deviations). Proportions were calculated by dividing the total number of coded details by the total number of words reported during the scene recall questioning. There was a main effect of delay (see Table 6 for statistics); old reports contained proportionality fewer unique narrative breadth details in comparison to new reports. There were no other effects.

To assess the research question regarding the type of narrative breadth details across old and new memory reports, proportions of each category of the narrative breadth details were compared across conditions (see Table 6 for ANOVA statistics; see Table 7 for means and standard deviations). Proportions were calculated by dividing the total number of coded details for each of the categories by the total number of words reported during the overall free scene recall questioning. Only the analyses on the delay condition were the central focus of this paper; however, the full model ANOVAs were conducted for exploratory reasons. Because there was no theoretical reason to believe that narrative breadth proportions would differ across interview conditions, the False Discovery Rate correction (Benjamini & Hochberg, 1995) was used for all tests without *a priori* hypotheses (all tests excluding the main effects of delay).

An ANOVA for each of the narrative breadth categories (setting/circumstance, conversations, objects, persons, and actions) was conducted (See Table 6). In comparison to old memory reports, new memory reports contained proportionally fewer setting/circumstance details and proportionally more conversation details, and more object details. There were no differences in proportions of person or action details across old and new memory conditions. There were no significant differences in proportions of each of the narrative breadth detail categories across any of the interview conditions.

3.3. Accuracy

Accuracy was assessed for overall free scene recall. Both generic and episodic units of information were coded for accuracy, which resulted in participants receiving three accuracy scores: overall free scene recall, generic free scene recall, and episodic free scene recall. For the overall free scene recall accuracy score, the generic free scene recall accuracy score, and the episodic free scene recall accuracy score, each score (out of 100) was calculated by summing the score for each unit of information (each unit being coded on a 0-2 scale with 0 being completely inaccurate and 2 being completely accurate) and dividing by the total possible score. Exploratory analyses indicated that participants had higher accuracy scores (overall free scene recall, and both generic and episodic free scene recall) for new memory reports than for old memory reports (see Tables 8, 9 and 10). See Table 11 for ANOVA statistics for all accuracy dependent variables.

It was hypothesized that participants who had their eyes closed would have higher accuracy scores for new memory reports than those who had their eyes open. Further, we conducted exploratory analyses on the impact of eye-closure on old memory report accuracy. There was an interaction between eye-closure and delay for episodic free scene recall accuracy (see Table 11 for ANOVA statistics). Follow up *t*-tests were conducted to analyze the impact of eye-closure on accuracy for the delay conditions separately (see Figure 1). For the new condition, there was no significant difference in episodic free scene recall accuracy across those who had their eyes closed and those who had their eyes open, $t(62.12) = -1.64$, $p = .108$, 95% CI [-0.11, 0.00], $d = 0.34$. For the old memory report condition, there was no significant difference in episodic free scene recall accuracy across those who their eyes open and those who had their eyes closed, $t(69) = -1.54$, $p = .127$, 95% CI [-0.01, 0.22], $d = 0.36$. Inspection of Figure 1 suggests that eye-closure decreased accuracy for the reports of old memories in comparison to those who had their eyes open. Further, as shown in Figure 1, eye-closure led to an increase in accuracy in comparison to those who had their eyes open for reports of new memories. However, the variability in the data was large, and neither *t*-test comparison was statistically significant. A replication is essential.

It was hypothesized that MCR would lead to higher accuracy scores for new memory reports in comparison to old memory reports. There was an MCR × Delay interaction for overall free scene recall accuracy (see Table 11 for ANOVA statistics). Inconsistent with the hypothesis, follow up *t*-tests indicated that for new memory reports, there was no difference in accuracy between those who had MCR and those who did not, $t(72) = 0.66$, $p = .256$, 95% CI [-0.04, 0.08], $d = 0.16$. Exploratory analyses indicated that for old memory reports, those who had MCR had higher accuracy scores than those who did not, $t(60.86) = -2.07$, $p = .043$, 95% CI [-0.18, -0.00], $d = 0.52$.

There was an MCR × Delay interaction for episodic free scene recall (see Table 11 for ANOVA statistics; See Figure 2 for a visual depiction). A follow up *t*-test indicated that for the new condition, there was no significant difference in episodic free scene recall accuracy across those who had MCR (see Table 10 for means and standard deviations) and those who did not, $t(72) = 0.52$, $p = .606$, 95% CI [-0.04, 0.08], $d = 0.07$. For the old condition, episodic scene recall accuracy was higher for those who had MCR (see Table 10) compared to those who had no MCR, $t(54.202) = .014$, $p = .014$, 95% CI [-0.29, -0.03], $d = 0.59$.

Responses to direct questions were not analyzed due to some unforeseen problems. First, the majority of participants self-selected popular actors/actresses (e.g., Amy Schumer, Dwayne ‘the Rock’ Johnson, Sandra Bullock) as the most memorable characters meaning the direct questions were focused on actors/actresses who had been seen in other movies or television shows and were familiar to participants. Although participants were asked to answer the direct questions with the character of the movie in mind, they likely thought of the actor/actress when attempting to answer some of the questions. Second, many of the self-selected characters were wearing a wardrobe that was easy to guess correctly. For example, 42 of the 77 participants selected Leonardo DeCaprio in *The Revenant* (wearing old western clothing) or Matt Damon in *The Martian* (wearing an astronaut suit).

Chapter 4.

Discussion

The present study was designed to compare old and new memory reports across differing interview conditions (MCR and eye-closure) where accuracy could be assessed. In comparison to new memory reports, old memory reports contained less information overall, proportionally more generic details and proportionally more unique setting/circumstance details, and proportionally fewer unique object and conversation details. New and old memory reports contained proportionally similar amounts of unique person and action details. In comparison to new memory reports, old memory reports were less accurate during overall free scene recall, generic free scene recall, and episodic free scene recall. Of particular interest was that MCR affected old and new memory reports differently. The data also suggest that eye-closure may affect old and new memories differently, but this needs to be replicated.

4.1. Memory Content

The finding that old memory reports contained proportionately more generic details, and proportionally fewer episodic details than new memory reports is supported by fuzzy-trace theory. According to fuzzy-trace theory, memory for the episodic details fade faster than memory for generic details (Reyna, 2012; Thompson, 2014). As a result, recalling episodic details from old memories is likely more difficult than recalling generic details. After lengthy delays, we would expect fewer episodic details to be reported during recall, as was shown with the present data.

New reports, in comparison to old reports, contained proportionately more unique narrative breadth details. That new memory reports were richer in detail than old reports aligns with well-known theory that memory fades with time (Rubin & Wenzel, 1996). As suggested by Bauer et al. (2014), a report that is rich in narrative breadth details may be considered more coherent than a report that does not contain such details.

Accordingly, a new memory report may be perceived as more credible than an old memory report.

Consistent with previous research suggesting that person and action details are likely to be recalled after lengthy delays (Bauer et al., 2014), similar proportions of unique person and action details were reported across old and new conditions. Who was present during an event and what those said people were doing is arguably central to an event, and central details have been shown to be less likely to be forgotten in comparison to peripheral details (Christianson & Loftus, 1987).

Although there were proportionately more unique object details in new than old reports, the proportions of reported unique objects were very small in both old and new conditions. It may be that object details are perceived as unimportant and therefore go unreported. It may also be that object details are often peripheral to an event (e.g., a pen lying on a desk) and are forgotten quickly, particularly after a delay. The rarity of reported objects in both delay conditions could be because the only objects that participants reported may have been ones that stood out during the movie, or objects that played central parts of the scene (e.g., weapons).

Previous research has shown that setting and circumstance details are likely to be reported after lengthy delays (Bauer et al., 2014; Leins et al., 2014). Further, Bauer et al. (2014) found that participants could recall the context (e.g., temporal, location) when asking participants to recall their earliest memories. We may expect that in a direct comparison to new memory reports, old memory reports would contain proportionately similar unique setting/circumstance details. Unexpectedly, the current data showed that old memory reports contained proportionately more setting/circumstance details than did new memory reports. It may be that contextual details are well-remembered after a lengthy delay and compose a larger portion of the memory report in comparison to a new memory report. Contextual information may have been reported for impoverished memories to help contextualize the scene. It may be that participants remembered similar amounts of setting/circumstantial details for the new memory condition, but did not report them because of the ability to recall other types of more specific information (e.g.,

object and conversation details). Participants may have reported similar raw numbers of setting/circumstance details (M_{old} = 9.74, M_{new} = 13.06), but because there were fewer details overall in old reports in comparison to new, the setting/circumstance details comprised a larger proportion of the narrative.

The finding that there were proportionally more unique conversation details in new reports in comparison to old reports is consistent with literature that is focused on memory for conversations (Brown-Schmidt & Benjamin, 2018; Campos & Alonso-Quecuty, 2006). Research suggests that recalling direct quotes from conversations after a delay is difficult due to memory decay (Brown-Schmidt & Benjamin, 2018). Recalling the gist of a conversation is easier in comparison (Brown-Schmidt & Benjamin, 2018). The present data suggest that after a long delay conversation details are not likely to be reported in comparison to after a short delay.

These data may provide a stepping stone for future research focused on interview-crafting for old memories. There were no effects of interview conditions on any of the narrative breadth dependent variables. It may be that MCR and eye-closure have little to no impact on the types of details in a memory report. Because we found that object and conversation details were rarely reported in the old memory condition, it may be advisable for investigators to avoid asking direct questions about object and conversation details. However, more research needs to be focused on old memory reports before firm recommendations can be made. Specifically, future research should focus on direct questioning of certain detail types (e.g., about conversations or objects) to determine the accuracy of reports of such detail after a lengthy delay.

4.2. Accuracy

Although it is expected that old memory reports will be less complete than new memory reports (Rubin & Wenzel, 1996), it is difficult to infer based on the current body of literature if the accuracy of old and new memory reports are comparable. This study was the first to directly compare the accuracy of old and new memory reports. Participants reported far more details for new than old memories. Overall, participants'

memory reports (general and episodic information) were fairly accurate across old (*M* = 75%) and new conditions (*M* = 89%). New reports were significantly more accurate than old reports.

These findings are consistent with previous field research indicating that memory reports can be relatively accurate after a delay (Christianson & Hübinette, 1993; Odinot et al., 2009; Yuille & Cutshall, 1986). It has been suggested that high accuracy in reports of old memories reported in previous studies may be a self-selection bias (Odinot et al., 2009). That is, those who choose to participate in field memory studies are eager to discuss their experiences and are unrepresentative of a typical witness sample. Those who have admittedly poor memory for a particular witnessed event may not want to volunteer to participate in a memory study. For the present study, participants were misled to believe the study was focused on personality types. Because participants did not know that they would be asked to remember past movies, this sample may have contained less bias than previous field studies for old memory reports. The present data suggest that memory reports for witnessed events can be relatively accurate after lengthy delays, despite the lack of completeness in comparison to a new memory report.

Notwithstanding high accuracy of old memory reports, new memory reports were more accurate (for all accuracy dependent variables) than old memory reports. Recall is more difficult as time since the event in question passes (Rubin & Wenzel, 1996), and increased difficulty can lead to lower accuracy. Further, as time passes between the event and recall, the potential for interference (e.g., source monitoring errors) may increase (Frost, Ingraham, & Wilson, 2002). A source monitoring error occurs when the source of a memory is confused and/or misattributed to an event other than the target event (Johnson, Hashtroudi & Lindsay, 1993). For example, one could watch a movie in which the main characters attend several parties (e.g., *La La Land*). One may report that the main character got into a fight, but misattribute the fight happening at the incorrect party. The central aspect of the event may remain in memory (e.g., the fight), while the source of the memory has decayed (e.g., at which of the three parties the fight occurred). As time passes and memory decays (as evidenced by the finding that there were more unique

details in new than old reports), it is possible that source monitoring errors fill in the forgotten aspects of the memory, leading to errors.

When separating overall free scene recall into generic and episodic units of information, accuracy was higher in the new condition in comparison to old for both generic and episodic units. The finding that episodic units of information were more accurate in new memory reports in comparison to old reports yielded a large effect size (η_{p2} = .26). The same finding for generic units of information yielded a smaller effect size (η_{p2} = .12). Consistent with fuzzy trace theory, the difference in accuracy between old and new memory reports was smaller for generic than episodic information (Reyna, 2012; Thompson, 2014).

4.3. Interview Techniques

In contrast to previous research (Perfect et al., 2008; Vredeveldt & Penrod, 2013; Vredeveldt et al., 2015b), and despite a trend in this direction in the current data, there was no strong evidence that eye-closure increased accuracy in the new memory condition. The lack of difference may be due, at least in part, to a ceiling effect; participants' average overall free scene recall accuracy score was 89% for the new movie condition. Further, 30 out of the 78 participants scored over 95% on the overall free scene recall for new reports. Because the scores were so high, eye-closure may have not been able to contribute to an increase in accuracy. There was a significant interaction between eye-closure and delay for episodic free scene recall. Likely because of the large variability in the data, there were no significant differences in accuracy between those who had their eyes open and those who had their eyes closed for both old and new memory conditions. However, there was a non-significant trend in the data indicating that for old memory reports, eye-closure decreased accuracy for episodic free scene recall (see Figure 1). For new memory reports, there was a non-significant trend indicating that eye-closure increased accuracy for episodic free scene recall. Replication is necessary to clarify these trends in the data.

Inconsistent with previous research (Dietze et al., 2011; Emmett et al., 2003; Memon et al., 2010), MCR did not enhance accuracy in new memory reports. However, as discussed above, we may have observed a ceiling effect. The new movie was likely engaging and so recent that it was easily recalled. It is also possible that participants spontaneously reinstated the context without receiving the instructions, creating no differences between the two groups.

MCR led to higher accuracy for the old memory reports for both overall free scene recall accuracy and episodic free scene recall accuracy. It was speculated that the mental context could have been forgotten in the old memory condition. MCR attempts to activate the context of several types of contextual information (e.g., who was present, where the event occurred, the smells or voices that were present), some of which can be remembered after a delay. For example, as shown by these results, movie viewers are likely to report similar proportions of person details when reporting a new memory in comparison to old. Further, previous research shows that it seems likely that people are able to recall who was present during events that occurred long ago (Bauer et al., 2014; Leins et al., 2014). It is possible that MCR is helpful for eliciting accurate reports of old memories by retrieving contextual information that is available. Perhaps for old memory reports, if MCR is used, it would be beneficial to focus on aspects that are likely to be remembered (e.g., who, where, and action), and omit the instructions that are in reference to aspects that are unlikely to be remembered (e.g., voices, objects, and conversations). Future researchers should consider testing the MCR technique for old memories with some instructions (e.g., memory for conversations/voices and objects) omitted.

Further, MCR may be helpful for eliciting accurate episodic details, those of which may be important to investigators. As this is the first study to find that MCR may increase accuracy when recalling old events, MCR cannot yet be recommended for old memory recall in practice. More research is needed on MCR and old memory reports.

4.4. Limitations

A three-way interaction between MCR, eye-closure, and delay was tested to determine if combining MCR and eye-closure would impact accuracy for old or new memory conditions. No such three-way interaction was observed for any of the dependent variables. This study was powered to find medium to large effect sizes for main effects, and underpowered to find a three-way interaction if one exists.

It is possible that participants were exposed to some of the content of the movies more than once. All movies used in this study were popular, and thus likely received media attention before, during, and after the time of airing in the theatre. Participants may have been exposed to specific scenes from the movies more than once (e.g., discussion of the movie with others before and afterwards, and teasers before the launch of the movie), and participants may have chosen such scenes to discuss in the present study. It is possible that the old memory condition was not reflective of a one-time witnessed event; to address this potential issue, participants were asked if they had seen the movies more than once, and were excluded if they indicated yes. Participants were not asked if they had seen any specific scenes more than once. It should be noted that if one witnesses a crime, there is potential for a similar pattern to occur. It may be that a witness would discuss a witnessed crime with others, or even be exposed to media coverage about the offence.

There are some disadvantages to using popular movies as stimuli. First, we were unable to control the stimuli as we would have if participants were shown stimuli in lab conditions. However, crimes will rarely, if ever, occur under lab conditions. Another disadvantage of having uncontrolled stimuli is that participants self-selected the old movie and were directed to watch one of two specific new movies. Old movies could have been inherently more interesting to the participants, and perhaps better remembered in comparison other witnessed events that occurred in a similar time frame. We attempted to incorporate movies with popular actors/actresses and considered to be highly anticipated in the media in the new movie conditions as these were the types of movies in

the old movie condition. However, particularly strong memories for older movies would have only worked against our hypothesis of weaker memory after a delay.

The sample was a convenience sample of undergraduates who frequently visited the movie theatre. The majority of participants (60%) reported that they visited the movie theatre at least once a month. We have no theoretical reason to believe that movie-goers would differ from the general population in relation to memory for witnessed events. Further, we argue that watching a movie can be somewhat comparable to witnessing a crime. Often, people feel emotionally invested in the media they watch and become immersed in the narrative (Green & Brock, 2000). The tendency for watchers to become personally invested in movie narratives potentially makes movies a sufficient method to examine episodic memory reports of old events. Additionally, witnessing a movie may be comparable to witnessing an event, as both can be emotionally investing while not necessarily personally involving the watcher/witness.

Chapter 5.

Conclusion

This study provides valuable information about direct comparisons of old and new memory report content and accuracy. Overall, we found that old and new memory reports were proportionally similar in unique person and action details, whereas old memory reports contained proportionality more setting/circumstance details and proportionately fewer conversation details and objects. These data show support for fuzzy-trace theory, as new memory reports contained proportionally more episodic details in comparison to old memory reports. These data suggest that MCR may aid in accuracy at a delay of two years from the event to the interview. More research is necessary to examine the impact of MCR and eye-closure on recall for old memory reports.

Chapter 6.

Tables and Figures

Figures

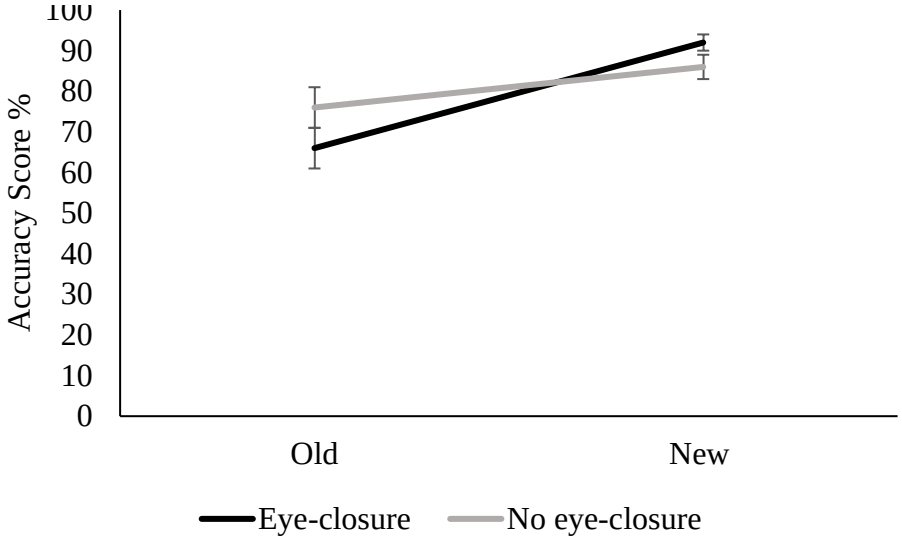

Figure 1. **Delay × Eye-closure interaction across episodic free scene recall. Error bars = standard error.**

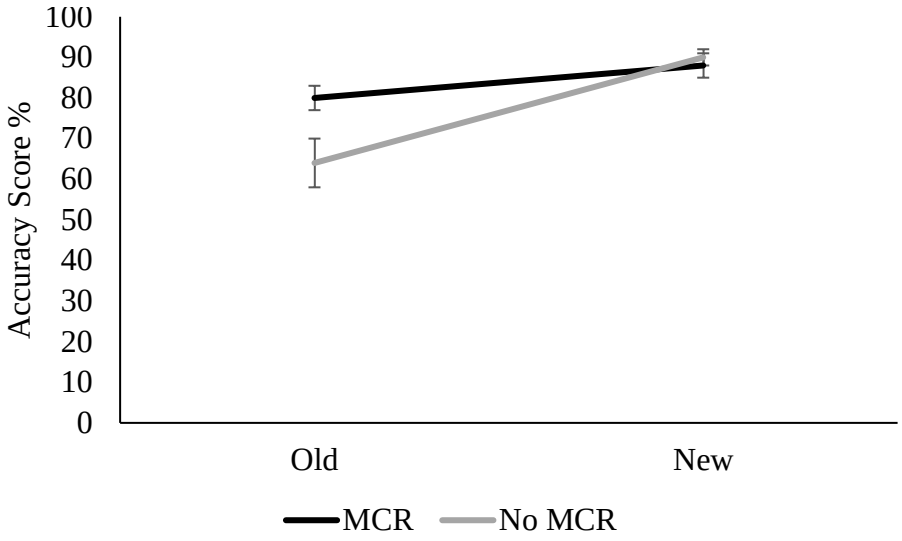

Figure 2. **MCR × Delay interaction across episodic free scene recall. Error bars = standard error.**

Tables

Table 1. Frequencies of Participants Who Watched Each Movie for the Old Movie Condition

Movie Title	Frequency (n)
The Revenant (2015)	21
The Martian (2015)	19
La La Land (2016)	18
Trainwreck (2015)	13
Arrival (2016)	3
The Big Short (2016)	2
Total	76

Table 2. Frequencies of Participants Who Watched Each Movie for the New Movie Condition

Movie Title	Frequency (n)
Crazy Rich Asians	35
Skyscraper	13
Ocean’s 8	12
A Simple Favor	11
Tag	5
Hereditary	1
Total	77

Table 3. Definitions and Examples of Narrative Breadth Categories

	Definition	Examples
Persons	Refer to specific characters and descriptions of characters (clothing, emotions)	He, she, dress, angry, Amy,
Action	Refer to a specific action carried out by a particular character	Jumped, went [into], played [basketball],
Setting/Circumstance	Refer to descriptions of the scene area, temporal location, explanatory plot details	Tower, snowing, afterwards, [ended up] together, [it was] chaos, [camera] pans to
Conversation	Refer to words that summarize dialogue and direct quotes	Talked, argued, [she] said, you, stole, the diamonds,
Object	Refer to an object present in the scene that can be manipulated	Ball, ring, perfume, gun, photograph, audio-clip

Table 4. Descriptive Statistics for Participants' Overall Free Scene Recall

			Word Count	Proportion Unique Narrative Breadth Details	Units of Information
Old	No MCR	Eyes open	151.00 (71.80)	.19 (.07)	12.47 (6.62)
		Eyes closed	176.25 (98.08)	.20 (.07)	13.35 (7.49)
		Total	163.95 (86.11)	.19 (.07)	12.92 (7.00)
	MCR	Eyes open	186.05 (84.80	.19 (.07)	12.42 (6.02)
		Eyes closed	216.75 (129.63)	.19 (.06)	15.69 (9.85)
		Total	199.69 (106.51)	.19 (.06)	13.39 (8.04)
	Total	Eyes open	168.97 (79.71)	.19 (.07)	12.45 (6.24)
		Eyes closed	194.25 (113.31)	.20 (.06)	14.39 (8.57)
		Total	181.11 (97.45)	.19 (.06)	13.39 (7.48)
New	No MCR	Eyes open	311.47 (196.33)	.22 (.07)	23.58 (12.48)
		Eyes closed	339.55 (193.95)	.23 (.05)	27.45 (20.83)
		Total	325.87 (193.05)	.22 (.06)	25.56 (17.17)
	MCR	Eyes open	277.95 (153.43)	.23 (.06)	20.47 (7.98)
		Eyes closed	288.63 (172.66)	.22 (.05)	21.69 (12.86)
		Total	282.69 (159.95)	.23 (.06)	21.03 (10.35)
	Total	Eyes open	294.28 (174.12)	.23 (.07)	22.03 (12.45)
		Eyes closed	316.92 (183.99)	.22 (.05)	24.89 (17.75)
		Total	305.15 (178.07)	.23 (.06)	23.42 (14.43)

Note. Means (standard deviations).

Table 5. Means (Standard Deviations) for Proportions of Generic Units of Information Across All Conditions

	Old			New		
	MCR	No MCR	Total	MCR	No MCR	Total
Eyes closed	.45 (.21)	.54 (.22)	.50 (.21)	.24 (.17)	.26 (.14)	.25 (.15)
Eyes open	.48 (.25)	.53 (.25)	.50 (.25)	.24 (.17)	.27 (.13)	.26 (.12)
Total	.46 (.23)	.54 (.23)	.50 (.23)	.24 (.15)	.26 (.13)	.25 (.14)

Table 6. Effects of Delay, MCR and Eye-closure (EC) on Narrative Breadth Detail Proportions

Effect	*F*	*df*	*p*	η_{p2}
Unique Narrative Breadth Details				
Delay × EC × MCR	0.27	70	.604	.00
Delay × MCR	0.06	70	.813	.00
Delay × EC	0.10	70	.749	.00
EC × MCR	0.20	70	.657	.00
Delay	12.11	70	.001*	.15
MCR	0.02	70	.886	.00
EC	0.00	70	.994	.00
Persons				
Delay × EC × MCR	0.54	70	.466	.01
Delay × MCR	0.20	70	.657	.00
Delay × EC	0.46	70	.502	.01
EC × MCR	0.09	70	.765	.00
Delay	0.95	70	.334	.01
MCR	0.34	70	.564	.01
EC	0.71	70	.404	.01
Actions				
Delay × EC × MCR	3.51	70	.065	.05
Delay × MCR	0.03	70	.863	.00
Delay × EC	0.02	70	.888	.00
EC × MCR	0.87	70	.353	.01
Delay	0.32	70	.575	.01
MCR	0.07	70	.798	.00
EC	0.42	70	.521	.01
Setting				
Delay × EC × MCR	0.38	70	.538	.01
Delay × MCR	0.07	70	.793	.00
Delay × EC	1.38	70	.245	.02
EC × MCR	0.47	70	.495	.01
Delay	5.63	70	.020*	.07
MCR	1.08	70	.302	.01
EC	0.01	70	.918	.00
Conversations				
Delay × EC × MCR	0.51	70	.477	.01
Delay × MCR	0.92	70	.341	.01
Delay × EC	0.78	70	.381	.01
EC × MCR	3.25	70	.076	.04
Delay	24.08	70	.000*	.26
MCR	0.02	70	.901	.00
EC	0.50	70	.482	.01
Objects				
Delay × EC × MCR	0.23	70	.631	.00
Delay × MCR	7.54	70	.008	.10
Delay × EC	0.00	70	.968	.00
EC × MCR	0.03	70	.861	.00
Delay	4.18	70	.045*	.06
MCR	0.09	70	.766	.00
EC	1.21	70	.275	.02

Note. False Discovery Rate was used to correct for non-bolded tests.

Table 7. Means (Standard Deviations) for Proportions of Unique Narrative Breadth Units out of Word Count

			Persons	Actions	Setting/Circumstance	Conversations	Objects
Old	No MCR	Eyes open	.04 (.03)	.07 (.03)	.06 (.03)	.01 (.02)	.02 (.02)
		Eyes closed	.05 (.47)	.05 (.03)	.05 (.03)	.02 (.03)	.02 (.02)
		Total	.05 (.40)	.06 (.03)	.05 (.03)	.01 (.03)	.02 (.02)
	MCR	Eyes open	.04 (.03)	.05 (.03)	.06 (.04)	.02 (.04)	.01 (.02)
		Eyes closed	.04 (.04)	.07 (.04)	.06 (.02)	.01 (.03)	.01 (.01)
		Total	.04 (.03)	.06 (.03)	.06 (.03)	.02 (.03)	.01 (.01)
	Total	Eyes open	.04 (.03)	.06 (.03)	.06 (.03)	.01 (.03)	.01 (.02)
		Eyes closed	.05 (.04)	.06 (.03)	.05 (.03)	.02 (.03)	.01 (.02)
		Total	.05 (.03)	.06 (.03)	.06 (.03)	.01 (.03)	.01 (.02)
New	No MCR	Eyes open	.05 (.03)	.06 (.03)	.05 (.03)	.04 (.05)	.02 (.01)
		Eyes closed	.05 (.02)	.07 (.02)	.04 (.02)	.05 (.04)	.01 (.01)
		Total	.05 (.03)	.06 (.03)	.05 (.03)	.05 (.05)	.01 (.01)
	MCR	Eyes open	.05 (.03)	.06 (.02)	.04 (.03)	.06 (.06)	.02 (.02)
		Eyes closed	.05 (.02)	.06 (.03)	.05 (.03)	.03 (.03)	.02 (.02)
		Total	.05 (.03)	.06 (.03)	.05 (.03)	.04 (.05)	.02 (.02)
	Total	Eyes open	.05 (.03)	.06 (.03)	.04 (.03)	.05 (.05)	.02 (.02)
		Eyes closed	.05 (.02)	.07 (.03)	.05 (.02)	.04 (.04)	.02 (.01)
		Total	.05 (.03)	.06 (.03)	.05 (.03)	.05 (.04)	.02 (.01)

Table 8. Means (Standard Deviations) for Overall Free Scene Recall Accuracy Across All Conditions

	Old			New		
	MCR	No MCR	Total	MCR	No MCR	Total
Eyes closed	.79 (0.13)	.65 (0.29)	.71 (0.24)	.89 (0.13)	.92 (0.05)	.91 (0.10)
Eyes open	.80 (0.14)	.77 (0.16)	.78 (0.15)	.87 (0.16)	.88 (0.13)	.88 (0.15)
Total	.80 (0.13)	.71 (0.24)	.75 (0.20)	.88 (0.15)	.91 (0.10)	.89 (0.13)

Table 9. Means (Standard Deviations) for Generic Free Scene Recall Accuracy Across All Conditions

	Old			New		
	MCR	No MCR	Total	MCR	No MCR	Total
Eyes closed	.84 (0.16)	.69 (0.27)	.75 (0.23)	.84 (0.27)	.93 (0.10)	.89 (0.20)
Eyes open	.81 (0.18)	.81 (0.16)	.81 (0.18)	.89 (0.14)	.91 (0.17)	.90 (0.15)
Total	.82 (0.18)	.75 (0.23)	.78 (0.21)	.87 (0.21)	.92 (0.14)	.89 (0.17)

Table 10. Means (Standard Deviations) for Episodic Free Scene Recall Accuracy Across All Conditions

	Old			New		
	MCR	No MCR	Total	MCR	No MCR	Total
Eyes closed	.75 (0.15)	.59 (0.35)	.66 (0.29)	.90 (0.14)	.93 (0.09)	.92 (0.11)
Eyes open	.85 (0.18)	.68 (0.35)	.76 (0.29)	.86 (0.21)	.86 (0.16)	.86 (0.18)
Total	.80 (0.18)	.64 (0.35)	.72 (0.29)	.88 (0.18)	.90 (0.13)	.89 (0.15)

Table 11. Effects of Delay, MCR and Eye-closure (EC) on Accuracy

Effect	*F*	*df*	*p*	η_{p2}
Overall Free Scene Recall				
Delay × EC × MCR	1.33	69	.253	.02
Delay × MCR	4.03	69	.049*	.06
Delay × EC	3.41	69	.069	.05
EC × MCR	0.39	69	.536	.01
Delay	27.58	69	.000*	.29
MCR	1.58	70	.213	.02
EC	0.41	69	.524	.01
Generic Free Scene Recall				
Delay × EC × MCR	2.32	69	.132	.03
Delay × MCR	3.66	68	.060	.05
Delay × EC	0.16	68	.693	.00
EC × MCR	0.58	68	.448	.01
Delay	9.55	68	.003*	.12
MCR	0.10	68	.750	.00
EC	1.05	68	.310	.02
Episodic Free Scene Recall				
Delay × EC × MCR	0.20	65	.887	.00
Delay × MCR	5.91	65	.018*	.08
Delay × EC	4.45	65	.039*	.06
EC × MCR	0.05	65	.825	.00
Delay	22.56	65	.000*	.26
MCR	2.85	65	.090	.04
EC	0.23	65	.636	.00

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Appendix A.

Interview Script

For those in the eye-closure condition: Please close your eyes for the duration of this interview.

For those in the MCR condition: Think about the day you saw that movie in the theatre. (Pause). Think about being in the theatre (Pause), think about what was happening around you (Pause), think about all of the things you felt (Pause), think about what special smells you could smell (Pause), and think of what sounds or voices you could hear (Pause). Think about all of the things you did and all of the people who were there around you. (Pause).

Those in the control condition will receive only the below instruction:

Let's talk about what you can remember. Report everything that you can remember, even if you do not think it is important. Please do not try to guess any details. It is okay if you answer with "I don't remember" or "I don't know".

Please tell me about the movie.

Now I would like you to think about specific scenes from the movie. Think about the scene that you remember best. Which scene is it?

Please start from the beginning of the scene, and tell me everything that happened in the scene. Please include any details that you can remember.

Can you remember anything else?

Have you told me everything that you can remember?

Please take a second to think about it. No detail is too small. Is there anything else you can remember?

I'd like us to talk about the most memorable character in that scene. Who is it? [Participant response]

Now I'd like to ask you some questions about that character.

Did (s)he speak to anyone during the scene?

Can you remember what color top (s)he was wearing?

Can you remember what color bottoms (s)he was wearing?

What type of shoes was (s)he wearing?

Did (s)he wear any jewelry?

What ethnicity was (s)he?

How old do you think (s)he was?

Was (s)he wearing glasses?

What color was his/her hair?

What color were his/her eyes?

Did (s)he have any distinguishing characteristics (for example: a scar, a piercing)?

Did this scene occur in the beginning, middle, or near the end of the movie?

Appendix B.

Questionnaire

Participant number: ___

Please answer the following questions.

How frequently do you go to a movie theater to see a film?

a) Once a week or more

b) Two to three times a month

c) About once a month

d) Few times a year

e) Almost never

f) Never

Do you feel relaxed when you are in the movie theatre?

a) Yes

b) No

c) Moderately

d) Not sure

Are you able to sleep better after coming home from a movie?

a) Yes

b) No

c) Moderately

d) Not sure

Do you ever go to movies during the exam period?

a) Yes

b) No

Do you always go to the movies with other people?

a) Yes

b) No

c) Usually

d) Not sure

Please describe how you feel when you think about a movie theatre (for example: anxious, excited): _____

If you could choose one word to describe yourself, what word would you choose? _____

What word do you think others would use to describe you? _____

Demographics

What is your gender: _____

What is your age: _____

What is your ethnicity: _____

What is your first language? _____

If English is not your first language,

how many years have you been speaking English? _____

Appendix C.

Title: The Impact of Relaxation on Productivity [1]

You are invited to participate in a study designed to investigate the impacts of taking 'a night off' on productivity a few days later. As detailed below, this study will include two phases of participation. To be eligible for this study, you must be 18 years old and must have seen at **least one** of the following movies **in the movie theatre**: The Revenant (2015), The Martian (2015), Trainwreck (2015), The Big Short (2016), Arrival (2016), and La La Land (2016).

If you are eligible to participate and agree to voluntarily participate in this research, your participation will include answering a questionnaire. You will receive 1% credit for your psychology course for completing this first phase. Then, you will be given a gift card ($20.00) to spend at the movie theatre. You will be asked to visit the theatre and view a specific movie. Then, you will be asked to come back to RCB 6211 to complete phase two of this study.

During phase 2, your participation will include: meeting with the researcher within a week of watching the movie to answer some questions about productivity. This meeting with the researcher and interview will take approximately 30 minutes of your time. This will be done in an interview format and **this interview will be audio recorded**. **It is very important that you complete the first phase of participation (visiting the movie theatre with the gift card) before you can participate in phase two**. In exchange for your time and participation, you will receive 3% credit toward your psychology class. In total for both phases of participation, you will receive 4% class credit.

It is important for you to know that your participation in this research must be completely voluntary. If you decide to participate, you may withdraw at any time during without consequences or explanation. If you withdraw from the study, your data will be destroyed. If you wish to withdraw your data after you leave, you can contact the researcher to request that your data be withdrawn.

All information obtained during the study will remain confidential. You will not write your name or any other identifying information on the research material. The researcher may contact you by information that you have provided (your email address) throughout the study to remind you for your phase two meeting. After completing phase one of this study, all participants will be assigned a participant number. This number will be used to link phase 2 responses with the phase 1 responses. Your email address will be linked to the participant number in a file separate from other data. Only the principal investigator will have access to this file. This file will be deleted after publication. The data will be stored in a locked filing cabinet in the secure Children's Research Memory Group Lab at Simon Fraser University. Data will be retained for a minimum of ten years after publication. Copies of the results of this study, upon its completion, may be obtained by providing your name and email address to the researcher. Only group data will be available and presented, no individual data will be identifiable. These data will be presented at national and international conferences and published in academic journals.

If you wish to discuss this research any further feel free to contact any one of the following people: Shelbie Anderson (Principal Investigator); Dr. Deborah Connolly (Faculty Supervisor). If you should have any ethical concerns about this study, please contact Dr. Jeff Toward, Director, Office of Research Ethics.

The study will run from the summer of 2018 for approximately one year. Data collection will take place in the Children's Research Memory Group Lab (RCB 6211) at Simon Fraser University.

I have volunteered to participate in this project, which is under the direction of Dr. Deborah Connolly from the Psychology Department at Simon Fraser University. I have been informed of the basic procedures of the study. I take part in this study with the understanding that I may withdraw my participation in the experiment at any time. A copy of this consent form has been given to me for my records.

Participant Signature _____

Date _____

(YYYY/MM/DD)

Print Name _____

Email Address _____

Appendix D.

Title: Movie Watching Study [2]

Welcome to phase 2 of your participation in this study. About a week ago, you were given a gift card to spend at the movie theatre. Phase 2 will consist of two interviews wherein you will be asked questions about your memory of two movies: one about a movie you have recently watched, and one about a movie you have watched in the past. **All interviews will be audio recorded**. This study will take approximately 30 minutes of your time. In exchange for your time and participation, you will receive 3% credit toward your psychology class. In total, you will receive 4% credit for participation in this study.

It is important for you to know that your participation in this research must be completely voluntary. If you decide to participate, you may withdraw at any time during without consequences or explanation. If you withdraw from the study, your data will be destroyed. If you wish to withdraw your data after you leave, you can contact the researcher to request that your data be withdrawn.

All information obtained during the study will remain confidential. You will not write your name or any other identifying information on the research material. After completing phase one of this study, all participants will be assigned a participant number. This number will be used to link phase 2 responses with the phase 1 responses. Your email address will be linked to the participant number in a file separate from other data. Only the principal investigator will have access to this file. This file will be deleted after publication. The data will be stored in a locked filing cabinet in the secure Children's Research Memory Group Lab at Simon Fraser University. Data will be retained for a minimum of ten years after publication. Copies of the results of this study, upon its completion, may be obtained by providing your name and email address to the researcher. Only group data will be available and presented, no individual data will be identifiable. These data will be presented at national and international conferences and published in academic journals.

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The study will run from the summer of 2018 for approximately one year. Data collection will take place in the Children's Research Memory Group Lab (RCB 6211) at Simon Fraser University.

I have volunteered to participate in this project, which is under the direction of Dr. Deborah Connolly from the Psychology Department at Simon Fraser University. I have been informed of the basic procedures of the study. I take part in this study with the understanding that I may withdraw my participation in the experiment at any time. A copy of this consent form has been given to me for my records.

Participant Signature _____

Date _____

(YYYY/MM/DD)

Print Name _____

Email Address _____

Appendix E.

Debriefing

Why was I deceived about the true purpose of this study?

Because this was a study about memory, we told you the study was about productivity so that you would not pay special attention to the movie you went to see. If you had known we were planning to test your memory, you may have viewed the movie differently than you would have otherwise.

What are we trying to learn with this research?

We are interested in gaining a better understanding of how adults can accurately describe things that they have witnessed in the recent and distant past. We are also interested in knowing the best methods to retrieve these memories. Thank you for helping us get closer to our goal of understanding these difficult research areas.

Why is this important to psychologists or the general public?

Attempting to talk to adults about their memories can be a difficult task, especially when the event in question happened many years ago. It is important to understand what are the best ways to conduct interviews as well as the degree of accuracy that is attainable for witnesses.

Is there anything that I can do if I found this experiment to be emotionally challenging?

If you feel uncomfortable, anxious, or emotional after discussing some of these movie scenes, there are services available to you for support.

If you are an SFU student: You can visit Counselling Services at Simon Fraser University. Counselling Services can be located by phone. Please do not hesitate to contact them after this study if you require assistance.

What if I have questions later?

If you wish to discuss this research any further feel free to contact any one of the following people: Shelbie Anderson (Principal Investigator); Dr. Deborah Connolly (Faculty Supervisor). If you should have any ethical concerns about this study, please contact the Simon Fraser University Office of Research Ethics.