

Mental time travel and eyewitness recall

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Mental Reinstatement of Context: Do individual differences in mental time travel and eyewitness
occupation influence eyewitness performance over different delay intervals?

Karen Bangs and James H. Smith-Spark

London South Bank University, London, United Kingdom

Author Contact

James H. Smith-Spark, Division of Psychology, School of Applied Sciences, London South
Bank University, 103 Borough Road, London, SE1 0AA, United Kingdom

Email smithspj@lsbu.ac.uk

Telephone +44 (0)20 7815 5884

Fax +44 (0)20 7815 8099

Conflict of interest statement

The authors have no conflict of interest to declare.

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Abstract

The Cognitive Interview is a memory-enhancing interview protocol designed to optimize the access and retrieval of eyewitness memories. Its Mental Reinstatement of Context (MRC) component requires interviewees to mentally reconstruct the crime event they witnessed. Individual differences in mental time travel (MTT) relate to the extent to which a person mentally re-experiences personal events from his or her past. Individual differences in MTT have been found to predict correct recall of a simulated crime event under immediate MRC recall conditions. To explore the relationship between MTT and performance under MRC conditions further, the present study presented a simulated crime video to 30 police officers and 26 members of the public. Eyewitness recall was tested under MRC conditions either immediately or one week later. Participants' general MTT and also MTT relating specifically to the crime video itself was measured via self-report. Less correct information and more confabulations were produced after one week but delay had no effect on the amount of incorrect information reported. No difference in recall was found between police officers and members of the public. Better quality MTT relating to the crime video was found to be a positive predictor of the amount of information correctly recalled under immediate conditions but not after one week. General MTT scores did not predict correct recall under either delay condition. Interviewers need to be aware that, due to individual differences, some witnesses may perform better under the MRC component than others.

Keywords: Eyewitness memory; Cognitive Interview; Mental Reinstatement of Context; Mental time travel; Delay interval

Introduction

Eyewitnesses often hold key information about the events that they have seen. Indeed, an eyewitness may be the only source of information available to investigators to identify and bring to justice those responsible for perpetrating a crime. The Cognitive Interview (Geiselman et al., 1984) is a commonly used interviewing technique designed to facilitate the recall of eyewitnesses. The current study explored eyewitness recall under its Mental Reinstatement of Context (MRC) component. Individual differences in the extent to which individuals mentally re-experience personally experienced past events, known as mental time travel (MTT; e.g., Tulving, 2002), have been found to influence the accuracy of eyewitness recall under MRC conditions when participants are questioned after a short delay (Smith-Spark, Bartimus & Wilcock, 2017). The current research built on this work; firstly, by testing eyewitness recall under MRC conditions either immediately after witnessing a simulated crime event or after a delay of one week and, secondly, by seeing whether MTT for the crime event itself, as well as general levels of MTT (as tested previously by Smith-Spark et al.), would predict eyewitness performance. More generally, it extended past research on the Cognitive Interview by having a serving police officer (the first author, KB) administering the tasks, testing police officers as well as university students and members of the public (thus obtaining a broader sample than just students), and using a simulated crime video filmed from a first-person eyewitness perspective rather than a third-person perspective (thus adding to the verisimilitude of the event witnessed).

The Cognitive Interview

The Cognitive Interview was developed by Geiselman et al. (1984; see also Fisher & Geiselman, 1992) as a memory-enhancing interview protocol designed to aid the elicitation of crime event information from eyewitnesses and cooperative suspects. The Cognitive Interview

has been found to elicit greater recall accuracy and completeness of reporting compared with a standard interview (Fisher, Geiselman & Amador, 1989; Geiselman, Fisher, MacKinnon & Holland, 1986; Stein & Memon, 2006). Its effectiveness as an interviewing tool has been demonstrated over different eyewitness age groups, in different countries, and in the field (e.g., Fisher et al., 1989; Paulo, Albuquerque & Bull, 2013; Stein & Memon, 2006; Verkamp & Ginot, 2009).

The Cognitive Interview utilizes different interviewing components to maximize eyewitness recall. At a theoretical level, it is underpinned by Bower's (1967) Multiple Trace Theory. This theory argues that different features make up a memory trace and that, as a result, multiple retrieval paths could be followed to access the same encoded event. Each Cognitive Interview component, therefore, triggers a different facet of memory recall to maximize the information accessed at retrieval. In this way, the interviewee is provided with alternative recall opportunities should one technique prove to be unsuccessful in obtaining information useful to the investigation (Westera, Kebbell & Milne, 2011). The four components of the Cognitive Interview are Report Everything, Change Perspective, Change Order, and Mental Reinstatement of Context (MRC). Report Everything instructs the eyewitness to report all the details that they can, even if they do not think them important. This component helps to prevent witnesses from withholding information that they do not consider relevant (Koriat & Goldsmith, 1996). Change Order requires the eyewitness to recall the event in a different order, such as in reverse chronological order, while Change Perspective asks the eyewitness to try to recall the event from an alternative perspective, such as from the perspective of another person present (Geiselman, Fisher, MacKinnon & Holland, 1985). The MRC component employs cues to prompt the eyewitness mentally to recreate the physical environment and emotions that were present at the

time of the witnessed event, effectively imagining themselves back at the crime scene, before being asked to recall their memory of that event (Davis, McMahon & Greenwood, 2005; Geiselman et al., 1986).

The MRC component was the focus of the current study. This component is aimed at increasing the overlap of features between encoding and retrieval cues (Geiselman et al., 1986) and is widely regarded as one of the most effective components of the Cognitive Interview (Dando, Wilcock & Milne, 2008). It is based on the Encoding Specificity Hypothesis (Tulving & Thomson, 1973) which argues that recall can be improved by providing cues to reinstate the context at the time that an event was encoded. The interviewer provides a series of short verbal prompts to the witness, such as “Think about that day”, “What was the weather like?”, “Who had you seen or spoken to that day”, “Think about the room you were in”, “Try and picture the room in your mind”, “Did you smell anything in that room?”, with sufficient time being allowed after each prompt to enable the eyewitness to re-create the event mentally.

The Cognitive Interview and MTT

Smith-Spark et al. (2017) highlighted the similarity between the process of mentally reinstating the context of a crime event under the MRC component of the Cognitive Interview and the processes involved in MTT, in which different phenomenological dimensions associated with a personally experienced event from one’s past are re-experienced. The authors investigated whether individual differences in MTT predicted eyewitness recall under two components of the Cognitive Interview, comparing performance under the MRC component with recall under the Report Everything component. A short mock-crime video, filmed from a third-person perspective, was shown to the participants. To avoid physical reinstatement of context from the surrounding environment, the participants were moved to a different room before being asked to

write down personal memories from specified time-periods after being given a cue word (Crovitz & Schiffman, 1974). Smith-Spark et al.'s participants then completed the Memory Characteristics Questionnaire (MCQ; Johnson, Foley, Suengas & Raye, 1988) for each recalled memory. The 12-item MCQ requires respondents to rate the extent to which they re-experienced a personally lived event along a range of phenomenological dimensions and is commonly used as a measure of MTT (e.g., Arnold, McDermott & Szpunar, 2011). An overall mean MCQ score was generated to provide a measure of each participant's general quality of MTT. Following this, the participants were allocated to one of the two Cognitive Interview conditions and either the MRC or the Report Everything instructions were presented. After receiving these instructions, the participants were given three minutes to write down what they could remember of the crime video. Individual differences in mental time travel, as measured by MCQ scores, were found to be positive predictors of both correct and incorrect eyewitness recall using the MRC component of the Cognitive Interview. However, no predictive relationship between MCQ scores and eyewitness performance was observed in the Report Everything condition, despite equivalent levels of accuracy being found between the two conditions. Thus, Smith-Spark et al.'s findings provided support for the argument that different Cognitive Interview components engage different cognitive processes for retrieval. More specifically, the results suggest that MTT is utilized by eyewitnesses responding under the MRC component of the Cognitive Interview.

Study rationale and hypotheses

To the authors' best knowledge, no other empirical studies have explored the relationship between individual differences in MTT and the effectiveness of the MRC component of the Cognitive Interview. Given that the effectiveness of the MRC component in facilitating eyewitness recall may be influenced by individual differences in MTT, further research is needed

to explore this relationship in more depth. To this end, the current study measured the influence of individual differences in MTT on recall of a simulated crime event video under MRC conditions after either a minimal delay or a delay of one week. Both general levels of MTT (as employed by Smith-Spark et al., 2017) and MTT relating specifically to the recall of the crime event video were investigated.

Memon, Meissner, and Fraser's (2010) meta-analysis indicated that little research has been conducted on the Cognitive Interview over differing delay intervals. In general terms, the delay incurred between the encoding and recall of information has a detrimental effect on memory. As more time elapses since encoding the information, the memory deteriorates and becomes less retrievable (e.g., Turtle & Yuille, 1994). Furthermore, finer-grained details are lost at a faster rate than basic information (Goldsmith, Koriat & Pansky, 2005). Memon et al.'s meta-analysis found that the duration of the delay between encoding and recall reduced the effect size for correct recall using the Cognitive Interview, while the effect size for confabulations increased. However, the advantage of the Cognitive Interview over a control structured interview was still sizeable.

As well as adding to the literature on the relationship between MTT and eyewitness performance under MRC conditions over differing delay intervals, the study also explored the effect of participant occupation on recall, comparing the eyewitness performance of law enforcement professionals with members of the public. As highlighted by Memon et al. (2010), only a small percentage of studies have assessed the eyewitness recall performance of law enforcement professionals under the Cognitive Interview. There have been mixed findings when the eyewitness memory of police officers has been compared with that of members of the public. Some studies have found that police officers recalled significantly higher quantities of correct

information than members of the public, with no increase in incorrect information (e.g., Christianson, Karlsson & Persson, 1998; Lindholm, Christianson & Karlsson, 1997). However, other studies have reported no difference in recall accuracy between police and civilian eyewitnesses (e.g., Stanny & Johnson, 2000). Given the nature of their role and its concomitant exposure as eyewitnesses to situations which require later reporting, more research is needed to understand the eyewitness recall performance of law enforcement professionals. Therefore, the current study compared the performance of serving police officers with non-police participants (a group consisting of members of the public and university students) to explore the influence of occupation on eyewitness recall under the MRC component of the Cognitive Interview. Further to this, a serving law enforcement professional (the first author, KB) administered the MRC instructions, thereby addressing a further concern of Memon et al. relating to the small number of studies in which the Cognitive Interview has been administered by law enforcement professionals.

It was predicted that the quantity of correct information would decrease after a one-week delay, while the quantity of incorrect recall and confabulations would increase. These predictions were based on studies investigating memory decay (e.g., Gabbert, Memon & Allan, 2003; Gabbert, Memon, Allan & Wright, 2004; Goldsmith et al., 2005; Turtle & Yuille, 1994). Given the equivocal findings regarding the relative eyewitness recall performance of police officers compared with non-police participants (e.g., Christianson, Karlsson & Persson, 1998; Lindholm, Christianson & Karlsson, 1997; Stanny & Johnson, 2000), it was an open question as to whether differences would be found between the two participant groups or whether there would be an interaction between occupation group and delay interval. From Smith-Spark et al.'s (2017) findings, it was hypothesized that individual differences in MTT would be a significant predictor

of the quantity of correct and incorrect information recalled under the immediate recall condition. Given the MRC's reported effectiveness over longer time intervals (see Memon et al., 2010, for a review) and the predictive relationship found between MTT and recall under the MRC component (Smith-Spark et al., 2017), it was expected that a similar relationship would emerge for the one-week delay condition. It was predicted that MTT scores relating to the crime event video itself would more closely predict recall than more general MTT scores derived from events unrelated to the crime video.

Method

Design

A series of analyses were performed to explore different aspects of eyewitness performance and their relation to individual differences in MTT under the MRC component of the Cognitive Interview.

Firstly, a 2 x 2 between-subjects design was used to investigate the effects of occupation group and delay condition on, firstly, MCQ scores and, secondly, on eyewitness recall. The factors were occupation group (levels: police, non-police) and delay condition (levels: immediate recall, delayed recall). The dependent variables were the number of bits of information correctly recalled, the number of bits of information incorrectly recalled, and the number of confabulations. Incorrect details were defined as errors of detail (e.g., an eyewitness stating that the colour of a person's hat was red when in fact it was black). Confabulations were commission errors (Memon et al., 2010), such as an eyewitness describing a hat worn by a suspect when, in fact, no hat was present.

Multiple regression was employed to determine the extent to which MCQ scores (both general and specifically for the crime event video) predicted eyewitness performance under the MRC component of the Cognitive Interview.

Participants

Fifty-six adults (31 females, 25 males, mean age = 38 years, $SD = 12$, range = 46) took part. Of the participants, 30 were police officers and 26 were either university students or members of the public. The participants were assigned randomly to one of two recall conditions, in which they were tested for their memory of a simulated crime event either immediately or after a delay of one week. Group characteristics are displayed in Table 1. The participants were tested either individually or in groups (when time constraints and resource limitations prevented individual testing). Group testing usually involved two participants but one group consisted of six participants and another group consisted of seven. Similar variation in the size of the groups tested has been reported previously by Smith-Spark et al. (2017). No inducement or rewards were offered for participation.

TABLE 1 ABOUT HERE

A one-way unrelated ANOVA indicated that there was a significant difference in age between the occupation groups, $F(3, 52) = 4.12$, $MSE = 113.60$, $p = .011$, $\eta^2_p = .19$. Post-hoc comparisons indicated that the non-police immediate recall group was significantly older than the police delayed recall group ($p = .046$), the police immediate recall group ($p = .015$), and the non-police delayed recall group ($p = .032$). No other comparisons were significant ($p = 1.00$). There was no significant association between gender and delayed recall condition, $\chi^2(1, N = 56) < 1$, $p = .453$. However, there was a significant association between gender and occupation group, $\chi^2(1, N = 56) = 9.134$, $p = .003$, such that there were more males ($N = 19$) than females

(N = 11) in the police group, while in the non-police group there were more females (N = 20) than males (N = 6).

Materials

Simulated crime video

A laptop computer was used to present a 1-minute 52-second simulated crime video depicting a non-violent burglary. The video was filmed from the first-person perspective of an eyewitness. The video showed a male trying to gain entry to a building. He enters the building as a female leaves it, by catching the door before it closes. The male then walks up some stairs, through the stairwell door, and a further door in the corridor. He then manages to gain entry to a locked apartment door. The male enters the apartment and goes into the lounge. He tries to open several doors within the apartment before finding an unlocked door. The male enters this room and re-appears after a few seconds holding a laptop computer. He walks across the lounge, confronting the camera-person in an agitated voice before rushing out of the apartment holding the laptop computer.

Cue word recall

Using the Crovitz-Schiffman technique (Crovitz & Schiffman, 1974), the participants were asked to recall past, personally lived events from three different temporal locations. The timeframes in question were one day ago, one week ago, and one month ago. Two cue words were provided by the researcher for each timeframe for two separate recall attempts. This gave a total of six events to recall. The same cue words were employed as those used by Smith-Spark et al. (2017), namely “garden” and “kitchen”. These words were matched for age of acquisition and imageability using ratings taken from Bird, Franklin, and Howard’s (2001) database and were also matched for Celex Word Frequency (Baayen, Piepenbrock & van Rijn, 1993). The

timeframe for the memory to be recalled and the cue word order was counterbalanced across conditions. Order 1 required memories to be recalled in the order of one day ago through to one month ago, while Order 2 required memories to be recalled in the reverse order to Order 1. The instructions were presented as a computer slide show as well as verbally.

Memory Characteristics Questionnaire

The participants were asked to complete a modified MCQ (Johnson et al., 1988) after each event that they were required to recall. The participants were instructed to answer 12 questions. Each question required the participants to rate on a one to seven scale the extent to which they experienced different dimensions of the event being remembered. The questions explored the degree to which the participants felt that they had mentally travelled back in time (1 = not at all, 7 = completely), to what extent the sound of the event was remembered (1 = a little, 7 = a lot), how much effort was needed to recall the event (1 = a little, 7 = a lot), the extent of a feeling of re-experiencing the event (1 = not at all, 7 = completely), the clarity of the location (1 = vague, 7 = clear), the degree of recalling bodily movements (1 = not at all, 7 = completely), the clarity of spatial arrangement of objects (1 = vague, 7 = clear), the clarity of spatial arrangement of people (1 = vague, 7 = clear), the extent of recall of smell or taste (1 = a little, 7 = a lot), the extent to which the event was recalled as a coherent story (1 = not at all, 7 = completely), the clarity of the time of day (1 = vague, 7 = clear) and the degree to which visual details were remembered (1 = a little, 7 = a lot). An N/A option was provided for some questions to allow for any events recalled that did not feature that characteristic (e.g., a smell or taste). A mean was calculated from the MCQ scores generated from the six personally lived events that had been recalled (referred to as mean cue word MCQ score henceforth). The mean MCQ score provided a measure of the participant's general quality of MTT, following the same method as Smith-Spark

et al. (2017). Higher MCQ scores indicated a higher level of phenomenological experience accompanying the recall of specific episodes from the participant's own past. An MCQ score based on the recall of the simulated crime video (referred to as video MCQ hereafter) was also obtained following the same procedure as described above.

Procedure

Ethical approval was granted by the relevant research ethics committee at the authors' host institution. Informed consent was obtained from the participants prior to testing.

Initially, the participants were informed that they would watch a mock-crime video and would be asked questions about it later. After viewing the video, the participants were taken to a different room to complete the remainder of the tests. This was done to ensure that physical reinstatement of context would not influence recall.

The cue word recall task was then completed. The experimenter read out the adapted Crovitz-Schiffman instructions. The participants were asked to use the first memory that came to mind. They were informed that it was not important for the memory necessarily to be related to the cue word as this had been provided simply to assist them. However, they were reminded that it was very important to ensure that the memory which they wrote about was from the correct timeframe. For each recalled event, the cue word and timeframe appeared on a computer slide. The participants were given three minutes to write down their memory for that cue word and timeframe in their answer books, before being asked to cease writing. The slide containing the cue word and the timeframe remained visible to the participants until recall of that memory had been completed. After the three minutes had elapsed, the participants were asked to complete an MCQ relating to their recall of the event about which they had written. The Crovitz-Schiffman

cue word recall task and completion of the associated MCQ was completed twice for each timeframe (once for each cue word), giving a total of six recalled events.

The participants' memory for the simulated crime event was then tested. In the immediate recall condition, the participants were tested straight after the completion of the six Crovitz-Schiffman and MCQ trials. The recall of the participants assigned to the delayed recall condition was tested one week later. They were asked not to discuss the contents of the video with anyone else in the meantime.

Regardless of the condition to which they had been assigned, all the participants received the same MRC instructions prior to recall and their memory for the simulated crime event was tested following the same procedure. The instructions presented a range of cues to help place the participants back at the time that they watched the video. The participants were asked to think back to the simulated crime that they watched as though they were trying to remember something that they had lost and were trying to remember where they had last seen it. They were then asked to think about what they had been doing just before watching the crime video, then to think about the room in which they had viewed it (thinking about its appearance, any smells, any noteworthy items present, the physical layout of the room, and where they sat to watch the screen). Following this, they were asked to think whether there was anyone else present in the room and where they were positioned. Once the participants had built up a good mental image of the room, they were then asked to write down as much information as they could recall about the mock crime event video in the answer book provided. They were told that it was important not to guess details or make them up and that it was fine to say if they did not know a detail. The participants were allowed five minutes to complete this phase before completing the MCQ

relating to the crime video. The answer books were then collected and the participants were debriefed.

Results

Comparison of scores under individual and group testing conditions

To determine whether any group differences in scores were evident between participants tested individually compared with those tested in groups, independent-samples *t*-tests were run on both MCQ scores and eyewitness recall performance.

There was no significant difference between the mean cue word MCQ scores of the participants tested individually (mean = 4.85, *SD* = 0.73) and those group-tested (mean = 4.87, *SD* = 0.73), $t(54) < 1$, $p = .941$. There was also no statistically significant difference in the mean video recall MCQ score between individually-tested (mean = 4.50, *SD* = 0.80) and group-tested participants (mean = 4.71, *SD* = 0.90), $t(54) < 1$, $p = .354$.

No significant difference was found in the amount of information correctly recalled by the individually-tested participants (mean = 22.76, *SD* = 10.03) and those who were group-tested (mean = 23.33, *SD* = 8.11), $t(54) < 1$, $p = .815$. There was also no significant difference in the mean amount of information incorrectly recalled by the participants tested individually (mean = 1.10, *SD* = 1.29) and those tested in a group (mean = 1.15, *SD* = 1.38), $t(54) < 1$, $p = .901$. However, individually-tested participants made significantly more confabulations (mean = 0.69, *SD* = 0.89) than the group-tested participants (mean = 0.22, *SD* = 0.42), $t(40.68) = 2.54$, $p = .015$, Cohen's $d = 0.63$.

Overall comparison of MCQ scores

Independent samples *t*-tests revealed no significant difference in the mean cue word MCQ score between the two counterbalanced orders of presentation, order 1 (mean = 4.80, *SD* = 0.62) and order 2 (mean = 4.93, *SD* = 0.67), $t(54) < 1$, $p = .471$.

To determine whether there was an effect on MCQ scores of the different timeframes over which MTT was required, a one-way related ANOVA (levels: one day ago, one week ago, one month ago) was performed. A one-way related ANOVA revealed that the timeframe being recalled for the word recall tasks had a significant effect on MCQ scores, $F(2, 110) = 28.61$, $MSE = .21$, $p < .001$, $\eta^2_p = .34$. Post hoc comparisons indicated that MCQ scores for a memory originating from one day ago (mean = 5.21, *SD* = 0.78) were significantly higher ($p < .001$) than MCQ scores from memories from both one week ago (mean = 4.82, *SD* = 0.69) and one month ago (mean = 4.56, *SD* = 0.76; $p < .001$). Memory Characteristics Questionnaire scores were also significantly higher for the one week ago timeframe than the one month ago timeframe ($p = .007$).

A related samples *t*-test indicated that the mean cue word MCQ score (mean = 4.86, *SD* = 0.64) was significantly higher than the mean video recall MCQ score (mean = 4.60, *SD* = 0.84), $t(55) = 2.56$, $p = .013$, Cohen's $d = 0.34$.

Memory Characteristics Questionnaire scores under different delay conditions

Mean cue word MCQ score

Mean cue word MCQ scores were very similar for the immediate recall condition (mean = 4.85, *SEM* = 0.13) and the delayed recall condition (mean = 4.86, *SEM* = 0.12). A two-way unrelated ANOVA indicated that there was no significant effect of delay condition on mean cue word MCQ scores, $F(3, 52) < 1$, $MSE = 0.433$, $p = .993$. The police group produced a slightly higher mean cue word MCQ score (mean = 4.91, *SEM* = 0.12) than the non-police group (mean

= 4.79, $SEM = 0.13$) but there was no significant effect of participant occupation on mean cue word MCQ scores, $F(3, 52) < 1$, $MSE = 0.433$, $p = .502$. Delay condition and participant occupation did not interact significantly, $F(3, 52) < 1$, $MSE = 0.433$, $p = .808$.

Video MCQ score

The mean video MCQ score for the immediate recall condition was 4.85 ($SEM = 0.13$) and 4.34 ($SEM = 0.15$) for the delayed recall condition. A two-way unrelated ANOVA showed that there was a significant effect of delay condition on video MCQ scores, $F(3, 52) = 6.07$, $MSE = 0.637$, $p = 0.17$, $\eta^2_p = .676$. The police group had a slightly higher video MCQ score (mean = 4.71, $SEM = 0.15$) than the non-police group (mean = 4.50, $SEM = 0.16$) but this difference was not significant statistically, $F(3, 52) < 1$, $MSE = 0.637$, $p = .338$. There was no statistically significant interaction between delay condition and participant occupation, $F(3, 52) = 1.78$, $MSE = 0.637$, $p = .188$.

Eyewitness recall performance

Eyewitness memory: Correct recall

The effects of occupation group and delay condition on the amount of information correctly recalled were analyzed using a two-way unrelated ANCOVA with age being entered as the covariate. A significantly higher amount of information was recalled correctly by the participants in the immediate recall condition (mean = 26.81, $SD = 7.13$) than those in the delayed recall condition (mean = 19.77, $SD = 9.42$), $F(1, 51) = 8.81$, $MSE = 74.575$, $p = .005$, $\eta^2_p = .147$. The police participants recalled slightly more information correctly (mean = 23.97, $SD = 7.71$) than the non-police participants (mean = 21.96, $SD = 10.49$). However, the difference in scores between the two occupation groups was not statistically significant, $F(1, 51) < 1$, $MSE =$

74.575, $p = .617$. No significant interaction was found between delay condition and occupation group, $F(1, 51) < 1$, $MSE = 74.575$, $p = .852$.

Eyewitness memory: Incorrect recall

A two-way unrelated ANCOVA was also used to analyze the effects of occupation group and delay condition on the amount of information incorrectly recalled, with age again entered as the covariate. Slightly more incorrect details were recalled by the immediate condition (mean = 1.19, $SD = 1.27$) than the delayed recall condition (mean = 1.07, $SD = 1.39$). However, the difference was not statistically significant, $F(1, 51) < 1$, $MSE = 1.629$, $p = .751$. The police participants recalled more incorrect details (mean = 1.43, $SD = 1.50$) than the non-police participants (mean = 0.77, $SD = 0.99$). The effect of occupation was significant, $F(1, 51) = 5.99$, $MSE = 1.629$, $p = .018$, $\eta^2_p = .105$. No significant interaction was found between delay condition and occupation group, $F(1, 51) = 1.90$, $MSE = 1.629$, $p = .174$.

Eyewitness memory: Confabulations

A two-way unrelated ANCOVA indicated that a significantly higher number of confabulations were produced by the delayed recall condition (mean = 0.70, $SD = 0.84$) than the immediate recall condition (mean = 0.19, $SD = 0.49$), $F(1, 51) = 7.01$, $MSE = 0.512$, $p = .011$, $\eta^2_p = .121$. The police participants provided approximately equivalent levels of confabulations (mean = 0.47, $SD = 0.73$) to the non-police participants (mean = 0.46, $SD = 0.76$). No effect of occupation group was found, $F(1, 51) < 1$, $MSE = 0.512$, $p = .761$. No significant interaction was found between delay condition and occupation group, $F(1, 51) < 1$, $MSE = .512$, $p = .529$.

Relationships between MCQ scores and eyewitness memory performance

Analyses were performed on the amount of information correctly produced by the overall sample of 56 participants and by the immediate and delayed recall conditions separately.

Analyses were not performed on the incorrectly recalled information or the confabulation data due to the low number of non-zero values obtained.

The mean amount of information correctly recalled by the 56 participants was 23.04 ($SD = 9.08$). The mean cue word MCQ score was 4.86 ($SD = 0.64$) and the video MCQ score was 4.60 ($SD = 0.84$). Mean cue word MCQ score and video MCQ score correlated significantly, $r = .511$, $p < .001$. There was no significant correlation between mean cue word MCQ score and the amount of information correctly recalled, $r = .126$, $p = .177$. However, there was a very significant correlation between video MCQ score and the amount of information correctly recalled, $r = .365$, $p = .003$.

The multiple correlation between the predictor variables and the amount of information correctly recalled was .372. The regression model accounted for 11% of the variance in correct recall (adjusted- R^2) and the model significantly predicted the amount of information correctly recalled, $F(2, 53) = 4.25$, $p = .019$. When the predictor variables were considered individually, video MCQ score was found to be a significant positive predictor of the amount of information correctly recalled, Standardized $\beta = .41$, $t = 2.74$, $p = .008$, while mean cue word MCQ score did not predict correct recall significantly, Standardized $\beta = -.08$, $t < 1$, $p = .584$. The positive association between video MCQ score and the amount of information correctly recalled is shown in Figure 1.

FIGURE 1 ABOUT HERE

To explore the contribution of MTT to eyewitness memory at a finer-grained level across the different delay intervals, regression analyses were also performed separately on the amount of information correctly recalled by the immediate recall and delayed recall conditions.

Immediate recall condition

The mean amount of information correctly recalled by the 26 participants in the immediate recall condition was 26.81 ($SD = 7.13$). The mean cue word MCQ score was 4.87 ($SD = 0.51$) and the video MCQ score was 4.91 ($SD = 0.86$). Mean cue word MCQ score and video MCQ score correlated significantly, $r = .459, p = .009$. There was no significant correlation between mean cue word MCQ score and the amount of information correctly recalled, $r = .100, p = .314$. However, there was a very significant correlation between video MCQ score and the amount of information correctly recalled, $r = .459, p = .009$.

The multiple correlation between the predictor variables and the amount of information correctly recalled was .484. The regression model accounted for 17% of the variance in correct recall (adjusted- R^2) and the model significantly predicted the amount of information correctly recalled, $F(2, 23) = 3.51, p = .047$. When the predictor variables were considered individually, video MCQ score was found to be a significant positive predictor of the amount of information correctly recalled, Standardized $\beta = .53, t = 2.59, p = .016$, while mean cue word MCQ score did not predict correct recall significantly, Standardized $\beta = -.15, t < 1, p = .487$. The relationship between video MCQ score and the amount of information correctly recalled is shown in Figure 2.

FIGURE 2 ABOUT HERE

Delayed recall condition

The mean amount of information correctly recalled by the 30 participants in the immediate recall condition was 19.77 ($SD = 9.41$). The mean cue word MCQ score was 4.86 ($SD = 0.74$) and the video MCQ score was 4.34 ($SD = 0.75$). There was a highly significant correlation between mean cue word MCQ score and video MCQ score, $r = .625, p < .001$. The mean cue word MCQ score and the amount of information correctly recalled did not correlate

significantly, $r = .149$, $p = .216$, nor did video MCQ score and the amount of information correctly recalled correlate significantly, $r = .131$, $p = .246$.

The multiple correlation between the predictor variables and the amount of information correctly recalled was .156. The adjusted- R^2 value was -.05 and the model did not significantly predict the amount of information correctly recalled, $F(2, 27) < 1$, $p = .716$. Neither video MCQ score, Standardized $\beta = .06$, $t < 1$, $p = .802$, nor mean cue word MCQ score, Standardized $\beta = .11$, $t < 1$, $p = .654$, were significant predictors of the amount of information correctly recalled. While non-significant, the relationship between video MCQ score and the amount of information correctly recalled is shown in Figure 3 for comparison with the immediate recall condition.

FIGURE 3 ABOUT HERE

Scrutiny of the scatterplot indicates a potential outlying data point. With it removed from the analysis, the multiple correlation was .335 and 4% of the variance was explained (adjusted- R^2). However, the model still did not predict the amount of information correctly recalled significantly, $F(2, 26) = 1.64$, $p = .214$. Neither mean cue word MCQ score, Standardized $\beta = .139$, $t < 1$, $p = .562$, nor video MCQ score, Standardized $\beta = .230$, $t < 1$, $p = .338$, predicted significantly the amount of information correctly recalled.

Discussion

This study investigated the influence of individual differences in MTT on eyewitness memory performance under the MRC component of the Cognitive Interview (e.g., Geiselman et al., 1984). Individual differences in MTT were found to predict the amount of correct information correctly recalled in the immediate recall condition but not in the delayed recall condition. However, the positive relationships between MTT and correct recall were specific to the recall of the crime event video itself (and not more general MTT) and were limited to the

immediate delay condition. The number of incorrect and confabulated responses was too low to allow meaningful statistical analysis. Further to this, two factors identified by Memon et al. (2010) as being underexplored in the Cognitive Interview literature were also tested, namely delay interval and participant occupation. A greater delay between encoding the mock crime event and having the opportunity to report it led to a lower amount of correct information being reported and a greater number of confabulations. The delay interval did not affect the number of incorrect pieces of information generated. No difference in recall performance was found between the police and non-police participant groups. Each of these findings will now be considered in more detail.

As predicted, the participants in the delayed recall condition provided significantly less correct information than the participants in the immediate recall condition. These findings are consistent with the previous literature in showing that the quality of eyewitness memory decreases over time (e.g., Goldsmith et al., 2005; Turtle & Yuille, 1994). No difference in the amount of incorrect information produced was found between the two delay conditions. More confabulations were found to be produced when recall was delayed than if recall took place immediately. The latter finding is consistent with Memon et al.'s (2010) meta-analysis which found that significantly more confabulations were produced under the Cognitive Interview when there was a delay between encoding and recall. However, the quantity of confabulations and incorrect details was very small in the current study. This may be because the participants were reminded not to guess or make things up and were also told that if they did not know a detail then that was acceptable. Thus, a report option was given when they received the MRC instructions and this has been found to contribute towards greater recall accuracy (Koriat & Goldsmith, 1996) and reduce incorrect information.

No effect of participant occupation on eyewitness performance was found in the current study. As noted in the Introduction, findings in this area have been equivocal but the present results are broadly consistent with Stanny and Johnson (2000) who reported no significant difference between police officers and members of the public in the amount of information correctly recalled. However, they are contrary to the findings of Christianson et al. (1998) and Lindholm et al. (1997) who found that police participants provided significantly more correct recall than non-police participants but did not produce an increased amount of incorrect detail.

This section will turn now to the relationship between MTT and eyewitness recall under MRC conditions. Video MCQ score was found to be a significant predictor of correct recall overall and in the immediate recall condition. This finding is consistent with Smith-Spark et al. (2017) in suggesting that eyewitness performance under MRC conditions is influenced by individual differences in MTT when tested after a minimal delay. Furthermore, since the video MCQ score was directly related to the recall of the crime event and was the strongest (and significant) predictor in the regression models, the results of the present study strengthen the case for a link between individual differences in MTT and the accuracy of eyewitness performance under the Cognitive Interview's MRC component. However, it should be noted that neither cue word MCQ scores nor video MCQ score was a significant predictor of correct recall in the delayed recall condition. After removing an outlying data point, there was a stronger relationship between video MCQ score and the amount of information correctly recalled than there was for the cue word MCQ scores (removing this data point from the overall analysis of 56 participants resulted in an adjusted- R^2 value of .21 and a Standardized β .of .528 for video MCQ score; full test statistics are available from the corresponding author on request). The reasons for the differing results over the two delay intervals will now be considered.

The mock crime video used in the current study was filmed from a first-person perspective and the participants viewing the video would, thus, have encoded the event from the point of view of being an eyewitness to it. Perhaps unsurprisingly, therefore, given that the crime event and any phenomenological aspects attached to it would be fresh in the participants' minds, a significantly higher video MCQ score was observed in the immediate condition than in the delayed recall condition. In contrast, the mean cue word MCQ score, representing general levels of MTT, was significantly higher than the video MCQ score overall but did not differ between the two delay conditions. This difference in MCQ scores may reflect the much greater phenomenological experience attached to the recall of lived events compared with the recall of a filmed event. Experience of the phenomenological dimensions of memories probed by the MCQ, therefore, may be limited when watching a video, possibly reducing the number or quality of memory cues available (such as smell, taste, and sense of embodiment). This may explain why the predictive relationship was not found over the longer delay interval.

Wright and Holliday (2007) suggest that live events provide a broader variety of available memory cues. While the use of a video filmed from a first-person perspective in the current study appears to have moderated this limitation for the immediate recall condition, the use of a first-person perspective video may still not be sufficient in the delayed recall condition to provide the cues necessary for MTT to occur to a meaningful extent. Although Smith (1988) suggested that MRC increased accessibility to memory especially after a delay, MRC may not be effective if the number and strength of cues are limited from the outset by the medium through which the eyewitness experienced the event in question. In support of this argument, participants actively involved in an event have been found to remember more than those not directly involved (Baker-Ward, Hess & Flanagan, 1990). Furthermore, live scenarios and experimental set-ups

requiring participant involvement have demonstrated greater effects of the Cognitive Interview (Köhnken et al., 1999), although this cannot be attributed to the MRC component alone. Further research on MTT and the MRC component of the Cognitive Interview should, therefore, utilize live events to elicit greater participant involvement. Alternatively, if video events are to be used in future research, a larger sample size is recommended to compensate for issues relating to statistical power.

The Crovitz-Schiffman word-cue recall task required each participant to recall a total of six events across three timeframes. It is possible that recalling six events may have become monotonous for the participants and, therefore, may have affected how much care they took to score each MCQ. Set against this objection, there was a significant difference in MCQ scores between the timeframes, with the event from one day ago having the highest MCQ score and the event from one month ago having the lowest MCQ score. This would suggest that the participants were engaging well with the task and putting careful, considered thought into their responses. Moreover, the pattern of MCQ scores fits comfortably with MTT theory. Roberts and Feeney (2009) have argued for a bi-cone distribution, with diminishing quality of MTT reported as the temporal distance from the present moment increases. In addition, the order of testing was counterbalanced to protect against potential order effects and, as reported in the Results, no difference between the two orders of presentation was found. No significant difference was found in any MCQ score between the police and non-police participants. Furthermore, there was no significant difference in mean cue word MCQ score between the two delay conditions.

In conclusion, this study explored different aspects of eyewitness recall under the MRC component of the Cognitive Interview. Participant occupation was not found to affect recall. A longer delay between witnessing the crime event and recalling it resulted in a lower amount of

correct information being reported and a greater number of confabulations being produced but did not lead to more incorrect information being generated. Further to this, it was found that a mock crime video shot from a first-person perspective led to a predictive relationship between MTT and the amount of correct information generated under immediate recall conditions using the MRC component of the Cognitive Interview. Although no significant predictive relationship was found between MTT and eyewitness performance in the delayed recall condition, this may be a result of the methodological limitations identified previously. That the success of the MRC component of the Cognitive Interview can be influenced by individual differences is likely to be of interest to law enforcement personnel and should inform their approach to interviewing eyewitnesses as some people will therefore respond more favourably to the component than others.

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Table 1. The participant characteristics of each experimental condition.

	Police immediate recall	Police delayed recall	Non-police immediate recall	Non-police delayed recall	Total
Number of participants	15	15	11	15	56
Mean age (<i>SD</i> ; range)	35.00 (7.75; 27)	36.73 (8.84; 29)	48.45 (13.15; 46)	36.13 (12.66; 37)	38.41 (11.53; 46)
Gender (female, male)	5F, 10M	6F, 9M	8F, 3M	12F, 3M	31F, 25M

Figure 1. The overall relationship between video MCQ score and the amount of information correctly recalled, collapsed across delay condition.

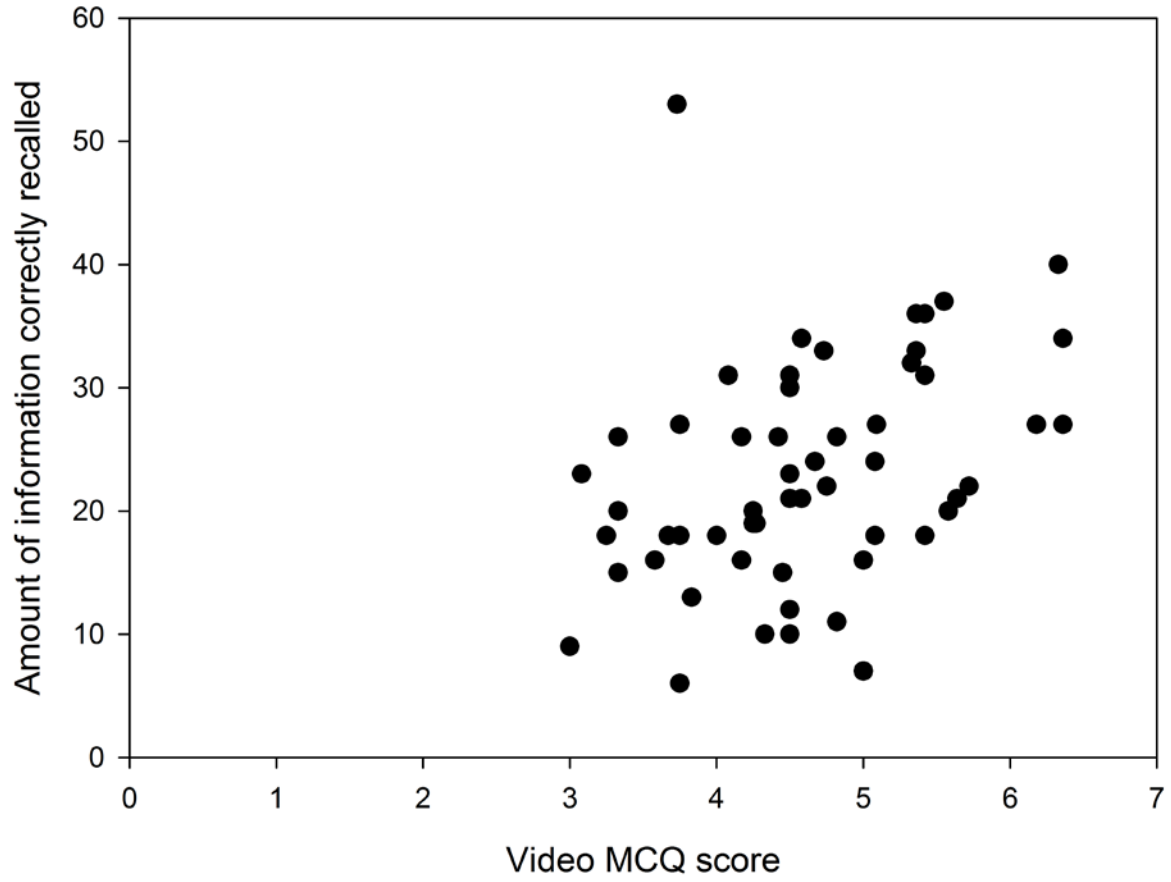


Figure 2. The association between video MCQ score and the amount of information correctly recalled under the immediate recall condition.

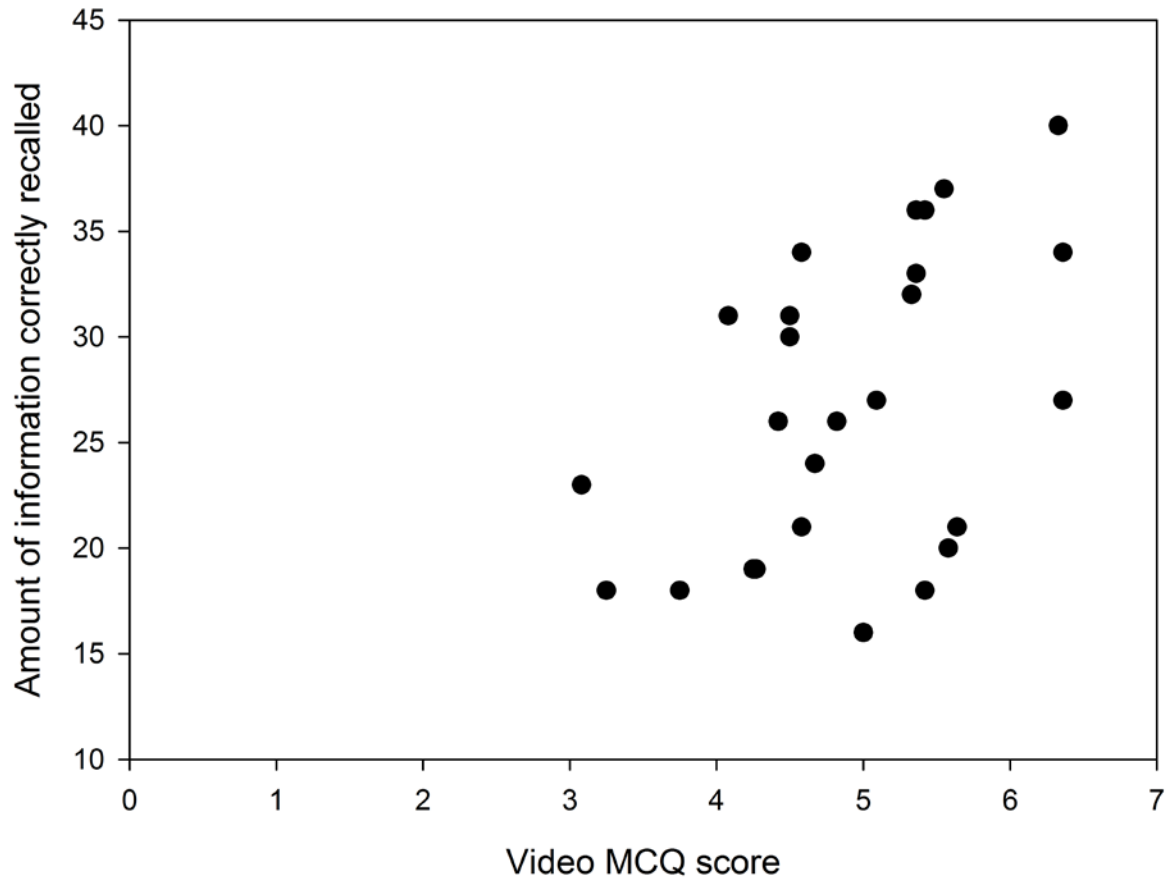


Figure 3. The relationship between video MCQ score and the amount of information correctly recalled under the delayed recall condition.

