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The Effects of Distributed Learning on Enhanced Cognitive Interview Training

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Interview training for police officers is generally limited and, when it occurs, rarely translates into optimal interviews. Training ineffectiveness may be partly due to the structure of the training programme. In the present study, 60 participants received two hours of training on the Enhanced Cognitive Interview (ECI), in either a massed (one two-hour session) or spaced (two one-hour sessions) format. Following training, participants conducted an ECI. Advantages for spaced training were found in open-ended prompt use, perpetrator-specific details elicited from open prompts, and the utilization of two critical ECI components. These results suggest that a simple alteration in training protocols could improve forensic interviewing skills.

Key words: forensic interviewing; distributed learning; interview training; skill acquisition.

Introduction

Eyewitness evidence is often a critical aspect of a criminal investigation, yet police interview training programmes generally occur over a short period of time, with an average training time of two days (Clarke & Milne, 2001; Snook, Eastwood, Stinson, Tedeschini, & House, 2010; Wells, Memon, & Penrod, 2006). A recent study examining 170 Canadian police officer interview training programmes found that fewer than half of the officers received formal interview training (Snook, House, MacDonald, & Eastwood, 2012). Even when training has occurred, it is uncommon for the information to effect a significant change in interviewing behaviour (Aldridge & Cameron, 1999; Lamb et al., 2000; Warren et al., 1999). For instance, Aldridge and Cameron (1999) compared investigative interviewers

(police officers and social workers) following an intensive one-week interview training programme with those who had not received the training. Despite an increase in knowledge, no behavioural differences were observed between the trained and untrained interviewers in appropriate and inappropriate question types, and adherence to interview protocol. The present study examines whether a simple alteration in the structure of the interview training format would improve interview performance following training.

The learning distribution, either massed or spaced, of interviewing training programmes may be one factor contributing to poor interviewing performance post-training. Cognitive and educational research indicates that information learned over longer periods of time, or temporally 'spaced', is better

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retained than information received over a shorter period of time, or in a 'massed' fashion (Carpenter, Cepeda, Rohrer, Kang, & Pashler, 2012; Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006; Gluckman, Vlach, & Sandhofer, 2014). Most formal education systems are premised on the notion that optimal learning occurs when information is spread over months, rather than condensed over days (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Pashler et al., 2007). One theory of why spaced learning is beneficial is that scheduling spaces in between instruction allows a learner to review the material, which increases the likelihood that the information will be better retained (Kornmeier & Sosic-Vasic, 2012). The mechanisms behind the advantage for spaced learning are grounded in cognitive and neuropsychological research. Consolidation theory posits that distributed learning allows breaks between instruction during which the memory traces are strengthened and learning consolidation occurs, which results in the improvement of skills without practice (Litman & Davachi, 2008; Robertson, Pascual-Leone, & Miall, 2004). Optimal consolidation of learned information may occur while sleeping, as a result of the slow-wave sleep (SWS) and rapid eye movement (REM) sleep support system aiding in synaptic consolidation (Diekelmann & Born, 2010; Stickgold & Walker, 2007). It is also suggested that spaced learning does not improve memory itself, but instead acts to decelerate forgetting by reinforcing memory consolidation (Litman & Davachi, 2008). Corresponding neuropsychological support for the consolidation theory indicates that, due to synaptic plasticity, there is a strengthening of the synapses that produces an increase in the communication between neurons (Kornmeier & Sosic-Vasic, 2012). It is this process that results in the benefits of spaced learning (Kornmeier & Sosic-Vasic, 2012).

Another possibility is that the benefits of spaced learning can be attributed to the recency and primacy effects associated with the serial position curve (Murdock, 1962). The serial position effect indicates that information presented first and last is more likely to be recalled than information in the middle (Murdock, 1962). Massed learning allows only one first and last exposure to the information. However, spaced learning has multiple opportunities of first and last exposure to the information and decreases the amount of poorly-recalled middle material. Although unclear exactly what neuropsychological and/or cognitive mechanisms are underlying the benefits of distributed learning, it is likely to be an automatic process independent from learner behaviour (Stickgold & Walker, 2007).

When police officers participate in an interview training programme it often occurs in a massed, rather than a spaced, format (Dando, Wilcock, & Milne, 2008; Warren et al., 1999). Interviews conducted by investigative interviewers of children before, during, and after two days of interview training revealed no difference in the pre- and post-interview behaviours (Rischke, Roberts, & Price, 2011). It was not until a second two-day interview training session − which took place two months later and comprised a review and classroom-based practice − that a significant improvement in performance was observed (Rischke et al., 2011). Price and Roberts (2011) found an increased use of open-ended prompts and more information elicited following eight months of training, which consisted of both classroom components and weekly feedback. A subsequent refresher session two months after the initial training resulted in continued improvements in interviewing behaviour (Price & Roberts, 2011). Though the same material was covered in each training session, these results suggest that the spaced format may facilitate interviewing skill acquisition. However, instead of conceptualizing massed and spaced training within a competitive framework, it is probably more realistic to consider the types of training as two available options that are both being used, with the underlying question as to which will better facilitate the transition of knowledge into skilled interviewing.

The benefits of spaced training to enhance learning and performance post-training have been demonstrated outside the domain of police interview training. Vlach and Sandhofer (2012) found that when simple and complex science concepts were learned over the span of four days, rather than in one day, children aged five to seven years were significantly more likely to acquire and generalize the knowledge of simple science concepts. Similarly, a study examining fifth-grade children in a classroom setting found that when vocabulary learning occurred one week apart, compared to during the same day, children recalled significantly more of the vocabulary definitions five weeks later (Sobel, Cepeda, & Kapler, 2011). The benefits of spaced learning have also been observed in samples of individuals with moderate and severe brain injury (Hillary et al., 2003). When to-be-learned words were not presented consecutively, but instead spaced apart using other words, participants recognized significantly more words (Hillary et al., 2003). A quasi-experimentally designed study found that when goal-focused coaching training occurred over a two-day period with three weeks in between or once per week for thirteen weeks that the coaching skills of the participants in both conditions significantly increased (Grant, 2007). However, participants in the thirteen-week condition were found to have significantly enhanced levels of emotional intelligence. These benefits of spaced learning have been observed in many different areas of learning (Carpenter et al., 2012).

Special strategies are required in order to enhance memory retrieval from witnesses (Fisher & Geiselman, 2010; Milne, 2004). Many relevant factors are outside police officers' control, including the contextual conditions of the crime and the psychological state and cognitive/verbal abilities of the interviewee (Fisher & Geiselman, 2010). However, the type of questions posed by interviewers is well within the control of the interviewer and is thus an important aspect of police training. A recent study examining question types used by investigative interviewers on child witnesses and alleged victims found that on average 40% were option-posing (e.g., 'Were you inside or outside when it happened?'), 30% directive (e.g., 'What colour was the shirt?'), and only 8% were open-ended invitations (e.g., 'Tell me what happened'; Luther, Snook, Barron, & Lamb, 2014). Improperly conducted interviews can further traumatize the interviewee and/or reduce the chances of acquiring crucial investigative information (Fisher & Geiselman, 2010). Furthermore, an improperly conducted interview can ultimately contribute to wrongful convictions (Snook et al., 2010).

The Enhanced Cognitive Interview

Founded on empirically-based forensic investigative interview guidelines, the Enhanced Cognitive Interview (ECI) is the gold standard of investigative interviewing with adult witnesses (Memon & Bull, 1991; Memon, Meissnier, & Fraser, 2010). The ECI is a structured interview that aims to enhance witness memory and elicit unbiased information from witnesses using memory retrieval tactics (i.e., outline interview, unlimited time, focused retrieval, report everything, context mental reinstatement, picture activation, vary temporal recall order, changes perspectives technique, memory jogs, thanking the interviewee) based on psychological research (Fisher & Geiselman, 2010; Memon et al., 2010). Because the amount of information provided is often associated with the psychological state of the interviewee, explaining the interview outline, emphasizing the lack of a time restriction, and thanking the interviewee near the completion of the interview all serve to make the interviewee feel more at ease. Other methods which are used to obtain maximum retrieval include directing the interviewee to focus on retrieving the information pertaining to the witnessed event, an open-ended prompt to report everything, to reinstate the mental context of the interviewee while the event was occurring, to

activate a more specific mental image of a specific episode during the event, to report the event in different temporal sequencing, to change perspectives when recalling the event, and using memory jogs (e.g., did the person remind you of anyone you know?).

The ECI began as the Cognitive Interview (CI) and was created in response to the need for an evidence-based investigative interviewing protocol (Fisher & Geiselman, 2010). Over the last 25 years the CI has been explored in over 100 studies and has been deemed a highly effective tool in obtaining information (Fisher & Geiselman, 2010). The CI has repeatedly been validated as extracting 25 to 40% more correct information than control interviews (Fisher & Geiselman, 2010; Memon et al., 2010). In 1992 the CI was enhanced by Fisher and Geiselman (1992; i.e., the ECI) to include more social components and add a consistent interview structure. These alterations in structure did not reduce the protocol's efficacy (Memon et al., 2010). In modified form, the ECI still elicits significantly more forensically-relevant details than other structured interviews (Colomb, Ginet, Wright, Demarchi, & Sadlet, 2013).

ECI Question Types

A common theme in evidence-based interviewing protocols is to focus on open, non-suggestive questions (Fisher & Geisleman, 2010). Consistent with this approach, the ECI specifically describes both desirable and undesirable questions in training, as outlined below (Milne, 2004).

Appropriate Question Types

Questions beginning with 'tell me', 'describe', or that are formatted in a way which elicit from the interviewee as unrestricted and impartial a response as possible are open-ended prompts (Milne, 2004; Wright & Powell, 2006). While the majority of questions asked during the ECI should be open-ended, this is often not the case in practice (Hughes-Scholes & Powell, 2008; Luther et al., 2014;

Wright & Powell, 2006). In one study, even after a week of training, a sample of investigative interviews were found to use only 23% open-ended compared to 77% specific questions during the post-training interviews. Furthermore, only 41% of the questions coded were non-leading (Aldridge & Cameron, 1999). A review of 90 investigative interviews performed by a Canadian police organization also found that, of all questions asked during the interviews, only 6% were open-ended (Snook & Keating, 2011).

Specific-closed questions inquire about a particular detail. These questions are designed to elicit a much shorter response, often one or two words or a short phrase, and generally start with 'what', 'where', 'how', or 'when' (Milne, 2004).

Inappropriate Question Types

A leading or misleading question is one that lacks impartiality. It can also include inquiries relating to information that has yet to be mentioned by the interviewee. A leading question steers the interviewee to the right response, as defined by the interviewer, while a misleading question leads to the wrong response. Multiple questions involve asking more than one question before the interviewee has had a chance to answer. Forced-choice questions offer only a limited number of response options and are most commonly found in the form of yes/no questions, but can also include a multiple-choice format (Milne, 2004).

ECI Structure

Nine Enhanced Cognitive Interview Phases

Nine phases comprise the ECI (for a summary refer to Table 1). As a highly structured interview, the ECI requires strict adherence to phase order and appropriate and inappropriate question types (Fisher, Geiselman, & Amador, 1989; Milne, 2004). Prematurely employing a phase, or the unintentional omission of one, could be damaging to an interview (Milne, 2004). It is important that

Table 1. The nine ECI phases.

Phase	Purpose/components
1: Establish Rapport	To make the interviewee as relaxed as possible
2: Explain Interview Objectives	Explain the interview purpose, interview outline, and transferring control to interviewee
	Instructions are comprised of focused retrieval, no time restriction, and report everything
3: Initiating the Free Report	Use an open-ended prompt to request the free report
	Context mental reinstatement, cue all senses, people, objects, layout, describe events free report initiation.
	Good interviewer behaviour, guggles/facilitators ('okay', 'mmhmm', 'yeah', etc.), and active listening strategies (echo probing, querying, and summarizing)
4: Questioning	Appropriate questioning types (open-ended and specific-closed), inappropriate (forced-choice, multiple, and leading/misleading)
5: Varied and Extensive Retrieval	Utilizing memory facilitation techniques such as vary temporal recall order, memory jogs, and change perspectives to obtain more information from the interviewee
6: Important Investigative Questions	Questions necessary for the investigation but not pertaining to the information provided in the free report
7: Summary	Summarize all the information obtained back to the interviewee
8: Closure	Leave the interviewee in a positive state of mind
9: Evaluation	Two types of evaluation that should occur, evaluation of obtained evidence and of interviewer

interviewers recognize how their behaviour affects the interviewees' ability to recall critical information. Participating in an interview, especially if the interviewee has been exposed to a traumatic experience, can be overwhelming and anxiety-provoking (Fisher & Geiselman, 2010; Fisher, Geiselman, & Raymond, 1987). If the interviewee is not comfortable then he or she is less likely to focus on maximum memory retrieval, which translates into less information obtained from the interviewee (Milne, 2004). Highlighting both appropriate and inappropriate question types, the ECI focuses on acquiring as much *accurate* information as possible (Fisher & Geiselman, 2010).

The Current Study

Hypotheses

There are a number of reasons for the non-transferral of skills following training (e.g.,

quality of trainers, structure of training, level of feedback, perceived relevance of material). The present study was designed to compare the effects of training using massed versus spaced learning conditions, which is just one of the factors that could influence interview skill transferral. Previous research has found that when interview training is spaced, rather than massed, correct procedures are more likely to be followed, and more open-ended questions, and fewer closed questions are asked (Rischke et al., 2011). The present study differs substantially from the Rischke et al. (2011) study, which investigated interviews with child witnesses, used the National Institute of Child Health and Human Development protocol (Lamb, Orbach, Hershkowitz, Esplin, & Horowitz, 2007), and implemented a within-subjects design with a different interview spacing and presentation format. Participants in the present study were trained in the proper way to conduct an ECI

in either a massed or spaced training session. Training sessions were structured to resemble as much as possible the actual police interview training format. Following the training session(s), participants were paired with a naïve interviewee (i.e., an undergraduate witness), who had previously watched a 10-minute video of a crime, and the pair participated in an audio-recorded ECI. It was hypothesized that participants in the spaced condition would use more appropriate (open-ended and specific-closed) and fewer inappropriate (multiple, leading/misleading, and forced-choice) prompt types, would utilize a larger number of ECI components, and would elicit more accurate and fewer inaccurate details than the massed condition. We also included a measure of motivation in interviewers. Because intrinsic motivation to learn has been strongly associated with skill acquisition, it was hypothesized that individuals high in intrinsic academic motivation would pose more appropriate and fewer inappropriate question types than individuals with lower intrinsic motivation (Quiñones, 1995; Ryan & Deci, 2000). It was also hypothesized that motivation would interact with the temporal distribution manipulation condition and that intrinsic motivation combined with spaced instruction would be associated with the most appropriate question types and fewest inappropriate question types.

Method

Participants

There were two samples of participants: training and interview participants. The 60 training participants who took part in the ECI training were undergraduate students enrolled in a third-year Forensic Psychology course (46 women, 14 men). Participating in the ECI training was a required component of the Forensic Psychology class. The 60 interview participants were introductory psychology students recruited from the psychology participant pool (46 women, 14 men) and did not take part in the ECI training. Interview participants received one course credit for their involvement in the study.

Materials

Academic Motivation Scale (Vallerand et al., 1992)

The Academic Motivation Scale (AMS-28) is a 28-item self-report measure designed to assess learning motivation (e.g., 'Why do you go to university?'). It has seven subscales measuring three forms of extrinsic motivation (identified, introjected, and external regulation), three forms of intrinsic motivation (to know, toward accomplishment, and to experience stimulation), and amotivation. Each item is rated on a seven-point Likert scale ranging from 1 (*Does not correspond at all*) to 7 (*Corresponds exactly*). The AMS-28 has been found to have a good level of internal consistency ($\alpha = .81$) and an acceptable test-retest reliability score ($r = .79$), while a factor analysis has endorsed the seven-factor structure (Vallerand et al., 1992).

Crime Video

Participants viewed a real surveillance video of a convenience store robbery (found on *YouTube*, titled 'Kirtland Giant Armed Robbery 8-3-2012') with a running time of 9 minutes and 22 seconds. The video presented two store clerks cleaning and several different customers entering and exiting the store. An armed robbery occurs, one of the store clerks is threatened with a gun, and forced to provide the money from the cash register. The perpetrator leaves, the police are called, and the remaining customers in the store communicate with the store clerks.

Although participants were not asked if they had previously viewed the video, the video was specifically selected as a target video in the present study for its low frequency of views (<1200 at the time of the study). Though they were not explicitly

asked, no participant spontaneously reported having previously viewing the video.

Procedure

Training Participants

Training participants attended highly scripted training sessions that were presented either in one two-hour ECI training block (massed condition) or two one-hour ECI training blocks distributed one week apart (spaced condition). Each training session was conducted by the principal researcher, and consisted of identical instruction and material emphasis. A sign-up sheet was circulated around the Forensic Psychology class for participants to choose which training session to attend. Students were led to believe that the training sessions were organized for their scheduling convenience and, thus, were unaware of the spacing manipulation. Both massed and spaced training sessions were scheduled in the mornings and afternoons, and were interspersed over a three-week period each semester. Participation in the study took approximately three hours, with two hours consisting of the ECI training and one hour allotted for conducting the ECI. All nine phases of the ECI were covered during the training session, with training participants paired to participate in mandatory 10-minute practice sessions following critical phases of the interview (i.e., phases 1 to 5). In the massed condition participants were taught all nine phases of the ECI over a two-hour period, whereas the participants in the spaced condition were taught the first three phases during the first week and the last six phases in second week. Spaced training participants were given a short (approximately 5-minute) refresher session at the beginning of the second week of training consisting of a brief overview of the material covered the previous week. To ensure similarity between the conditions, massed training participants also received the same refresher session at the same time during the interview training

session. Training participants were informed that the interview participants had viewed a video of a crime unfolding, and were instructed to conduct an ECI in the way in which they had been trained to do during the session(s). After training, participants were then randomly paired with the interview participants (approximately 15−30 minutes following the completion of training), provided with a digital audio-recorder, and instructed to find a quiet place to proceed with the interview. Debriefing and collection of the recorders and questionnaires followed.

Following the training session while the interview participants watched the crime video, training participants completed the Academic Motivation Scale (AMS-28; Vallerand et al., 1992). During the interview, training participants were permitted to refer to the handouts received during the training session, but it was suggested that constructing a quick-glance reference sheet would be a convenient option for ease of use during the interview.

Interview Participants

Interview participants watched a 10-minute surveillance video depicting an armed robbery at a convenience store. Interview participants were told that they would be interviewed regarding what they had viewed on the video. Immediately following the video, the interview participants were paired with a training participant and interviewed about what they could recall from the video.

Results

Coding

The interviews were transcribed and coded for the question types used by the training participants, utilization of critical ECI components, and accuracy. A total of 13 interviews (22% of the total sample) were coded by two trained researchers, one of whom was the principal researcher, with an inter-coder reliability of .88. Considering the acceptable

inter-coder reliability score, the remaining 47 interviews were coded solely by the principal researcher. Coders were blind to the participant condition.

Question Types

Utterances were coded as either appropriate (open-ended and specific-closed) or inappropriate (multiple, leading/misleading, and forced-choice). Utterances beginning with 'tell me', 'describe', or formatted in a way that produced as unrestricted and impartial interviewee response as possible were coded as open-ended prompts, whereas questions inquiring about a particular detail, often starting with 'what', 'where', 'how', or 'when', were coded as specific-closed questions. If a question began with 'tell me' or 'describe' but was inquiring about a specific detail, it was coded as a specific-closed question. Although in the ECI procedure it is preferred that specific-closed questions follow an open-ended prompt, in the present study training participants were not penalized for not following this particular questioning sequence.

Questions which lacked impartiality, including inquiries pertaining to information not yet mentioned by the interviewee or questioning that steered the interviewee to the 'right' or 'wrong' response were coded as leading/misleading questions. Questions were coded as multiple when more than one question was asked before the interviewee had a chance to respond. Questions offering a restricted number of response options (e.g., yes/no questions) were coded as forced-choice questions.

Critical ECI Components

Ten critical ECI components (outline interview, unlimited time, focused retrieval, report everything, context mental reinstatement, picture activation, vary temporal recall order, changes perspectives technique, memory jogs, thanking the interviewee) were coded as either present or absent.

Accuracy

Critical details from the crime video and incorrect details provided were coded and used to determine interviewee accuracy. Overall, there were 33 critical details consisting of 16 perpetrator-specific and 17 other details. The critical details included information pertaining to the setting of the crime and the behaviour, appearance, clothing of the store clerks, perpetrator, and witnesses (e.g., 'the setting is a convenience store', 'the customer has pink hair', 'the perpetrator has nylon over his face'). Incorrect information was determined by calculating the number of incorrect details provided by the interviewee during the interview.

Question Types

Separate univariate analyses of variance (ANOVAs) were conducted for each appropriate (open-ended and specific-closed) and inappropriate (multiple, leading/misleading, and forced-choice) question type to assess whether the use of each question type varied by learning condition (see Table 2). Open-ended prompts differed significantly, with participants in the spaced condition ($M = 3.53$) using more open-ended prompts than those in the massed condition ($M = 2.27$), $F(1, 58) = 4.07$, $p = .05$. There were no significant differences between the massed and spaced conditions in the use of specific-closed questions, $F(1, 58) = 0.02$, $p = .88$.

Table 2. Mean number of question types used in the massed and spaced conditions.

Question type	Massed		Spaced		Inter-rater
	M	*SD*	*M*	*SD*	
Open-ended	2.27	1.64	3.53	3.03	0.83
Specific-closed	3.53	2.81	3.67	3.87	0.82
Multiple	0.93	1.34	0.47	0.63	0.87
Leading/misleading	0.63	1.35	0.17	0.46	1.00
Forced-choice	6.00	9.10	4.37	3.59	0.80

Table 3. Mean proportion of question types in the massed and spaced conditions.

Question type	Massed		Spaced	
	M	*SD*	*M*	*SD*
Open-ended	.20	.18	.25	.17
Specific-closed	.22	.14	.23	.18
Multiple	.06	.08	.03	.05
Leading/misleading	.45	.20	.47	.19
Forced-choice	.03	.06	.02	.03

There were also no significant differences between the two conditions in any of the inappropriate question types: multiple questions, $F(1, 58) = 2.99$, $p = .09$; leading/misleading, $F(1, 58) = 3.20$, $p = .08$; forced-choice, $F(1, 58) = 0.31$, $p = .58$.

To control for the overall number of questions asked by the interviewers, the proportions of each question type per interview were also calculated and analysed using separate ANOVAs (see Table 3). There were no significant differences between the massed and spaced conditions for either of the appropriate question types: open-ended prompts, $F(1, 58) = 1.523$, $p = .22$; specific-closed, $F(1, 58) = 0.06$, $p = .81$. Nor were there any significant differences found for any of the inappropriate question types between the conditions: multiple questions, $F(1, 58) =$

1.93, $p = .17$; leading/misleading, $F(1, 58) = 2.71$, $p = .11$; forced-choice, $F(1, 58) = 0.27$, $p = .58$.

Interview Components

Separate Chi-squared tests were conducted to determine if there were differences between the massed and spaced conditions in the presence of the critical components of the ECI (see Table 4). Two of ten critical components were found to differ significantly. Participants in the spaced condition were more likely to request that the interviewee attempt focused retrieval, $\chi^2 (1, n = 60) = 5.71$, $p = .03$, and used the vary temporal recall order retrieval strategy more often than those in the massed condition, $\chi^2 (1, n = 60) = 5.46$, $p = .04$. A univariate ANOVA was performed to assess whether there was a difference in the total number of interview components used within the massed and spaced conditions. The result was not significant, $F(1, 58) = 1.61$, $p = .21$.

Two separate univariate ANOVAs were conducted to determine if there were differences in the use of active listening strategies (echo probing, querying, and summarizing) or guggles/facilitators ('okay', 'mmhmm', 'yeah', etc.) between the massed and spaced conditions. There were no significant differences between the massed and spaced conditions in the use of: active listening strategies,

Table 4. Critical interview components.

Interview components	Massed Present	Spaced Present	χ^2	Cramer's V	Inter-rater
Outline interview	13 (43%)	17 (57%)	1.07	.13	1.00
Focused retrieval	7 (23%)	16 (53%)	5.71	.31	1.00
Unlimited time	26 (87%)	24 (80%)	0.48	.09	1.00
Report everything	28 (93%)	27 (90%)	0.22	.06	1.00
Context reinstatement	10 (33%)	13 (43%)	0.64	.10	1.00
Picture activation	6 (20%)	3 (10%)	1.18	.14	1.00
Vary recall order	21 (70%)	28 (93%)	5.46	.30	1.00
Change perspectives	11 (37%)	9 (30%)	0.30	.07	1.00
Memory jogs	7 (23%)	7 (23%)	0.00	.00	1.00
Thank interviewee	20 (67%)	23 (77%)	0.74	.11	1.00

$F(1, 58) = 0.43$, $p = .52$; guggles/facilitators, $F(1, 58) = 0.08$, $p = .78$.

Accuracy

Analysing the number of critical details obtained by the interviewer is a means for determining how successful the interview has been. Acquiring critical details is, after all, the primary purpose of almost any interview. Two separate univariate ANOVAs were conducted to assess differences between the massed and spaced conditions in the number of critical details (total and perpetrator-specific) elicited from interview participants (see Table 5). Neither the total number of critical details, $F(1, 58) = 1.12$, $p = .30$, nor the perpetrator-specific details, $F(1, 58) = 0.01$, $p = .92$, varied between conditions. However, the difference between the numbers of perpetrator-specific details obtained through open-ended prompts differed significantly between the massed ($M = 1.10$) and spaced ($M = 2.23$) conditions, $F(1, 58) = 3.88$, $p = .05$. Details acquired through open-ended prompts are more reliable as they are unlikely to be influenced by interviewer bias.

Another method of determining the success of an interview is by analysing the number of incorrect details provided by the interviewee. Obtaining incorrect information can be detrimental to an investigation and can waste scarce resources. Two separate univariate ANOVAs were conducted to assess

Table 5. Mean number of critical details (total and perpetrator-specific) elicited by question type by condition.

Question type	Massed		Spaced	
	Total	Perp.	Total	Perp.
Open-ended	1.90	1.10	3.23	2.23
Specific-closed	1.43	0.90	1.00	0.53
Multiple	0.13	0.13	0.07	0.00
Leading/misleading	0.07	0.07	0.00	0.00
Forced-choice	0.10	0.03	0.17	0.13

differences between the massed and spaced conditions on the number of inaccurate details (total and perpetrator-specific) elicited from the interviewees. Neither the total number of critical details, $F(1, 58) = 0.03$, $p = .86$, nor perpetrator-specific details, $F(1, 58) = 0.38$, $p = .54$, varied between conditions.

Motivation

Motivation to learn has been strongly associated with skill acquisition (Quiñones, 1995; Ryan & Deci, 2000). It was hypothesized that individuals high in intrinsic academic motivation would use more appropriate and fewer inappropriate question types than those with lower intrinsic motivation. Separate Pearson product-moment correlations were conducted to assess whether high scores on intrinsic motivation were associated with a higher number of appropriate questions asked. This hypothesis was not supported; open-ended prompts, $r(56) = .18$, $p = .17$, and specific-closed questions, $r(56) = .04$, $p = .76$, were not associated with higher intrinsic motivation scores. Similar non-significant results were found for the hypothesis that high levels of intrinsic motivation would be inversely correlated to inappropriate question types: multiple, $r(56) = -.11$, $p = .41$, leading/misleading, $r(56) = -.20$, $p = .88$, and forced-choice, $r(56) = -.03$, $p = .83$. There is nothing which suggests that high intrinsic motivation scores were related to the use of fewer inappropriate question types in this sample.

To determine whether motivation interacted with the massed vs spaced learning condition, partial correlations of condition, controlling for intrinsic motivation score, with appropriate questions and inappropriate questions were examined. These analyses indicated no significant correlations with condition.

Discussion

Forensic interview training for police officers is often limited, averaging around two days,

which can impact the acquisition of witness evidence (Clarke & Milne, 2001; Snook et al., 2010; Wells et al., 2006). However, even when training has occurred it does not always translate into properly conducted interviews (Aldridge & Cameron, 1999; Warren et al., 1999). Based on the theory of distributed learning, skill acquisition is more likely to occur when the information is learned in a spaced, rather than a massed, format (Cepeda et al., 2006). Although literature exists on factors that improve police interviewing (e.g., Snook et al., 2010) and on the benefits of spaced learning (e.g., Cepeda et al., 2006), there is a dearth of research on the impact of spaced learning on interviewing practices. As previously mentioned, Rischke et al. (2011) observed improvements in interviewing performance following a refresher session in which the same material was presented again. The present study was unique in that the interview material was learned over a one-week span, with a 5-minute refresher session in between, and different material presented in each session. If the structures of police interview training programmes are not empirically evaluated, it is likely that the field will continue to observe poor transfer of training to performance. Unlike much of the research on improving investigative interviewing practices, the present study investigated the effect of a simple change in training format, either massed or spaced instruction. If such a simple alteration can influence interview effectiveness, this could have important resource implications for increasing the success of training programmes.

Participants in the spaced condition used a significantly greater number of open-ended prompts, and elicited more correct perpetrator details from such questions. Because participants in both conditions received the same ECI training, this is as a direct result of the experimental manipulation of learning spacing. Many ECI components (i.e., vary temporal recall order, picture probing, and memory jogs) require the interviewer to use open-ended prompts and thus those question types

were referenced numerous times during the training session for both conditions. Though the proportion of open-ended prompts did not differ between experimental conditions, this finding remains important because this larger number of open-ended questions resulted in a greater number of perpetrator-specific details reported in the spaced condition. In relation to a criminal investigation the perpetrator-specific details are arguably the most relevant to the task of identifying the culprit and thus furthering the investigation. Although the present study did not find any significant differences between the massed and spaced conditions in the use of specific-closed questions or inappropriate question types, the significant difference between open-ended prompt usage between the massed and spaced conditions is a promising finding. Open-ended prompts are well regarded for their ability to acquire information that is as free from interviewer influence as possible, and infrequent use of such prompts is often cited as a cause of improperly conducted interviews (Aldridge & Cameron, 1999; Milne, 2004). If such a minimal manipulation used in the present study has increased the number of open-ended prompts, this has the potential to significantly improve the effectiveness of interview training.

Additional differences were observed between conditions in the use of varying temporal recall order and focused retrieval techniques, which are key ECI components. Considering the substantial amount of research which suggests that information acquired over a longer time period results in an improvement in skill acquisition, it could be that two hours of interview training was not enough time to produce a noticeable behaviour change in all elements of the ECI, so it remains to be seen whether longer training periods would show additional differences. There is also the possibility that a longer duration of time between training and interviewing would have produced a larger difference between conditions. Research suggests that when information is retrieved after a

delay, rather than immediately, performance is enhanced (Cepeda, Vul, Rohrer, Wixted, & Pashler, 2008; Loaiza & McCabe, 2012). One study that investigated the optimal gap found that there was no ideal amount of time between review and testing of material (Cepeda et al., 2008). However, if testing occurs too soon after material is learned, the results will likely yield misleadingly high levels of immediate mastery (Cepeda et al., 2008). Still, with only two hours of training there were significant and promising findings related to properly conducting the ECI. Considering the time limitations on police interview training, these findings are particularly important because with only two hours of training there were several significant areas of improvement, each of which may considerably improve interviewing effectiveness.

It was hypothesized that individuals high in intrinsic academic motivation would use more appropriate and fewer inappropriate question types. This hypothesis was not supported. but there was little variation in the motivation scores, which limited the ability to observe correlations. It is possible that the lack of differences related to motivation is simply an indication that spaced training would improve performance for all trainees, irrespective of their motivations to obtain training.

There are differences in the benefits gained by spacing learning and the subsequent effects on skill acquisition and post-training behaviour (Carpenter et al., 2012). Carpenter et al. (2012) note that there is not a 'one-size-fits-all' approach to the improvements gained from spaced learning, and that optimal time between sessions is based on what type of information is required for memory retrieval. It is important from a research and applied point of view to examine the optimal amount of time and of spacing to determine how police interviewing can be enhanced by using spaced learning, as currently there is no empirical research investigating the impact of spacing interview training in the same format as the formal

education system does by spacing new material over time. These differences in the temporal spacing of learning and its effects on the subsequent benefits, coupled with the scarcity of research regarding the benefits of spaced learning on police interview training, makes this research a stepping stone to furthering the field of police interview training.

With growing restrictions on training budgets, there may be an interest in having select team members attend extensive training with the aim of having these trained members then disseminate their knowledge to their colleagues. In such a format, knowledge of how to best temporally distribute 'in-house' training sessions in the most practical and economical way is essential. In the context of the present research, it appears that spacing even very brief training or refresher sessions would be most advantageous. This strategy could be used for any discipline seeking to best make use of limited training budgets.

Limitations

To assess skill acquisition properly it would have been desirable to have a longer time interval between the training and the retention test (Donovan & Radosevich, 1999). In this study, the training participants had 15−30 minutes to refresh themselves on the earlier material. Having the training participants return after a longer interval would have been a more ecologically valid gauge of skill. Further, the short delay meant that the interview participants' memory for the event was quite strong and that much of the video was remembered for both conditions, which could be an underlying cause of the relatively small effect sizes.

A further issue relates to the training of university students, which may not be generalizable to a population of police officers. For police officers, interview training is a skill necessary for a career in law enforcement, whereas for the university participants it was a required assignment. Interest, involvement, and motivation may not be the same between

the two groups. However, the lack of effect of motivation suggests that these factors may not influence relative performance between the two learning conditions. These factors would have little impact on skill acquisition if the neuropsychological and/or cognitive mechanisms underlying the benefits of spaced learning are automatic. It is also crucial to explore if a more representative sample of police officers would show similar benefits with the spaced training format. The findings would not only contribute to the distributed learning literature, but would also suggest whether police interviewing research should focus on police officers as participants or if university students are an approximately equivalent population.

Conclusion

Inferior interviewing practices have been implicated in causing failures within the justice system (FPT Heads of Prosecutions Committee Working Group, 2011). It is hypothesized that thousands of innocent individuals have been charged with and convicted of crimes they did not commit because of the improper interviewing of witnesses (Snook et al., 2010). With only a simple alteration in training format it was possible to observe significant improvements in interviewing practices. If distributed learning principles are utilized then interviewing practices could benefit, which could result in a substantial improvement in skill acquisition and a subsequent reduction in injustice.

Disclosure statement

No potential conflict of interest was reported by the authors.

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