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To know where the bodies are buried: The use of the cognitive interview in an environmental scale spatial memory retrieval task.

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Abstract

Missing body homicide cases have gained public interest globally due to some high-profile cases. In many of these cases, the task of locating the victim's remains relies on the information investigators can gain through the interviewing of willing suspects. To date investigative interviewing research has largely focussed on the retrieval of episodic memory (events) without focussing on spatial memory; a prominent cognitive task required in locating a victim's remains. The current experiment tests the enhanced cognitive interview (ECI) against a free recall strategy in a mock homicide scenario where participants are required to hide and retrieve an object in a natural bushland setting. The results showed that those in the ECI condition produced more coarse- and fine-grained details of landmarks and their actions at, and journeying to the deposition site. This demonstrates the value of using the ECI in generating more valuable information to assist in successive search attempts.

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Introduction

Matthew Levenson died in 2007. His suspected killer, Michael Atkins, was acquitted of murder but later admitted to disposing of his body in a tract of bushland after being compelled to give evidence in a Coroner's inquiry into the death. Nine years had passed from the time of Matthew's death to the admission from Atkins. Police investigators took Atkins to the proposed deposition site on three separate occasions to identify possible locations (State Coroner's Court of New South Wales, 2017) and excavated and sieved 7500 square meters of bushland. It was not until the last hour, of the last day, of the final search attempt, that Matthew's body was found approximately 30m from one of the potential deposition sites identified by Atkins (State Coroner's Court of New South Wales, 2017).

In some cases, the victim's body is hidden from investigators and the perpetrator is willing to co-operate by providing information about the location of the body. However, the perpetrator may be unable to accurately recollect the location of the victim's body because of problems with memory. In these cases, it is often only the suspect that holds the information that will lead to the successful retrieval of the victim's remains and the investigative interview strategy chosen by the investigator becomes particularly important (Ryan, Westera, Kebbell, Milne & Harrison, 2016).

The Levenson case demonstrates the importance of obtaining accurate accounts about where bodies are disposed. This is reflected in legislation such as the 'No body, no parole' Law, that at the time of writing is currently before parliament in the United Kingdom ("Helen's Law") and propose that perpetrators who have hidden a victim's remains will not be eligible for parole unless they successfully disclose the location of the deposition site (Unlawful killing (recovery of remains) Act (2017). This is similar to legislation in other countries, for instance in Australia the Queensland Government in Services (No Body, No Parole) Amendment Act (2017), that prevents a killer from being released without a body being recovered.

Whilst trying to get offenders to find the bodies of their victims is rare, there are many other situations in which police need to find the locations that only a suspect or witness might know. For instance, the police may want to find out where an offender has hidden drugs or a weapon. In one case, the police returned a convicted arsonist to a tract of bushland to identify the location at which a lethal bushfire was started. Finding this location helped to identify the extent to which the arsonist was responsible for the deaths of people killed in the fire (McDermott & Hassall, 2018). Further, in many cases crime victims, such as rape victims, are asked to provide information about where an offence occurred so that forensic evidence can be collected, and accounts corroborated. Therefore, in many instances, it is important for the police to be able to help people remember locations.

Eyewitness memory and interviewing, broadly defined, has had a great deal of attention (Loftus & Palmer, 1974; Loftus, Loftus & Messo, 1987; Fisher, Milne & Bull, 2011). Commonly, research conducted into the area of investigative interviewing focuses on the retrieval of episodic memory (the memory for events) or descriptions of actors in the environment, such as the appearance of a suspect, or descriptions of objects in an environment (such as colour and size etc.) (Köhnken, Milne, Memon & Bull, 1999; Memon, Meissner & Fraser, 2010). Typically, the research paradigm for investigative interviewing is to show a participant a video of a crime or a staged event and then conduct variations of interview techniques and use measures such as correct responses, incorrect responses and confabulations to assess relative effectiveness (see for example, Paulo, Albuquerque, Saraiva, & Bull, 2015; Prescott, Milne & Clarke, 2011). This is relevant to many witnessing scenarios and police interviews, however, the memory for the location of objects (such as a body) may be different in some salient ways.

First, there are somatosensory aspects of placing and locating objects – the individual is moving around to achieve this task (Jones & Martin, 2009; Ruddle, Volkova, Mohler, & Bülthoff, 2011; Tversky, 2003). Second, the individual is not a passive witness to an event, they are an active decision-maker – deciding where to go and what to do. This more active involvement may encourage deeper processing thus a stronger memory trace (Jacoby, & Craik, 1979; Fu, Maes, Varma Kessels & Daselaar, 2017). For example, it has been shown that when retrieving spatial memories participants are more likely to recognise those landmarks that were located at ‘decision points’ (points where the participant made a choice about which direction to go) (Janzen, 2006). Although it is not known whether similar processes exist in episodic memory, it is an important aspect to consider when delineating between passive witnesses and active agents in a spatial memory task.

Locating a missing body engages the use of spatial memory. This is a distinct form of memory related to relationships between objects in space (Hegarty, Richardson, Montello, Lovelace & Subbiah, 2002; Tversky, 2003). Objects and relationships between them within space are often separated into landmarks, (notable features in the environment) and routes, (the pathways between landmarks) (Thorndyke, 1981; Thorndyke & Hayes-Roth, 1982). Individuals use this spatial information to find their way back to locations. The retrieval of spatial memory engages somatosensory systems that engage with the environment in a specific way when encoding spatial information (Jones & Martin, 2009; Ruddle et al., 2011; Tversky, 2003). When retrieving spatial memories, the engagement of these somatosensory networks improves the ability of participants to retrieve the spatial memory; that is by reinstating the physical interaction with the environment the retrieval of these relationships becomes more accurate (Jones & Martin, 2009; Ruddle et al., 2011; Tversky, 2003).

Logically when the task of locating a missing body is required, a return to the environment that engaged with the somatosensory system of the subject should activate this memory trace. Returning the subject to the deposition site should then act as another variation of memory retrieval that should assist in the specific task of finding the deposition site.

Nevertheless, spatial memory is prone to its own set of errors. Features of the environment can affect individuals' memory of spatial features, such as the Feature Accumulation effect, which is that the complexity of a route, can change participants' estimations of distance where the more features in a route, the greater the estimated length of the route (Jansen-Osman & Berendt, 2005). This is just one example of many errors or heuristics that can affect the retrieval of spatial memory. Although there is a substantial body of research into these errors, no research has examined investigative interviewing techniques specifically on the retrieval of spatial memory. Thus, little is known about how people who are trying to find objects can be interviewed most effectively.

A commonly used interview technique, with willing interviewees, that has been well documented concerning episodic, non-spatial memory, is the Cognitive Interview (CI). The underlying principles of the CI is that memory can be encoded in many ways and therefore varied retrieval attempts may unlock different memory traces, it follows that the more attempts at the retrieval of a memory, the more likely it is that the memory will be retrieved, and that memory retrieval is a cognitively demanding task therefore the interviewee must be free from distraction (Fisher & Geiselman, 1992). These principles formed the basis of the mnemonics in the CI and were expanded with the development of the ECI including the psychology of communication and more cognitive techniques. The ECI consists of: (1) Establish Rapport, building the initial relationship with the interviewee; (2) Focused retrieval, encouraging the participant to concentrate hard when attempting to recall information; (3) Report everything, instructing the interviewee to give fine detail no matter the perceived relevance; (4) Transfer of control, handing the control of the flow of recall over to the interviewee; (5) Mental reinstatement of context, encouraging the interviewee to focus mentally on the details of the scene such as smells, feelings, sounds, etc; (6) Interviewee compatible questioning; (7) Varied retrieval, which includes - Reverse order, instructing the participant to recall events in a different order and Change perspective, instructing the participant to picture the events from another person's perspective; and, (8) a summary, closure and evaluation phase (Fisher & Geiselman, 1992; Milne, 2017). Research has shown that the CI is successful at increasing the quantity and quality of information from interviewees with 41% more correct detail recalled when compared to a control interview (Khönken et al., 1999; Memon et al., 2010). A possible increase in correct details in the context of spatial information such as landmarks, should assist individuals in navigating back to a previous location. If this is the case, this increased accuracy would be valuable to investigators when interviewing perpetrators in missing body homicide cases. While this is encouraging for the possibility of use in a large-scale environment, such as a journey to a deposition site, to date no research has tested the use of the CI in this manner.

These mnemonics came with recommendations that the interview must take place in an environment free from distraction as taking an interviewee back to the site of the event may contaminate their memory (Fisher & Geiselman, 1992). This was justified by the environment not being the same as the time the event took place. Sound, smells, light and other aspects would change and therefore contaminate the witness's account (Fisher & Geiselman, 1992). Of course, the event cannot be recreated but only reconstructed by the witness. So, in the case of retrieving the memory of an event this would be crucial. However, in the case of missing body homicides and specifically the goal of locating the deposition site this may not be as important as the site as it was at the time of deposition, may still exist. The landmarks and routes taken by the subject may still be intact. Therefore, taking a subject to the deposition site, after an off-site interview has been conducted to retrieve an uncontaminated memory of the event, could be an effective way of assisting them to locate the victim's remains.

While previous research has touched upon spatial memory, indirectly, as part of the CI, i.e. asking participants to remember the general positions of objects and people within a room, this may not be congruent with the task of locating an object in a large scale space, such as the task of locating a deposition site in a naturalistic setting, such as a tract of bushland or forest. Hegarty et al. (2002) proposed a distinction between three scales of space that are interpreted and used through different cognitive processes. These are figural or small scale space (typically objects that are pictorial in nature or small objects relative to the subject and able to be manipulated), Vista space (a scene that can be observed in a singular view but is equal to or larger than the person viewing it) and Environmental space (a large scale space which contains the subject and requires movement within it to capture all aspects) (Hegarty, et al., 2002). Essentially when navigating through Environmental space, subjects would see landmarks and other spatial detail appear in front of them and disappear behind them as they navigate through the environment. This distinction instigated the development of the Santa Barbara Sense of Direction Scale (SBSODS) which is used to determine an individual's level of ability to navigate through environmental scale space (Hegarty, et al., 2002). The task of locating a missing body would typically take place in this scale of space. This would require the suspect to move through an environment, such as a forest. It could be argued that at best the current body of research examining the CI tests some aspects of participant's retrieval of Vista space, as viewing an event on a screen or staged in a lecture theatre can be perceived from one particular vantage point. The variation in ability of individuals to navigate through the environment is an important factor to capture in any study that investigates the retrieval of environmental scale memory. Using the SBSODS to measure these differences may account for variation in the accuracy of participants and avoid confounds. Essentially the retrieval of Environmental spatial memory using the ECI mnemonics has yet to be tested.

In a study conducted by Ryan et al. (2016) investigators discussed the importance of gaining environmental detail in missing body homicide cases. Essentially, it was suggested that finding specific detail about the environment could be used to assist search teams in their efforts to locate the victim's remains. The goal of this information being too narrow down the search area. Detailed information about the journey undertaken by the perpetrator or how the perpetrator buried or hid the body may give important information about soil types, the types and amounts of foliage in the area, and key landmarks to guide search attempts (Harrison & Donnelly, 2008; Ryan et al. 2016). In the case of an on-site interview, this would become particularly relevant if the perpetrator was unable to locate the deposition site directly and further search attempts were required.

The current study

The current paper is the first study, to our knowledge, investigating how interviewing might be improved to help aid the finding of objects that a person has hidden. Participants were required to hide an object whilst being filmed and tracked via GPS in a tract of natural bushland and retrieve it after a 30-day period. It is hypothesised that consistent with the CI research into the retrieval of episodic memory that the stages of the ECI that are applied by practitioners will generate more environmental space detail. Further, due to the success of the CI in increasing the quantity and quality of information from interviewees with 41% more correct detail recalled when compared to a control interview (Khönken et al., 1999; Memon et al., 2010), increasing the ability of participants correctly identifying landmarks, which are used for navigation, will lead to an improved ability to find the deposition site, resulting in a greater level of accuracy compared to participants in a FR condition.

Furthermore, it is hypothesised that this technique will increase the spatial accuracy of participants when it comes to identifying the location of a hidden object as the increased environmental space detail will assist participants in navigating back to the deposition site

Method

Participants

A sample of 40 (Male =18, Female= 22) undergraduate students from Griffith University were recruited from the School of Psychology subject pool, with a mean age of 27.6 years (*SD*=11.25). Participants received a partial course credit for participating in the study. A chance at winning a Samsung tablet (value of $150 AUD) was also used as an incentive to encourage participants to return for the second phase of this study.

Design

A between subjects experimental design was employed. The independent variable was interview type with two levels: (1) abbreviated cognitive interview (n = 20), and (2) free recall (n = 20). The dependant variable was the accuracy of participants' ability to locate an object measured by distance between the actual deposition site and the indicated deposition site in meters. Further, the effect of interview type was examined on the fine and coarse grain detail of the spatial information provided; Landmarks and route/road, and behaviours and decisions making; Actions, Elimination tactic, Environmental changes, Decision making (self), Decision making (others) and Decision making (speculative) (dependant variables). Participants were randomly assigned to one of the two interview conditions CI or FR.

Interview Conditions

An abbreviated version of the Enhanced Cognitive interview was compared to a Free recall condition due to the absence of any consistent interview strategy among investigators when taking a perpetrator to a deposition site in missing body homicide cases as identified in Ryan et al. (2019). Therefore, it was deemed that a free recall condition was most consistent with what was described by these investigators. Both interview conditions consisted of a rapport building phase where the interviewers engaged the participants in general conversation prior to commencing the information gathering aspects and a clear description of the purpose of the interview, to locate the hidden object. Due to comparing the CI with a free recall condition, only the initial stages of the CI were used to avoid excessive repeated retrieval attempts confounding the results.

The Abbreviated Cognitive Interview

The abbreviated CI consisted of mental reinstatement, focused retrieval and report everything phases. The mental reinstatement phase consisted of instructions such as ‘I want you to think about the route you took’, ‘Think about the features in the landscape that you noticed along the way’, Think about how it felt to walk along that path’, ‘Think about the choices you made when hiding the object’ and ‘Think about why you made those choices’. Focused retrieval was achieved by stating ‘I want you to take a moment to think back to when you were here to hide the object. I want you to concentrate hard when thinking about this’ and finally for the report everything phase participants were told ‘As you lead me towards that location I want you to tell me what you are thinking as you go in as much detail as you can. Tell me everything even if you think it is trivial unimportant. For example, ‘from the start point I walked a short way down this path and remember seeing a sign, this sign was about at eye level, was brown and had some writing on it’.

A further aspect to this interview was added in the form of a prompt to be used during the journey to the deposition site if the participant became disoriented. This prompt instructed participants to take their time and focus on the last landmark they were certain they remembered. This was used as a way of activating the participant’s spatial memory around landmarks with a view to improving accuracy of retrieval.

Free Recall

The free recall condition consisted of several instructions and a general prompt. Participants were instructed ‘ I want you to try really hard to remember where you hid the object and in a moment lead me to that location.’, ‘as you lead me towards that location I want you to tell me what you are thinking as you go’ and ‘you can say anything you like but the more detail you can provide about what you are thinking the better.’ In addition to these instructions, participants were also prompted during the journey if they became disoriented which consisted of the being told to ‘take their time’.

Materials

A Trimble R1 GNSS receiver linked to an Apple 5c mobile phone was used in conjunction with Trimble Terraflex GIS workflow software to collect and store the GPS data. A real time differential adjustment was used to improve accuracy of the receiver to allow for sub meter accuracy via the Trimble RTX correction service. Both phases of the study were video recorded via a Hero 4 Go Pro camera and both camera and GNSS receiver were attached to a hard hat that was worn by participants in the first phase. A 50x80cm white polypropylene sack, half filled with empty plastic bottles was used as the object to be hidden.

Standardised interview scripts were used for each interview condition containing information for interviewers on what to tell the participants (See appendix A & B). Participants were also given the Santa Barbara Sense of Direction Scale (SBSODS) which is a paper survey used to measure sense of direction in large scale environments (Hegarty et al., 2002). A further paper survey was used to collect demographic information.

Procedure

Ethics was obtained from the University Ethics Board. The experiment contained two phases. The first phase was a hiding phase, where participants were led to an area of bushland near the University and asked to hide a sack. The second phase required the participant to retrieve the sack.

Phase 1. Participants were led to a starting point where a vignette was read about a homicide that they had committed and the need to hide an incriminating object. They were also advised that they had 1 hour to scout out a location for the object, then return to the starting point to collect the object and hide it before another participant would commence searching for the object. They were also advised that this was a two-part study requiring them to participate in a survey after approximately one month.

There were two aspects of this information that were misleading. First was the use of a second participant. This was a deception as there was no second participant trying to find the sack. The fake participant was used for the purposes of ecological validity in two ways. First, to create a situation where participants would begin thinking about where other people might look for their object consistent with the task faced by a perpetrator hiding an object from the police. Second, to create a sense of increased urgency around the 1-hour timeframe by introducing the risk of being caught in the act. In addition, the purpose of the second phase of the experiment was masked. The reason for this was to prevent the participants from ruminating over the location of the object and therefore possibly making it easier to locate in the second phase and to prevent the participants from deliberately hiding the object in an easy to remember location.

Participants were then asked to walk through the tract of bushland and scout out possible locations to hide the object and to return to the start point after finding a suitable location. Upon returning to the start point participants were given a hard hat fitted with the GNSS receiver and video camera. They were also given the sack and the mobile phone that contained the tracking software. After receiving some instruction on how to use the software, they were asked to take the bag back to the location they had chosen and mark this location with the tracking software. Then once again return to the starting point. Following this the participants were dismissed, and the experimenter then entered the bushland to retrieve the sack and take a more accurate measure of the deposition site with the GNSS receiver and a differential correction.

Phase two. After one-month participants were led back to the starting point and were allocated to either the free recall or abbreviated ECI condition. Upon returning to the site the interviewer advised the participant that their task was to retrieve the sack that they had hidden previously and that the participant who was the closest to identifying the location of their sack would win a Samsung tablet. Again, this incentive was used to provide some form of ecological validity as in many cases a perpetrator is given some incentive for accurately identifying the deposition site. Participants were unaware that the sack had been removed. The interview protocol was then conducted, with the interviewer applying either the ECI or FR instructions, depending on the allocation of the participant, at the end of which the participant was told to lead the interviewer back to the deposition site. During the journey back to the deposition site the interviewer would use the prompts if the participants became disoriented. The interview was video recorded, and participants were again tracked using the GNSS receiver. Once the participant had identified the ‘remembered’ deposition site it was marked with the GIS software and the participant was led back to the starting point to complete the surveys. Upon completing the surveys, the participants were debriefed.

Interviewer Training

Three interviewers participated in a two-hour training session on the aspects of interviewing relevant to the needs of the experiment. All interviews were supervised and evaluated by the experimenter reviewing the visual recordings of the interviews. Verbal feedback was provided to interviewers after each interview regarding how accurately they applied the interview protocols.

Coding

All recordings of the interviews were transcribed. A coding protocol was developed and a sample of 10 interviews were then coded by two independent coders to measure inter-rater reliability. Once an acceptable level of agreement was reached, the remaining interviews were coded.

Analysis

Coding Protocol

A coding protocol was developed based on themes discovered in the transcribed interviews, the literature on spatial memory (Thorndyke, 1981; Thorndyke & Hayes-Roth, 1982) and previous investigative interviewing studies (Koriat & Goldsmith, 1994; Koriat & Goldsmith, 1996; Sauer & Hope, 2016). The interviews were divided into information about the journey and information about the deposition site. Furthermore, this information was also separated into 'coarse' and 'fine grain' details. This distinction is important when conducting research in a naturalistic setting as a focus on quality as well as quantity gives a more comprehensive measure of memory retrieval (Koriat & Goldsmith, 1994; Koriat & Goldsmith, 1996; Sauer & Hope, 2016). Coarse details refer to general details such as an object existing for example: "I hid it under the tree", the indication of the tree being a coarse detail. Fine grained details are those that give additional information about an object or route such as: "I hid it under a large tree that had been hollowed out by a fire". The coding protocol consisted of eight variables related to the details given by participants: (i) Landmarks – details about notable features of the environment; e.g. "There was like a burnt out like stump up in the distance", (ii) Route/Road knowledge – environmental details about the paths between landmarks; e.g. "it's an old track, still fairly used and all that stuff, but it's not in great condition", (iii) Actions – what participants did while hiding the object e.g. buried the bag with sticks and grass; e.g. "I covered it with like sticks and stuff from around here as well as some leaves from around the corner", (iv) Elimination tactics – a process where participants explored the environment to eliminate areas they were certain they had not hidden the object; e.g. "So we'll just go up a little bit further and If it doesn't look like it up there, I'm pretty sure this is the spot…There was no track. I didn't cross a track", (v) Environmental changes – participants' claims that the environment had changed; e.g. "The whole scene looks the same but I'm pretty sure that was a log, but it looks like it's been split up", (vi) Decision Making (self) – decisions based on the participant's own assessment of the environment; e.g. "this area is not dense enough to hide the bag", (vii) Decision Making (others) – decisions based on participants' beliefs about where another person might search for the bag; e.g. "I was thinking about hiding it around the bridge but again it would be too easy and too obvious to find. I'm sure that someone would search there", (viii) Decision making speculative – disoriented participants' beliefs about where they think they would or would not have hidden their object; e.g. "I think in the end I may have just thrown the object, I wouldn't have thrown it there I don't think because that's quite open". As an example of the way units were coded in the statement 'I hid it under a large tree that had been hollowed out by a fire', this would be scored as one point for 'action deposition site' (hid it under), one point for 'landmark deposition site (coarse)' (tree), and two points for 'landmark depositions site (fine)' (large, hollowed out by fire).

Inter-rater Reliability

Inter-rater reliability was calculated using an intra-class correlation (ICC) analysis (Shrout & Fleiss, 1979). The results indicated a high level of consistency between raters with an average ICC of .862 and a 95% confidence interval from .488 to .965 ($F(9,9) = 7.768$, $p < .01$).

Interviewer demeanour

To ensure that no bias was introduced by the interviewers an independent rater observed two randomly selected recorded interviews of each interviewer (one ECI and one FR) and scored them for rapport, encouragement, body language and disposition. The goal of this analysis was to determine if there were differences in the way the interviewers treated the participants which may have biased the outcomes of the interviews. A 2x3 ANOVA with the independent variables, interview type (ECI, FR) x interviewer (Interviewer 1, interviewer 2, interviewer 3) was conducted to test for significant differences between interviewers across conditions. The dependant variable was interviewer demeanour, which included ratings of rapport, encouragement, body language and general disposition. The independent rater scored each dependant variable on a 5-point Likert scale rating ranging from '1 strongly disagree to 5 strongly agree'. Statements included 'In this interview the interviewer: Was friendly; Had welcoming body language; Seemed grumpy or unhappy'. The results for each response were totalled and a mean score for interviewer demeanour was created. No significant interaction or main effects were found, suggesting that there was no significant difference in way interviewers behaved.

Results

Random allocation to groups. To assess whether randomisation was effective in countering any systematic error between groups, a series of independent samples t-tests were conducted. The independent variable has two levels (ECI versus FR) and the dependant variables were age, gender and sense of direction (measured with the SBSODS). No significant differences were found between the conditions on any of the dependant measures.

Retrieval of site details. A one way MANOVA was conducted to assess the total effect of interview (ECI versus FR) on the twelve dependant variables; Landmarks journey (coarse), landmarks journey (fine), landmarks deposition site (coarse), landmarks deposition site (fine), route/road, actions journey, actions deposition site, elimination tactic, environmental changes, decision making (self), decision making (others) and decision making (reflective). Breaches of univariate and multivariate normality were detected. Tranformations were deemed unnecessary due to there being no reason to expect that the DVs would not be normally distributed in the population (Tabachnic & Fidell, 1996). A series of bivariate correlations was performed to assess for multicollinearity. As seen in Table 1 most variables were within an acceptable range indicating a meaningful relationship between variables. A Box's M of 191.05 was found to be significant (p=.001) based on a cutoff of .005 as suggested by Huberty and Petosky (2000) indicating unequal covariance of matrices. To account for this breach in assumption a Hotelling's T was used which is regarded as robust to breaches of covariance of matrices when comparing two groups with equal sample size (Hakistan, Roed, & Lind, 1979). The results of the MANOVA were found to be non-significant; Hotelling's T = .79, F(12, 1.78) = .11. Due to the small sample size and the conservative nature of the MANOVA when accounting for type 1 error a series of post hoc analyses were conducted to detect if any effect of interview condition on each individual independent variable.

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Table 1. Bi-variate correlations of dependant variables to assess for multicollinearity

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Landmarks journey (coarse)	-											
1. landmarks deposition (coarse)	.325*	-										
2. Landmarks Journey (fine)	.762*	.358*	-									
3. Landmarks deposition (fine)	.481*	.709*	.506*	-								
4. actions journey	.535*	.362*	0.240*	0.286*	-							
5. actions deposition	.316*	.493*	.375*	0.290*	.407*	-						
6. Route/road	.508*	0.296*	.474*	0.270*	.537*	.444*	-					
7. Elimination tactics	.652*	.493*	.620*	.801*	0.272*	0.225*	.368*	-				
8. Environmental change	.369*	.500*	.355*	0.174	.334*	.493*	.497*	0.213*	-			
10. Decisions other	0.143	0.119	0.105	0.025	.459*	.320*	.345*	-0.107	0.227*	-		
11. Decisions (self)	0.013	-0.023	0.003	0.034	0.018	-0.095	0.010	0.091	-0.055	0.076	-	
12. Decisions (reflective)	0.099	-0.141	0.272	-0.146	-0.098	0.118	0.116	-0.078	0.055	-0.100	0.076	-

**correlations within range of .2-.8*

A series of independent samples *t*-tests were conducted to analyse the effect of interview condition on each of the twelve dependant variables as listed above. An alpha level of .05 was adopted for all analyses. Normality was breached for all variables with the exception of ‘Actions journey’. Normality of distributions were gauged using a standardised cut-off of $z = 3.29$, as recommended by Tabachnick and Fidell (2007). A series of transformations were applied to adjust for skew and the analyses were again conducted. No changes to significance levels were found. Therefore, the untransformed data has been presented. A lavene’s test for equality of variances was conducted and found to be significant for ‘Landmarks journey (fine)’, ‘Landmarks deposition site (fine)’, ‘Actions journey’ and ‘Elimination tactics’. To address this issue degrees of freedom were adjusted to a more conservative level.

The results for these analyses are presented in Table 2. The results indicated that the CI generated more coarse and fine grain details regarding Landmarks along the journey. This difference represented a large effect size, indicating that the ECI is effective at eliciting more information about landmarks on the journey to the deposition site than the FR conditions. Further, significantly more coarse and fine grain details about landmarks were also given by participants in the ECI condition when referring to the depositions site. This difference represented a medium effect size, indicating that the ECI is more effective at eliciting more information about landmarks at the depositions site. Further, significantly more detail regarding actions of the participants was generated in the ECI condition. This difference represented a medium effect size, indicating that the ECI is more effective at generating information regarding the participant’s actions on the journey to, and at the deposition site than the FR condition. Regarding the remaining dependant variables, no significant difference was found between conditions. This finding is consistent with previous research demonstrating that the CI tends to generate more coarse- and fine-grained details than other interview methods (Köhnken, Milne, Memon & Bull, 1999; Memon, Meissner & Fraser, 2010).

Accuracy of Object Location. Accuracy was gauged as the distance between the DGPS point where the bag was initially hidden and the DGPS point where the participant indicated they had hidden the bag when they returned to the site. A Lavene's test of variance was conducted and found to be not significant, $F = 2.53$, $p = .12$. A breach of normality was found. One outlier was detected; however, removal of this person did not adequately correct the skew. The outlier was replaced and a Log10 transformation was conducted to achieve normality. Normality of distributions and outliers were gauged using a standardised cut-off of $z = 3.29$, as recommended by Tabachnick and Fidell (2007). No difference in significance levels were found, therefore the untransformed data has been reported. An independent samples *t*-test indicated there was no difference between participants in the free recall condition ($M = 8.78$, $SE = 2.63$) compared with the ECI ($M = 20.50$, $SE = 11.27$, 95% CI [-35.15, 11.73], $t(38) = 1.012$, $p = .159$, $d = 0.24$). A Bayesian factor independent samples test was also conducted to assess the fit of the data under the null hypothesis and the alternative hypothesis. Due to the lack of previous research in this field a non-informative prior distribution was chosen. The results of this analysis showed an anecdotal level of support for the hypothesis $BF= 2.75$, 95% CI [-12.50, 35.93] as suggested by Jeffreys (1961), indicating that the data is 2.75 times more likely under the hypothesis than the null hypothesis. This finding is consistent with the independent samples *t*-test demonstrating that there is no effect of interview condition on accuracy of object location.

Table 2. Independent samples t-tests comparing effect of interview conditions on detail recalled

	Free Recall (*n*=20)		Cognitive Interview (*n*=20)						
	M	*SD*	*M*	*SD*	*CI (95%)*	*t*	*df*	*p*	*d*
Landmarks journey (coarse)	3.40	3.33	7.80	6.24	[-7.60, -1.19]	2.78	38	<.01**	0.88
Landmarks journey (fine)	0.55	0.94	3.05	2.99	[-3.96, -1.04]	3.56	22.73[a]	<.01**	1.13
Landmarks Deposition site (coarse)	0.90	1.17	1.80	1.67	[-1.82, 0.02]	1.97	38	.028*	0.62
Landmarks deposition site (fine)	0.25	0.55	1.10	1.59	[-1.63, -0.07]	2.26	23.51[a]	.017*	0.71
Route/ Road	1.80	2.38	3.05	2.63	[-2.85, 0.350	1.58	38	.061	0.50
Actions journey	4.300	4.21	7.25	4.59	[-5.77, -0.13]	2.12	38	.021*	0.67
Actions deposition site	1.30	.92	2.40	2.23	[-2.21, -0.01]	2.04	25.31[a]	.026*	0.64
Elimination tactic	0.45	1.36	1.95	3.87	[-3.40, 0.40]	1.64	23.59[a]	.057	0.52
Environmental changes	0.35	.081	0.85	1.79	[-1.39, 0.39]	1.14	38	.131	0.36
Decision making (self)	3.90	2.90	4.10	3.23	[-2.16, 1.76]	0.21	38	.419	0.07
Decision making (others)	1.55	1.76	1.90	2.25	[-1.64, 0.94]	0.54	38	.293	0.17
Decision making (reflective)	0.10	0.31	0.15	0.37	[-0.167, 0.27]	0.47	38	.322	0.15

**p<.05. **p<.01. [a] denotes an adjusted degrees of freedom to address unequal variances.*

Finally, most participants were accurate to within a 10-metre radius when identifying the location of their hidden object. It is important to note the impact of this error rate on the size of a potential search area for investigators (see Table 3). Although it is unknown at what level of error a search becomes unworkable, a reasonable estimation of the increase in difficulty for investigators can be deduced from this information.

Table 3. Participants' Error Range (distance between deposition site and indicated deposition site) in meters and potential Search Area

	Error Range(m)								
	0-5	6-10	11-15	16-20	21-25	26-30	41-45	46-50	225+
Search Area (upper limit m²)	78.54	314.16	706.86	1256.64	1963.50	2827.44	6361.74	7854	159043.5
Participants (%)	50	25	2.5	5	7.5	2.5	2.5	2.5	2.5

Discussion

This study is the first to examine the CI in an on-site, naturalistic setting with the task of locating an object. Previous research has focused on the retrieval of episodic memory. Typically, these studies present a visual recording of a crime event and ask participants to recall details in various interview conditions that are conducted in an interview room setting (Khönken et al., 1999; Memon et al., 2010; Paulo et al., 2015). The current study has focused on interviews that are conducted on-site with a view to locating missing objects or the retrieval of spatial memory. The results of this study found that the CI is an effective tool for generating more information and more detailed information than a free recall strategy. Previous research has shown that the CI can generate up to 41% more information than other interview strategies (Köhnken et al., 1999; Memon et al., 2010). The current study shows that it is much more effective in generating spatial details, such as coarse and fine grain details about landmarks, and details regarding the interviewee's own actions. Although no significant change in participants' accuracy of locating the deposition site were found between conditions, the CI does not impede the primary goal of the task, locating the missing object, and generates significantly more information which may be of use for successive search attempts.

The non-significant results when it comes to the accuracy of the participants locating the missing object may be a function of the site itself. Context re-instatement is used to activate the interviewee's memory through cognitively recreating the environment in which the memory was encoded (Fisher & Geiselman, 1992). This may not be as effective in an on-site interview, as returning the interviewee to the site should automatically re-instate much of the environmental detail that will facilitate memory retrieval (Godden & Baddeley, 1975). This is particularly relevant in the Australian bushland as, compared to other environments, and particularly over a 30-day interval, it is largely static. It is possible that the physical rather than the mental re-instatement of the environment was the cause for most participants being accurate to within 10 metres and this may have masked the effect of the CI on participants that were less accurate. In environments that change drastically over time, context re-instatement may be more effective, such as seasonal changes between winter and summer in environments containing largely deciduous trees and seasonal snow.

The increased level of information generated by the CI, although not assisting with increasing the participant's chances of locating the object, may assist in successive search attempts. This may be particularly important in cases where only one site visit is possible, for legal or practical reasons. The increased amount of coarse and fine grain detail about landmarks, may be able to assist search teams in narrowing down a search area, or expand it to encompass areas that also fit the description given by an interviewee. For instance, if an interviewee was to state that they buried an object under the root bowl of a fallen tree (a root bowl being the void left under the root system of a tree after it has been uprooted) and gave enough fine grain detail about this tree, investigators may be able to broaden their search area to locate large fallen trees, and then focus their search around these environmental features. The relevance of this would obviously be dictated by the nature of the information given and the surrounding environment. A large fallen pine tree in a pine forest would be a very common object and therefore may render this information useless. However, whether this information would be useful to investigators would be dependent on the level of detail given by the interviewee. In addition to this, the increased level of information regarding the actions of the participant at the deposition site may also assist investigators.

An increase in the details of what participants did at the deposition site might allow investigators to gain important detail about the deposition site itself and the likelihood of being able to retrieve the victim's remains. Participants who have buried a body may give detail about their actions which could indicate the nature of the soil and give investigators additional information to assist search efforts. The 'digability' of the soil is an important factor that could determine where a body is hidden (Harrison & Donnelly, 2008). Investigators may be able to rule out certain sections of a search area because the soil would be unable to be excavated based on the actions taken by the participant e.g. if they were using their hands to bury an object, they would not have been able to bury a body in a location where the soil would not allow it. Therefore, investigators may be able to narrow down search areas with this information. In addition, the details of how the perpetrator covered the body, whether it was buried or not, will give some indication of whether there are any remains. If a participant indicates that they placed the victim in a root bowl and covered them with sticks and leaves, the body will decay faster than a body that has been buried at a substantial depth (Mann, Bass & Meadows, 1990). This of course is time dependant; it is possible that if a time period has passed, such as in the Levenson case, and the body was left on the surface rather than being buried there would be no remains to locate, for example, because of interference by animals.

The interviews yielded some interesting findings on the thought processes and strategies that participants used to find their objects. Participants tended to make decisions based on a combination of what they thought was a good place to hide the object and where they thought other people would look for the object. Although some research has been conducted into ‘hide and seek’ behaviours, to the knowledge of the researchers, no research has investigated the decision-making process of individuals’ choices in hiding missing bodies or other types of evidence that may be of interest in an investigation.

Many participants appeared to be using an ‘elimination strategy’. Participants would search the area if unsure of the location of the deposition site and eliminate locations that they were sure they had not been to previously. This strategy was not something that was encouraged but was independently adopted by these participants. It is consistent with one technique identified in a previous study by Ryan et al. (2016) where an investigator recommended that participants who became disoriented should explore the environment in a systematic way to eliminate areas that were not familiar and hopefully discover a familiar landmark to progress a search. With this suggested strategy the interviewee would be asked to walk along a logical trajectory into the environment until they either eliminated that trajectory by way of seeing things they knew they had not seen before or recognised aspects of the environment that would allow them to continue the journey. If a trajectory was ‘eliminated’ the interviewee would return to the point where they had commenced the process and then choose another trajectory (Ryan et al, 2016). It may be that this method is tapping into a natural search instinct of the interviewee, however, it is not known whether this is an effective strategy in improving recall and requires further research.

A question generated from this research is how accurate is accurate enough? While most participants were accurate to within ten metres, it is unknown to the researchers, how accurate an interviewee must be to adequately assist search efforts. A relatively small decrease in a participant's accuracy will result is a substantially larger search area. The difference between a five-metre radius and a twenty-metre radius dramatically increases the excavation required from $79m^2$ to $1257m^2$. This of course is only considering surface area as a two-dimensional space without considering the undulations in the surface of the environment which will also increase the search area.

Another finding in this study, which warrants mentioning, is that there were errors among participants. It is important to note that this study verifies that it is reasonable to believe that an interviewee may be genuinely unable to find where they have hidden a victim's remains. One participant identified a location 219 meters away from their deposition site. Considering the interval between hiding and attempting to retrieve the object is only 30 days, this is particularly salient as many cases, such as the Levenson case, have time frames of years between the disposal of the victim and the retrieval attempt of the perpetrator. This gives weight to the claims by investigators that there are perpetrators that they believe are trying to find the victim, but simply cannot, rather than it being a function of deceit (Ryan et al., 2016) and could be relevant to the fairness of 'no body, no parole' decisions.

The length of time between encoding and retrieval is a limitation of this study. The example case provided in the introduction contains an interval of nine years. While one month is a substantial amount of time between phases from a long-term memory perspective, it does not represent many of these cases which have much larger intervals between encoding and retrieval. It may be that with a larger interval (years) that the error rate among participants would have been much larger and provided a more ecologically valid result. Considering this, as previously stated it is also possible that the effect of the CI on the accuracy of participants was lost through the number of participants who were within a reasonable search range. An increase in time between phases may have generated a larger error rate and exposed the effect of the CI, however this cannot be resolved in the current study.

Not addressed in this study was the emotional arousal of the participant. It could be that perpetrators would have a high level of emotional arousal while conducting the task of hiding a victim's remains. This is an assumption as no research has been conducted to investigate how perpetrators were feeling while doing this. Without this research it was decided not to introduce a level of arousal to the study. However, previous research shows that highly aroused participants tend to focus on specific aspects of the environment that are of most importance, such as the 'weapons focus effect' (Loftus, Loftus, & Messo, 1987; Saunders, 2009). It is possible that participants may focus on different aspects of the environment and ignore peripheral details in the same way. This also may have an impact on accuracy. Further, the emotional arousal of the perpetrator may cause them to ruminate on the location of the victim's remains. This was not addressed in this experiment due to the need to hide the second phase of the study to increase the difficulty of the retrieval task and avoid participants deliberately hiding the object in an easy to remember location.

The CI can enhance the amount of detail reported by people trying to retrieve a hidden object. This detail has the potential to assist future, forensic, search attempts and is an important finding that can assist investigators to make evidence-based choices when conducting on-site interviews. It is important to remember that in missing body homicide cases there is an emotional toll on those who remain. The importance of finding a way to improve the outcomes for search attempts has the potential for the families and friends of the victims to gain closure gained by being able to farewell their loved one.

References

Boelen, P. A., van Denderen, M., de Keijser, J. (2016). Prolonged grief, posttraumatic stress, anger, and revenge phenomena following homicidal loss: the role of negative cognitions and avoidance behaviors. *Homicide Studies, 20*(2), 177-195. doi: 10.1177.10887679155806674

Corrective Services (No Body, No Parole) Amendment Act 2017

Fisher, R. P., & Geisleman, R. E. (1992). *Memory-enhancing techniques for investigative interviewing*. Springfield: Charles C Thomas

Fisher, R. P., Milne, R., & Bull, R. (2011). Interviewing Cooperative Witnesses. *Current Directions in Psychological Science*, *20*(1), 16–19. https://doi.org/10.1177/0963721410396826

Fu, L., Maes, J. H. R., Varma, S., Kessels, R. P. C., & Daselaar, S. M. (2017). Effortful semantic decision-making boosts memory performance in older adults. *Memory, 25,* 544-549.

Godden, D. R., & Baddeley, A. D. (1975). Context-dependent memory in two natural environments: on land and underwater. *British Journal of Psychology, 66*(3), 325-331

Hakstian, A. R., Roed, J. C., & Lind, J. C. (1979). Two sample T^2 procedure and the assumption of homogenous covariance matrices. *Psychological Bulletin, 86,* 1255-1263

Harrison, M. & Donnelly, L. J. (in press). Locating Concealed Homicide Victims: Developing the role of geoforensics. In Ritz, K., Dawson, L. & Miller, D., Criminal and Environmental Soil Forensics. Soil Forensics International, Edinburgh Conference Centre, 30 October -1 November 2008, Springer

Hegarty, M., Richardson, A. E., Montello, D. E., Lovelace, K., & Subbiah, I. (2002). Development of a self-report measure of environmental spatial ability. *Intelligence, 30,* 425-447.

Jacoby, L. L., & Craik, F. I. M. (1979). Effects of decision difficulty on recognition and recall. *Journal of Verbal Learning and Verbal Behaviour, 18,* 585-600

Jansen-Osman, P. & Berendt, B. (2005). What makes a route appear longer? An experimental perspective on features, route segmentation, and distance knowledge. The Quarterly Journal of Experimental Psychology, 58A(8), 1390-1414.

Janzen, G. (2006). Memory for object location and route direction in virtual large-scale space. *The Quarterly Journal of Experimental Psychology, 59*(3), 493-508. doi: 10.1080/02724980443000746

Jones, G. V., & Martin, M. (2009). Spatial recall improved by retrieval enactment. *Psychometric Bulletin & Review, 16*(3), 524-528. doi: 10.3758/PBR.16.3.524

Köhnken, G., Milne, R., Memon, A., & Bull, R. (1999). The cognitive interview: a meta-analysis. *Psychology, Crime & Law, 5*(1-2), 3-27. doi: 10.1080/10683169908414991

Koriat, A., & Goldsmith, M. (1994). Memory in naturalistic and laboratory contexts: Distinguishing the accuracy-oriented and quantity-oriented approaches to memory assessment. *Journal of Experimental Psychology: General, 123,* 297-315. doi:10.1037//0096-3445.123.3.297

Koriat, A., & Goldsmith, M. (1996). Monitoring and control process in the strategic regulation of memory accuracy. *Psychological Review, 103,* 490-517. doi:10.1037/0033-295x.103.3.490

Loftus, E. F., Loftus, G. R., & Messo, J. (1987). Some facts about “Weapon Focus”. *Law and Human Behaviour, 11*(1), 55-62.

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory.Journal of verbal learning and verbal behavior, 13(5), 585-589

Mann, R. W., Bass, W. M., & Meadows, L. (1990). Time since death and decomposition of the human body: variables and observations in case and experimental field studies. *Journal of Forensic Sciences, 35*(1), 103-111.

Mastrocinque, J. M., Metzger, J. W., Madeira, J., Lang, K., Pruss, H., Navratil, P. K., Sandys, M., & Cerulli, C. (2015). I'm still left here with the pain: exploring the consequences of homicide on families and friends. *Homicide Studies, 19*(4), 326-349. doi: 10.1177/1088767914537494

McDermott, Q. (Producer) & Hassall, G. (Writer) (2018). *Australian story: Inside the mind of an arsonist* [Television documentary]. Sydney, NSW: Australian Broadcasting Corporation.

Memon, A., Meissner, C., & Fraser, J. (2010). The cognitive interview: a meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy and Law, 16*(4), 340-372. doi: 10.1037/a0020518

Milne, R. (2017). The enhanced cognitive interview: a step by step guide.

Paulo, R. M., Albuqueque, P. B., Saraiva, M., & Bull, R. (2015). The enhanced cognitive interview: testing appropriateness perception, memory capacity, and error estimate relation with report quality. *Applied Cognitive Psychology, 29,* 536-543. doi: 10.1001/acp.3132

Prescott, K., Milne, R., & Clarke, J. (2011). How effective is the enhanced cognitive interview when aiding recall retrieval of older adults including memory conversation? *Journal of Investigative Psychology and Offender Profiling, 8,* 257-270. doi: 10.1002/jip.142

Queensland parole system review (2016, November)

Rose, C. & Beck, V. (2016). Eyewitness accounts: false facts, false memories, and false identification. *Journal of Crime and Justice, 39*(20), 243-263. doi: 10.1080?0735648X.2014.940999

Ruddle, R. A., Volkova, E., Mohler, B., & Bülthoff, H. H., (2011). The effect of landmark and body-based sensory information on route knowledge. *Memory and Cognition, 39,* 686-699. doi: 10.3758/s13421-010-0054-z

Ryan, N. C., Westera, N. J., Kebbell, M., Milne, R. & Harrison, M. (2016). Where's the body? Investigative interviewing strategies in missing body homicide cases. *International Investigative Interviewing Research Group (iIIRG),* London, 22-24 June, presented 24 June 2016.

Sauer, J., & Hope, L. (2016). The effects of divided attention at study and reporting procedure on regulation and monitoring episodic recall. *Acta Psychologica, 169,* 143-156.

Saunders, J. (2009). Memory impairment in the weapon focus effect. *Memory & Cognition, 37*(3), 326-335. doi: 10.3758/MC.37.3.326

Shephard, E. & Griffiths, A. (2013). *Investigative interviewing: the conversation management approach.* New York: Oxford University Press

Shrout, P. E. & Fleiss, J. L. (1979). Intraclass correlations: uses in assessing rater reliability. *Psychological Bulletin, 86*(2), 420-428

State Coroner's Court of New South Wales (2017). Inquest into the death of Matthew John Leveson. Retrieved from http://www.coroners.justice.nsw.gov.au/ Documents/Findings%20Matthew%20Leveson.pdf

Tabachnick, B. G. & Fidell, L. S. Using multivariate statistics (3rd ed.). Boston, NY: Pearson, Allyn & Bacon.