What happened that day? Recall for events of a day that later became important

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Abstract

Purpose – *The purpose of this study was to explore potential witnesses' memories for a day that was experienced an unremarkable. There may be instances in an investigation in which all leads have been exhausted, and investigators use a broad appeal for witnesses who may have witnessed something important. Investigators can benefit from knowing the types of information that may be recalled in such circumstances, as well as identifying specific methods that are effective in eliciting useful information.*

Design/methodology/approach – *The present study explored how the delay to recall and recall method influenced the recollection of a seemingly unremarkable day that later became important. Participants were asked to recall an experienced event that occurred either recently (a few weeks prior) or in the distant past (a year prior). Participants recalled via either a written method, in-person individual-spoken or collaborative-spoken interviews.*

Findings – *Results suggest an independent benefit for individual-spoken in-person recall (compared to written or collaborative-spoken recall) and recall undertaken closely after an event (compared to delayed recall). Both individual-spoken interviews as well as more recent recollection resulted in a greater number of overall details recalled. The authors further examined the types of details recalled that might be important to progressing an investigation (e.g. other witnesses and records).*

Originality/value – *The present work provides important implications for interviewing witnesses about a seemingly unremarkable event that later became important.*

Keywords *Memory, Interviewing, Written recall, Collaborative recall, Delayed recall*

Paper type *Research paper*

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If a crime has occurred and investigators have exhausted all obvious leads, they may seek out individuals who have unknowingly witnessed something important or relevant to the investigation. Such an investigative approach may be likely in both recent (i.e. timely) investigations, as well as cases in which active leads have gone stagnant (i.e. cold cases). Research has shown that the successful resolution of many timely criminal investigations is linked to the information obtained during an interview (Vrij *et al.*, 2017). In one investigation into the case files of 189 solved and unsolved cold cases, Davis *et al.* (2013) determined the leading contributor to solved cases was information from new witnesses or new information provided by witnesses interviewed previously. Although extensive research has examined witnesses who are aware they have witnessed a crime and were interviewed in a timely manner (Fisher, 1995; Vallano and Compo, 2015b; Vrij *et al.*, 2017), limited knowledge exists regarding the optimal approach to interviewing individuals about events they may not have considered remarkable (e.g. a person who was at a park from which a child goes missing), particularly after a substantial delay between the event and recalling it. In the present work, we investigated three approaches (i.e. written, in-person individual-spoken and in-person collaborative-spoken) to gathering information from witnesses who were unaware they may have witnessed relevant information about an event

that occurred recently (weeks ago) or after a long (one-year) delay. We are interested in the amount and types of information that could be recalled, including verifiable details (i.e. details that could be confirmed via another piece of evidence).

Memory decay

There is a body of work to suggest that the greatest amount of forgetting will take place shortly after an event (Ebbinghaus, 1885/1964; Rubin and Wenzel, 1996; Wixted, 1990). This pattern of forgetting has been supported in lab-based studies. For example, Odinot and Wolters (2006) asked participants to recall details about a video one, three or five weeks after watching it (or a combination of those delays). A longer delay between watching the video and recalling it resulted in less information and fewer accurate details reported, as well as reduced confidence in memory. Similarly, Spearing and Wade (2022) found that participants who recalled a mock crime video immediately, one week or one month later showed reduced accuracy and confidence after the longest delay. This pattern is not limited to adults; in a sample of 9-to-12-year old children, El Asam and Samara (2015) found that with increasing delays, the amount of correct information recalled decreased.

Field studies on the impact of delay on memory have often focused on delays of a year or less (Christianson and Hübinette, 1993; Odinot *et al.*, 2009; Yuille and Cutshall, 1986) and found that witnesses are generally accurate in their recall after such delays. For example, Odinot *et al.* (2009) asked participants to recall an armed robbery they had witnessed three months earlier. Witnesses' recall was compared to security camera recordings. Witnesses who were directly involved and previously interviewed by police (central witnesses) recalled more details on average than witnesses who were not as involved and not interviewed by police (peripheral witnesses). Recall accuracy was relatively high overall (84%), and witnesses primarily recalled people details, followed by action and then object details. Yuille and Cutshall (1986) interviewed witnesses to a shooting four to five months after they had initially been interviewed by the police. Reports were compared to details of the event as determined by information related to the investigation (e.g. autopsy reports, forensic evidence and official witness statements). Again, witnesses were quite accurate in their recall (73%–85%) and central witnesses provided more details than peripheral witnesses.

Researchers have also examined memory for longer delays via adults' recall of their childhood. For example, Wells *et al.* (2014) asked adults to recall early positive and negative childhood memories. Participants had difficulty recalling specific details such as time of day/week/year or the weather, but recalled central details of the events such as who was involved, what happened and where the event(s) took place. It should be noted that ground truth for the childhood events was unknown, so recall accuracy could not be assessed. Quas *et al.* (2010) compared legal documents with teenagers' and adults' recall of involvement in legal proceedings (i.e. sexual abuse as a child) that occurred 14-years prior. Interviewees who experienced more severe abuse and more extensive involvement in the legal proceedings were more accurate in their recall of the legal proceedings. Further, Goldfarb *et al.* (2023) investigated interview protocols after a 20-year delay regarding memories for a child maltreatment medical exam and found that what participants were able to recall was generally accurate, though participants recalled central details with higher accuracy than peripheral details. Thus, it appears that the central features of salient events can be retained in memory for long periods of time (see also Peterson and Bell, 1996; Peterson and Whalen, 2001).

Prior work examining long-term memory has often focused on stressful or emotional events to examine how particularly salient events may be recalled (Fivush *et al.*, 2004; Peterson, 1999; Peterson and Whalen, 2001). Stressful events may either hinder (Deffenbacher *et al.*, 2004) or enhance (Talarico *et al.*, 2004) recall. While the literature does not clearly indicate that emotional memories are remembered better than non-emotional memories (see McNally, 2005), some memories are more likely to be rehearsed either through re-telling or

re-thinking. With such rehearsal and strengthening of the memory, some details of old crime memories may well be retained for long periods of time. However, as discussed, witnesses in some investigations may have important information that was experienced as part of an everyday, or unnoteworthy, event. As such, further research into long-term recall of unremarkable events, that are unlikely to be recalled repetitively, is needed.

Recall methods

The way in which a witness is asked to recall an event might have implications for their memory report, including the number of details recalled and the accuracy of those details. For instance, some research has demonstrated a *spoken superiority effect*. Sauerland and Sporer (2011) investigated the modality of memory recall by asking participants to provide a verbal or written recall of a short video depicting a theft. For descriptions of the crime, verbal recall resulted in higher accuracy and quantity of information than written recall. However, for descriptions of the perpetrator, verbal recall resulted in more central details (e.g. facial descriptions) while written recall resulted in more peripheral details (e.g. clothing). Bekerian and Dennett (1990) also tested the impact of written versus verbal recall. Participants recalled details about a series of slides depicting an accident, either by verbal free recall or written free recall. Those recalling verbally were more accurate in their recall, although the completeness of their accounts did not differ. Some researchers have suggested that verbal recall may be less taxing on working memory than written recall, leading to enhanced reports (Kellogg, 2007).

Other researchers, however, have hypothesized that writing is less cognitively demanding than speaking, resulting in better recall (Grabowski, 2007) – a *written superiority effect*. Written recall also offers a chance for the reviewing and editing of one's report that verbal recall may not. In two studies, Sauerland *et al.* (2014) investigated written and verbal recall of a video depicting a theft. Participants who wrote their recollection of the event, when compared to those who verbally spoke into an audio recorder, reported a greater amount of information, though this information was not more accurate. This significant difference was only present in free recall, as opposed to cued recall. In their second study, there was a benefit to written recall (in quantity, but not accuracy, of information recalled) when reporting event related details. A written superiority effect has been further demonstrated in contexts outside of eyewitness memory (e.g. word list recall; Grabowski, 2007).

Some researchers, however, have found no impact of recall method on accuracy or number of details reported. McPhee *et al.* (2014) investigated verbal and written recall taken immediately after a target event took place (i.e. viewing a mock crime video). There were no significant differences between verbal and written recall accuracy or quantity of information reported. Verbal and written recall also demonstrated similar resistance to misinformation in a later recall session. It is likely that other studies observing no significant differences across recall modality remain unpublished given the mixed findings of the literature on recall modality, as well as the file-drawer problem (Rosenthal, 1979).

Collaborative recall

If multiple individuals witness a crime, there may be, and often is, opportunity for them to discuss the witnessed event among each other prior to being interviewed by the police. There is a large body of research that has examined the influence of co-witness contamination on individual recall (Paterson and Kemp, 2006). However, less attention has been given to witnesses who may be interviewed collaboratively.

While current evidence and policy largely suggest that witnesses should primarily be interviewed individually to capture a single witness' perceptions and recollections (National Institute of Justice (NIJ), 2023), there may be some benefit to collaborative recall. The

impact of eyewitness collaboration in an interview has been investigated in prior research, with mixed results. Wessel *et al.* (2015) had participants view a video of a fatal car accident and then recall the details of the video individually or collaboratively (in groups of three). Collaborative groups had to discuss and agree upon details. Collaborative recall (i.e. the combination of the three participants' recall) led to more details being recalled and increased accuracy when compared to a single individual's recall. However, collaborative recall resulted in fewer details and reduced errors when compared to the nominal combined recall of three participants who had been interviewed individually. Yaron-Antar and Nachson (2006) asked participants to recall the assassination of Israel's Prime Minister, either in collaborative groups of three or individually. Collaborative groups again had to agree upon their answers. Collaborative groups recalled more details, both accurate and inaccurate, compared to individuals. However, collaborative recall led to fewer accurate and inaccurate details when compared to nominal responses of three individuals.

A body of work has also found negative impacts of collaborative recall. For example, Hope *et al.* (2008) asked either pairs or individual participants to remember details regarding a video depicting a crime. For those tasked with recalling in pairs, each participant viewed a different video depicting the same event from different angles and were asked to discuss the event during their recall. Those recalling in pairs reported more inaccurate details of the version of the video that they had watched, but often reported details provided to them from their co-witness. Reporting details from a co-witness was particularly common for those whose co-witness was a friend or romantic partner, as opposed to a stranger. Ito *et al.* (2019) had participants view two versions of a movie before collaborating on a recall task about what they viewed and completing individual recall. Participants were likely to report details that had been suggested to them during their collaboration, even if those details were different from what they themselves had viewed. In a set of studies, Takahasi and Saito (2004) asked participants to recall, either individually or in a pair, details of a story they had previously read. Collaborative pairs recalled fewer details overall when compared to individuals, a phenomenon known as collaborative inhibition. However, this collaborative inhibition was reduced when a delay of a week or more was introduced between the initial reading of the story and collaborative recall. This body of work suggests that collaborative recall may impede the amount information provided by witnesses, perhaps as a result of interference from knowledge of others' responses (Wright and Klumpp, 2004).

In the majority of the aforementioned studies investigating collaborative recall, participants were asked to agree upon and provide a common answer. In real investigations however, witnesses may be more likely to speak freely and investigators to take in all responses, rather than limiting responses to a single answer. Some research has focused on the benefits of collaborative recall where participants could recall freely, without having to provide a single answer. For example, Vredeveldt *et al.* (2017) had participants view a video of a violent event. All participants then took part in individual interviews, followed by either a collaborative interview with a familiar co-witness or another individual interview and ending with a final individual interview. There were no significant differences in the number of accurate details between individuals and collaborative pairs. However, those who had been interviewed together reported fewer repeated details in subsequent interviews and more new details in their final individual interviews. Collaborative pairs also reported fewer incorrect details. Vredeveldt *et al.* (2016) also interviewed individuals about a theatre event they had attended a week prior. Participants were interviewed either two times individually, or individually and then collaboratively (again with a familiar co-witness). The quantity of details recalled was similar across conditions, however those interviewed collaboratively made fewer errors than those interviewed individually. Overall, collaborative interviews may lead to fewer errors in recall as participants work together to remember the event.

The current study

Prior research which focused on memory after a delay demonstrated that fewer details may be recalled compared to memory for a timely event, but what is recalled can be highly accurate. However, the extant research has focused primarily on recall of notable events. As new witness evidence may be a central reason for clearing cold cases after a delay (Davis *et al*., 2013), it is important to investigate how to best elicit information from witnesses after varied retention intervals and when the witnesses may not have encoded the event as particularly noteworthy. In the present study, participants were asked to recall the events from a day that had occurred relatively recently (within weeks) or distantly (last year) with either written, collaborative-spoken or individual-spoken recall. Participants' reports were coded for number of details and types of details. There are some details which may be of particular relevance to an investigation, such as those that provide tangible leads or that can be confirmed through additional evidence. We refer to these as verifiable details. Prior literature has focused on verifiable details in the context of deception detection (Dunbar *et al*., 2022; Nahari *et al*., 2012). Little work, however, has examined rates of verifiable details in general recall; we examine recall for verifiable details in the current work. We anticipated that participants would recall more information about the recent than distant event, but we developed no additional a priori hypotheses given the lack of research on memory for unremarkable days.

Method

Participants

The present study was approved by the ethical review board at [blinded for review]. A total of 147 participants took part in this study. Four participants across two collaborative-spoken interviews were excluded due to experimenter error (e.g. individuals interviewed collaboratively were interviewed about different events, audio file lost due to technical issue), one participant/interview was excluded as the interviewee did not attend the event in question, one participant/interview was excluded as it was not clear which event (recent or distant) they were remembering, and one participant was excluded because they did not recall the day in question. Thus, our final sample consisted of 140 participants: 51 participants completed individual-spoken interviews; 58 participants completed collaborative-spoken interviews, and 31 participants provided a written account (see Table 1 for a breakdown of participants per condition). This sample size was a result of practical constraints. Specifically, participants were a convenience sample of students, staff or faculty from a Canadian university who had been on campus on one of two particular days in the two years prior to the interview. There was no compensation for taking part in the study.

Participants who provided *written* recall were 81% women, 19% men and in their early-to-mid 20 s. Due to ethical restrictions (i.e. disclosure of demographic information could reveal a participant's identity as they were registered in a class taught by someone involved in the research), additional demographic information was not available for these participants. Participants who took part in a *verbal* interview were from the same university as those completing written interviews; they were 54.12% women and 25.29% men (19.27% did not

Table 1 Number of participants who recalled a recent or distant event as a function of recall method

Recall method	*Recent event*	*Distant event*
Individual-spoken interview	30	21
Collaborative-spoken interview	34	24
Written interview	16	15

Source: Table created by authors

report gender), with a mean age of 22 years and were primarily students (92.66%). For participants who were interviewed *collaboratively*, they knew each other on average for a span of three and a half years ($SD = 6$ min and 38 s), with a range from "just met" ($n = 3$ pairs) prior to the interview to 15 years ($n = 1$ pair).

Design and procedure

The study design, materials and procedure were pre-registered prior to data collection (see https://osf.io/dnpey). Regarding deviations from the pre-registration plan, we made the decision to also code for verifiable details (in addition to the pre-registered coding of amount, and types, of details). The decision to code for verifiable details was made to increase the applicability of the results for applied readers. We used a 2 (delay: recent, distant) × 3 (recall method: written, individual-spoken, collaborative-spoken) between-subjects design.

Written, individual-spoken and collaborative-spoken recall. All participants, regardless of recall condition, were told they would be asked to recall information about a particular day – a university-wide event welcoming students back to campus during the first week of classes. Participants attended the several hours-long event of their own volition and as such, experiences, time spent and attention paid differed across participants. These conditions represent a realistic context in which witnesses to an event have different perspectives and experiences that may provide varied information as part of an investigation. Participants were asked to recall this event either from the current year (approximately seven weeks prior to the interview; recent interview) or the year prior (approximately 14 months prior to the interview; distant interview). Prior to taking part in the study, participants were asked to read an informed consent form which explained that they could withdraw from the study at any time without consequence; participants were also given a chance to ask questions prior to participating.

Written reports were provided by undergraduate students enrolled in an upper-level Psychology course focusing on cold case investigations. The participants who provided a written report were the same individuals who interviewed participants about their recall (described below). Individuals provided their written report prior to knowing they would be conducting interviews. Participants in the written condition were prompted with several open-ended questions, including a general probe about everything they remembered about being on campus, what they were doing, where they went, if they saw anything unusual and any people with whom they interacted. These participants were asked to write their responses to the questions and asked to provide a written account in whatever form they felt was best (e.g. full sentences, point-form) and were given up to 20 min to complete their responses. All participants completed their responses before the 20-min mark.

In-person individual-spoken and collaborative-spoken interviews were conducted by 32 undergraduate students enrolled in an upper-level psychology course focusing on cold case investigations (i.e. those who provided a written report described above). Each interviewer conducted interviews with at least three witnesses: at least one interview was about the recent event, at least one interview was about the distant event, and one interview was a collaborative-spoken interview with two witnesses (which could be about either the recent or distant event). Interviewers were provided with training on how to conduct an interview before interviewing participants and were provided with an interview script. The training included 1.5 h of in-class instruction on investigative interviewing and 1.5 h on basic memory processes that relate to witness memory (e.g. suggestibility). Interviews were structured to follow best-practice investigative interview principles (i.e. open-ended questions, follow up prompts).

Participants were recruited by interviewers based on opportunity. As such, interviewers may have interviewed someone they were familiar with prior to the interview, but were instructed to invite only those they did not know well. Participants were interviewed either independently or in collaboration with one other individual. To replicate conditions likely to be present in forensic interviews, participants were interviewed collaboratively to understand the impact of having

another witness present during the interview, but witnesses were not asked to provide consistent, agreed upon answers. Participants were only asked about one of the two possible days, as directed by the interviewer. Participants who were not on campus during the initially offered target day were offered the other day for possible recall or excluded from participating if they did not attend either day.

Participants were informed that a crime had occurred on campus on the target day and were asked to recall everything they could from the day to gather comprehensive information about the event. Participants were then prompted using the scripted set of prompts (the full interview script is available at the OSF link above). The prompts included general follow-up prompts ("What else do you remember?"), asking what the individual was doing that day, where the individual went, who they spent time with and if they noticed anything unusual. Participants were also asked to rate how well they believed they remembered the day and how confident they were in the accuracy of their recall of the day, both on a scale that ranged from 1 (not well at all, not at all confident) to 10 (extremely well, extremely confident). After completing the interview, participants were told that no crime had taken place, but researchers were interested in understanding more about memory for events from the recent or distant past that may be helpful in the context of a cold case investigation. All verbal interviews were audio-recorded and transcribed by research assistants for coding.

Participants who were interviewed collaboratively were also asked to rate how well they knew each other on a scale that ranged from 1 (not at all) to 10 (very well). The average response for how well interviewees knew each other was 7.04 ($SD = 2.60$). Roughly half ($n = 14$) of the collaborative pairs reported being together for part of the day they were asked to recall while the remaining pairs did not recall spending time together that day [1]. Upon completion of the study, participants were thanked for their time and provided another opportunity to ask questions.

Interviewer questions

Interviewers asked both scripted (e.g. those provided to the interviewers in their instructions) and unscripted (e.g. those the interviewer asked that were not provided to them as part of the scripted interview) questions. Verbal interviews took an average of 6 min and 10 s for individual-spoken interviews ($SD = 2$ min and 90 s, range = 2 min and 45 s – 20 and 56 s) and 10 min and 6 s for collaborative-spoken interviews ($SD = 5$ min and 10 s, range = 3 min and 39 s – 28 min and 40 s).

Scripted questions: Interviewers were provided with six scripted questions to ask, some of which could be repeated (e.g. What else do you remember?). Overall, interviewers asked an average of 6.73 scripted questions, ranging from two to nine. In collaborative-spoken interviews, interviewers asked an average of 6.45 scripted questions, ranging from two to eight questions. Collaborative-spoken interviewers asked scripted questions to both witnesses at the same time. In individual-spoken interviews, interviewers asked an average of 6.90 scripted questions, with a range of two to nine questions.

Unscripted questions: On average, interviewers asked 1.63 unscripted questions, with a range of 0 unscripted questions up to 18. The unscripted questions included open-ended ($M = 2.17$, range = 0–18) or closed ($M = 1.08$, range = 0–10) questions. Interviewers in collaborative-spoken interviews asked an average of 2.40 (range = 0–18) open unscripted questions and an average of 1.08 (range = 0–9) closed unscripted questions. In individual-spoken interviews, an average of 1.46 (range = 0–7) open unscripted questions were asked, and an average of 1.50 (range = 0–10) closed unscripted questions were asked.

Coding

We were interested in the amount and types of details recalled by participants. Because we did not have ground truth for each participant's activities on the days in question, recall

accuracy could not be determined. The current study does, however, reflect the conditions of many real investigations in which base truth is unknown. Coders identified location, people, time and action details mentioned throughout the interview and separated them into their respective categories. Two coders initially independently coded ten interviews and met to discuss disagreements where one may have identified a detail that the other did not. All disagreements were resolved and the remaining interviews were all double coded, which revealed $k = 0.86$ overall, suggesting excellent agreement among coders (Landis and Koch, 1977). All interviews were then discussed and disagreements resolved.

Interviewee responses were coded for location, people, time and action details:

Location/Setting – details related to the setting or environment (e.g. locations that the participant visited, number of people present, music playing, noise levels, specific booths seen or visited at the event, weather);

People – individuals with whom the participant interacted (e.g. specific individuals, performers, groups of individuals);

Time – details related to specific times of day (e.g. 11:30, noon); and

Actions – actions that took place (e.g. got a hamburger, picked up free things, attended morning class, activated my student card, went home).

Each detail was only classified into one category; if a detail was mentioned more than once, it was only coded once. For collaborative-spoken interviews, details were attributed to which participant reported the detail. Details could be mentioned and coded more than once during collaborative-spoken interviews but only once per participant (e.g. if both participants mentioned seeing the band perform, they would each receive a code for the band). Although interviews were conducted collaboratively, each participant's responses were evaluated independently, which negates possible inflation of the number of details mentioned by both participants.

Next, we were interested in details that could theoretically be used by investigators to verify witness statements. Verifiable details were classified as details that could be checked against an outside source for confirmation (e.g. timing of a class, purchase made with receipt) if a full investigative team was available to explore such details (e.g. through subpoenas, additional witness interviews, ATM receipts/footage). Although we were unable to verify details ourselves, verifiability was coded to explore the frequency of potential investigative leads. Details that were identified as verifiable were then categorized into how they might be verified. Details were categorized into one of the following categories:

Person – a person or group of people that the witness interacted with (e.g. classmates, friend) who could be contacted to verify the witness' claims;

Schedule – scheduled event that was attended (e.g. work, class) that could be confirmed by investigators;

Paperwork/Records – reported details that could be verified through a paper trail or records (e.g. purchase verified by a receipt, parking pass); and

Other – a verifiable detail that did not fit into a prior category (e.g. logged into a video game). Details coded into the "Other" category represented less than 2% of all verifiable details.

Interrater agreement was established between two independent coders at $k = 0.95$, suggesting excellent agreement (Landis and Koch, 1977). Almost all remaining participants recall were double-coded ($N = 139$) and disagreements were discussed [2]. Kappa was $k = 0.95$ overall ($k = 0.98, 0.95, 0.98, 0.97$ for each section of the coding process).

Results

We first assessed the impact of our independent variables by conducting a 2 (delay: recent, distant) × 3 (recall method: collaborative-spoken, individual-spoken, written) analysis of

variance (ANOVA) with the total number of details recalled as the continuous dependent variable. Next, we conducted a series of 2 (delay: recent, distant) × 3 (recall method: collaborative-spoken, individual-spoken, written) ANOVAs for proportions of each detail type (i.e. setting, people, time, action), as well as the number (i.e. people, schedule, paperwork/records) of verifiable details. We report descriptive information for the types of verifiable details recalled. We also conducted 2 (delay: recent, distant) × 3 (recall method: collaborative-spoken, individual-spoken, written) ANOVAs to investigate the impact of our independent variables on participants' confidence and self-reported memory of the event. Tukey's honest significant difference post hoc analyses were used where appropriate. The false discovery rate (FDR) correction was applied where appropriate. Using the default Cauchy prior scale of 0.707, Bayes factors were calculated in JASP 0.17.2.1 (JASP Team, 2023). See Tables 2 and 3 for the descriptive data.

Table 2 Means and 95% confidence intervals of overall details recalled, verifiable details, confidence in memory and how well participants reported they remembered the event

	Individual-spoken recall		*Collaborative-spoken recall*		*Written recall*		*Total*	
Detail	*M*	*95% CI*	*M*	*95% CI*	*M*	*95% CI*	*M*	*95% CI*
Recent event								
Overall details	25.43	[20.33, 30.54]	28.18	[23.81, 32.55]	20.00	[15.64, 24.36]	25.51	[22.73, 28.29]
Verifiable details	6.60	[5.19, 8.01]	7.21	[5.77, 8.65]	7.06	[5.69, 8.43]	6.95	[5.11, 6.92]
Confidence	7.10	[6.26, 7.94]	7.35	[6.76, 7.92]	6.19	[4.95, 7.44]	7.02	[6.56, 7.48]
Memory	5.67	[4.83, 6.50]	5.94	[5.31, 6.57]	5.50	[4.49, 6.51]	5.75	[5.131 6.19]
Distant event								
Overall details	27.57	[22.81, 32.34]	17.67	[14.50, 20.831]	17.13	[13.35, 20.92]	21.00	[18.50, 23.50]
Verifiable details	7.67	[5.74, 9.59]	4.88	[3.63, 6.12]	5.52	[4.23, 6.84]	6.02	[6.13, 7.77]
Confidence	7.10	[6.20, 8.00]	7.20	[6.34, 8.05]	5.68	[4.26, 7.10]	6.80	[6.23, 7.37]
Memory	6.82	[5.25, 8.40]	5.21	[4.27, 6.15]	4.50	[2.89, 6.11]	5.59	[4.831, 6.36]
Total								
Overall details	26.31	[22.83, 29.80]	23.83	[20.71, 26.95]	18.61	[15.83, 21.40]	23.58	[21.65, 25.51]
Verifiable details	7.04	[5.92, 8.15]	6.24	[5.23, 7.25]	6.32	[5.39, 7.26]	6.55	[5.94, 7.16]
Confidence	7.10	[6.50, 7.70]	7.28	[6.81, 7.76]	5.95	[5.06, 6.84]	6.93	[6.57, 7.28]
Memory	6.13	[5.34, 6.92]	5.64	[5.11, 6.17]	5.03	[4.15, 5.92]	5.68	[5.28, 6.09]

Source: Table created by authors

Table 3 Mean proportions, standard deviations and confidence intervals of setting, people, action and time details

	Individual-spoken recall		*Collaborative-spoken recall*		*Written recall*		*Total*	
Detail	*M*	*95% CI*	*M*	*95% CI*	*M*	*95% CI*	*M*	*95% CI*
Recent event								
Setting	40.57	[35.74, 45.41]	36.34	[33.1339.54]	33.25	[30.00, 36.52]	37.31	[34.96, 39.66]
People	19.12	[15.65, 22.57]	19.57	[16.07, 23.07]	18.21	[14.01, 22.42]	19.12	[17.07, 21.18]
Action	32.28	[28.51, 36.06]	37.56	[34.53, 40.60]	30.83	[27.10, 34.55]	34.24	[32.16, 36.31]
Time	8.03	[5.73, 10.30]	6.54	[4.41, 8.66]	17.70	[12.20, 23.20]	9.33	[7.50, 11.20]
Distant event								
Setting	39.57	[35.67, 43.473]	39.09	[32.84, 45.36]	37.73	[31.05, 44.41]	38.92	[35.80, 42.04]
People	20.70	[15.72, 25.67]	20.73	[16.21, 25.25]	19.41	[15.50, 23.31]	20.39	[117.84, 22.94]
Action	32.33	[27.86, 36.79]	36.64	[30.43, 42.84]	33.47	[29.12, 37.84]	34.34	[31.33 37.34]
Time	7.41	[5.31, 9.50]	3.54	[1.50, 5.57]	9.39	[4.92, 13.90]	6.36	[4.77, 7.94]
Total								
Setting	40.16	[37.00, 43.33]	37.48	[34.37, 40.58]	35.42	[31.91, 38.93]	38.00	[36.12, 39.87]
People	19.76	[16.98, 22.55]	20.05	[17.36, 22.74]	18.79	[16.08, 21.50]	19.67	[18.08, 21.25]
Action	32.30	[29.52, 35.08]	37.18	[34.17, 40.19]	32.11	[29.38, 34.83]	34.28	[32.55, 36.00]
Time	7.78	[6.22, 9.33]	5.30	[3.78, 6.82]	13.70	[9.98, 17.40]	8.06	[6.80, 9.32]

Source: Table created by authors

Total number of details reported

Total number of details reported was a combination of all details reported regarding location, people, time and action details. There was a significant impact of recall method on the total number of details reported, $F(2, 134) = 4.90$, $p = 0.009$, $\eta^2 = 0.06$, 95%CI [0.002, 0.14], $BF_{10} = 0.134$. A greater number of details were recalled in individual-spoken interviews when compared to written interviews, $p < 0.01$, $d = 0.71$, 95%CI [0.24, 1.18]. There were no significant differences between individual-spoken and collaborative-spoken, $p = 0.49$, $d = 0.21$, 95%CI [−0.17, 0.58] or written and collaborative-spoken interviews, $p = 0.10$, $d = -0.49$, 95%CI [−0.94, −0.04] in terms of the number of details reported. There was an impact of delay, $F(1, 134) = 5.14$, $p = 0.02$, $\eta^2 = 0.03$,95%CI [0.00, 0.09], $BF_{10} = 0.09$, on the overall number of details recalled. Significantly more details were recalled for the recent day than the distant day, $d = 0.41$ (95%CI [0.07, 0.75]). There was also a significant interaction between delay and recall method, $F(2, 134) = 4.56$, $p = 0.01$, $\eta^2 = 0.06$, 95%CI [0.00, 0.14]. For those recalling collaboratively, a greater number of details were recalled for the recent day compared to the distant day, $p < 0.001$, $d = 0.98$, 95%CI [0.40, 1.54]. There were no other significant differences, p's > 0.30. See Figure 1.

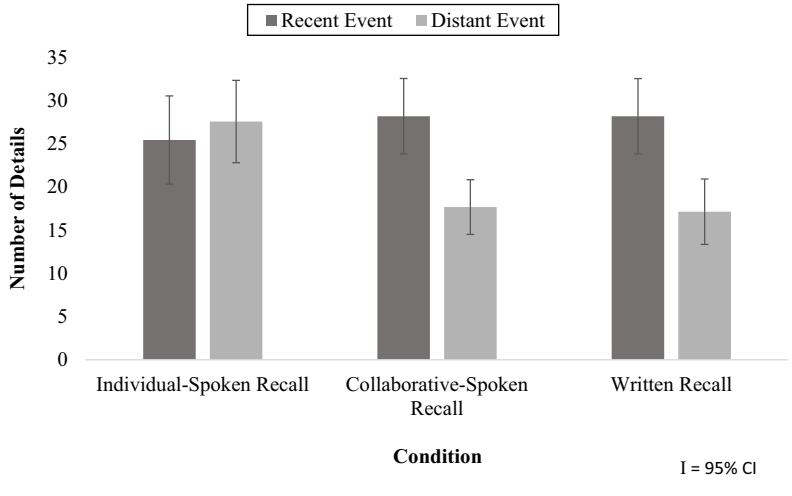
Type of details

See Table 4 for the inferential statistics for the types of details recalled. There was no significant impact of recall method or delay on the proportion of setting, people or action details reported by participants, nor was there a significant interaction. There was, however, a higher proportion of time details recalled in written recall compared to both the individual-spoken and collaborative-spoken recall conditions. There was also a higher proportion of time details recalled for the recent day compared to the distant day. There was no significant interaction between delay and recall method on time details.

Number of verifiable details

Participant responses were also coded for verifiable details. There was no effect of recall method, $F(2, 134) = 0.76$, $p = 0.47$, $\eta^2 = 0.01$, 95%CI [0.00, 0.06], $BF_{10} = 0.14$ or delay,

Figure 1 Total number of details reported



Source: Figure created by authors

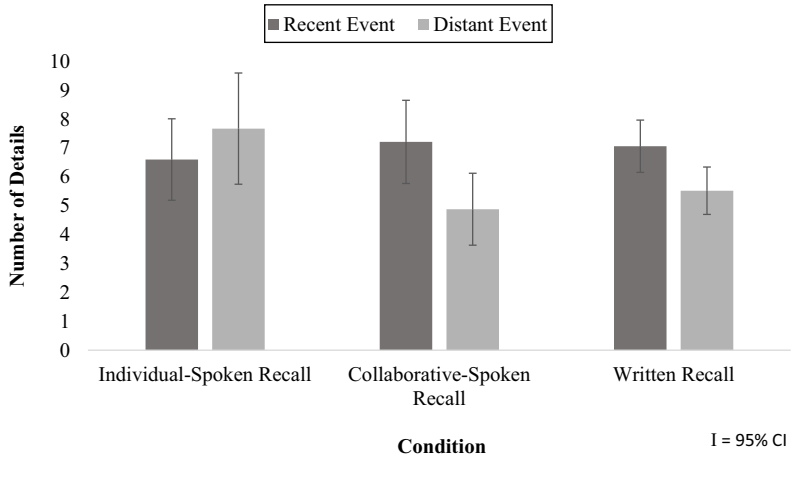
Table 4 Inferential statistics for type of overall details recalled

Detail	df	F	p	η^2 *(95% CI)*	BF_{10}
Setting					
Recall method	2, 134	1.84	0.39	0.03 (0.00, 0.09)	0.34
Delay	1, 134	0.87	0.70	0.006 (0.00, 0.03)	0.25
Time × method	2, 134	0.66	0.78	0.009 (0.00, 0.04)	
People					
Recall method	2, 134	0.18	0.98	0.003 (0.00, 0.02)	0.08
Delay	1, 134	0.65	0.73	0.004 (0.00, 0.03)	0.24
Time × method	2, 134	0.01	0.99	<0.001 (0.00, 0.003)	
Time					
Recall method	2, 134	16.46	<0.001	0.19 (0.08, 0.30)	0.09
Delay	1, 134	8.82	0.02	0.05 (0.00, 0.12)	1.85e-5
Time × method	2, 134	3.28	0.012	0.04 (0.00, 0.10)	
Actions					
Recall method	2, 134	4.01	0.08	0.05 (0.00, 0.12)	1.00
Delay	1, 134	0.02	984	<0.001 (0.00, 0.003)	0.08
Time × method	2, 134	0.31	0.97	0.004 (0.00, 0.03)	

Note: All *p*-values presented are adjusted with the FDR correction
Source: Table created by authors

$F(1, 134) = 2.27$, $p = 0.13$, $\eta^2 = 0.02$, 95%CI [0.00, 0.08], $BF_{10} = 0.52$, on the number of verifiable details recalled. There was, however, a significant interaction, $F(2, 134) = 3.12$, $p = 0.047$, $\eta^2 = 0.04$, 95%CI [0.00, 0.12]. To explore this interaction, we compared recall method at each delay. There were no significant differences across recall method for the recent delay, but when participants were asked to recall a distant event, those in the individual-spoken condition reported more verifiable details than those in the collaborative-spoken condition, $p = 0.02$, $d = 0.78$, 95%CI [0.14, 1.40]. Written recall did not differ from collaborative, $p = 0.82$, $d = 0.24$, 95%CI [−0.43, 0.90] or individual-spoken recall, $p = 0.15$, $d = 0.60$, 95%CI [−0.09, 1.27], for the distant day. See Figure 2 for a representation of verifiable details.

Figure 2 Number of verifiable details reported



Source: Figure created by authors

Types of verifiable details

We were also interested in the types of verifiable details witnesses recalled that could be used by cold case investigators to corroborate witness statements. To explore this question, we examined the average number of details reported by participants that fell into one of four verifiable categories. Participants reported an average of 6.6 ($SD = 3.64$) verifiable details. Most verifiable details were reported in relation to person details (64.99%; $M = 4.3$, $SD = 3.06$; i.e. other individuals the witness interacted with such as friends, instructors, cashiers or classmates), followed by schedule related details (23.88%; $M = 1.6$, $SD = 1.12$) and paperwork/records (9.71%; $M = 0.63$, $SD = 0.88$). All remaining verifiable details (e.g. "I downloaded an app") were coded as other (1.85%; $M = 0.10$, $SD = 0.38$).

Memory

Witnesses also rated how well they remembered the event on a scale from 1 to 10. There was no significant impact of recall method, $F(2, 132) = 2.03$, $p = 0.13$, $\eta^2 = 0.03$, 95%CI [0.00, 0.09], $BF_{10} = 0.37$ or delay, $F(1, 132) = 0.08$, $p = 0.77$, $\eta^2 < 0.001$, 95%CI [0.00, 0.01], $BF_{10} = 0.20$ on memory ratings. There was also no significant interaction, $F(2, 132) = 2.74$, $p = 0.07$, $\eta^2 = 0.04$, 95%CI[0.00, 0.10].

Confidence

Witnesses also provided a confidence rating on a scale from 1 to 10 for their memory of the event. There was a significant effect of recall method on confidence, $F(2, 132) = 4.38$, $p = 0.01$, $\eta^2 = 0.06$, 95%CI [0.00, 0.14], $BF_{10} = 1.00$. When asked to recall verbally (either collaboratively or individually), participants were more confident in their recall than when asked to write down their report of the event. There was no impact of delay, $F(1, 132) = 0.24$, $p = 0.63$, $\eta^2 = 0.002$, 95%CI [0.00, 0.02], $BF_{10} = 0.08$, on confidence in memory. There was also no significant interaction, $F(2, 132) = 0.14$, $p = 0.87$, $\eta_p^2 = 0.002$, 95%CI [0.00, 0.02].

Discussion

Our findings provide important insight for investigators interviewing witnesses who may have unknowingly witnessed something helpful to an investigation. Though small and inconsistent, advantages observed across recall methods were primarily associated with individual recall, and in no instance was there an advantage to collaborative recall (though, perhaps concerningly, those who recalled collaboratively were more confident than those who completed written recall). Only those who recalled in written form demonstrated reported greater amounts of time-related details. Not surprisingly, significantly more details were recalled for the recent day than the distant day, but it was interesting to note that there were not more verifiable details reported by those who recalled the recent event. Perhaps solely due to the delay, or other influential factors during the delay (e.g. interference from similar events), recall of event details for the distant event was lower than that for the recent event. This finding is consistent with a large literature suggesting that investigators should seek to gather information from witnesses as soon as possible after an event (Fisher and Geiselman, 1992; Lamb *et al.*, 1998). Of course, once considerable time has passed, as is the case in a cold case investigation, investigators must be aware of relatively weaker memories and adjust their expectations for event details recalled.

In the present study, those recalling the event individually in verbal form recalled a greater amount of information than those writing their recall. Perhaps interviewer prompting with additional questions may have provided witnesses with further opportunities for recall (Bergmann *et al.*, 2004; Sauerland and Sporer, 2011; Sauerland *et al.*, 2014). It may also be that spoken recall resulted in more information as the verbal modality is used more in day-to-day life than writing, and is less cognitively taxing (e.g. takes less time, do not have to

consider spelling; Kellogg, 2007; but see Grabowski, 2007 for a conflicting perspective). We found no benefit to collaborative-spoken recall on the overall number of details reported in the present study, but also no negative impact – a finding that is contrary to some prior work (Hope *et al.*, 2008), which found more inaccuracies with collaborative-spoken recall. Perhaps simply being interviewed in a pair, but not being asked to agree upon an answer reduced the negative impact of collaborative-spoken recall. Takahasi and Saito (2004) also found that the negative effects of collaborative recall were reduced after a shorter delay than in the present work (i.e. 1 week), which may help to explain our findings. The lack of a benefit to collaborative-spoken recall over individual-spoken recall, paired with the lack of clear disadvantage for collaborative-spoken recall, might point to the use of collaborative-spoken interviews when investigative resources are taxed and interviewing multiple witnesses is more practical. Of course, in the present study we were unable to assess accuracy. Future research should assess the potential costs and benefits to the accuracy of details reported with each recall method.

There was only one instance in which there was an advantage to written recall: an increased proportion of time-related details (e.g. time of day, morning, afternoon). It may be that writing down events allows for better recall or organization of timing. Grabowski (2007) suggested writing reduces demands on working memory and cognitive load, and may result in improved recall over spoken recall, a conflicting argument to that of Kellogg (2007). Although we did not see a generalized benefit of written recall, perhaps the reduction in cognitive load may allow those providing written recall to produce more specific information, such as times of day. Specific exploration, and replication, of this finding is needed before recommendations can be made.

We also examined participants' recall of verifiable responses (i.e. those that could be followed up on as a lead in an investigation). Participants in all modalities recalled information that would allow officers to further their investigation. As witnesses may be a particular useful form of evidence in closing investigations (Davis *et al.*, 2013), it is important to understand the circumstances under which the greatest amount of verifiable information may be produced. In the present study, participants recalled a relatively large number of verifiable person details, which investigators could use to track down additional potential witnesses; even these "secondary" witnesses can lead to additional witness evidence which will further require additional resources to gather. These witnesses may ultimately contribute to a break in the case and it is crucial that investigators have evidence-based methods with which they can gather large volumes of witness information from witnesses who may not be aware of what they know.

When participants were asked to recall a distant event, more verifiable details were reported when recalling individually than in a pair. Though further research is required, it appears that when recalling after a delay, individual-spoken recall may prove most productive for investigative leads. A potential explanation for why individual-spoken interviews resulted in more verifiable details is that memory is weaker after a delay, and participants may have been more hesitant to report details they were less sure of in front of a partner who may have a stronger memory. Interviewees may have withheld from reporting information that they were less sure of or that could be proven wrong by the additional witness.

The present work also provides some insight into interviewer variability. Although interviewers were provided with a script containing specific questions to use in interviews, there was variability in the number and types of questions asked, as well as the length of interviews. Interviewers asked both scripted and unscripted questions. Further, unscripted questions were both open and closed. All interviewers received the same training but were given discretion in conducting the interviews based on responses provided by participants as would happen during the execution of a real investigative interview. Although outside the scope of the present work, further research should systematically examine differences across interviewers to better understand how interviewer variability may impact recall.

Limitations and future directions

As is the case with many studies regarding long-term recall, ground truth in the present study was unknown. As such, we were not able to evaluate the accuracy of participants' memories and our analyses were restricted to the volume and types of details recalled. However, in real world cold case investigations, ground truth is also unknown. Nonetheless, future research should address this important limitation. Another limitation is that undergraduate students took on the role of interviewers. While the students received training in best practice interview techniques, this training does not replace the experience that investigators would bring to an interview. Investigators may choose to ask different questions or follow different lines of questioning to obtain relevant information. Further, in the present design, 32 interviewers each interviewed between three and five "witnesses." It should be noted that there may be interviewer effects because some witnesses were interviewed by the same interviewer. While interviewer effects were not the central focus of the present study (and interviewers always interviewed participants in both individual and collaborative spoken interviews), it remains possible that this clustering may have impacted our findings. Specifically, the interviewer clustering inflated our sample. Thus, we encourage replication of our research to determine whether interviewer clustering impacted our findings. A third limitation was that our sample size was limited due to practical considerations. However, we conducted a sensitivity analysis after completion of data collection and determined we had power of 0.80 to detect an effect as small as $f > 0.27$, power of 0.90 to detect an effect as small as $f > 0.31$ and power of 0.95 to detect an effect as small as $f > 0.34$. Future research should attempt to replicate our findings with a larger sample.

Conclusion

The present study offers a first step in understanding what may be recalled in a simulated cold case investigation. In a variety of contexts, investigators may put out a wide call for witnesses when all other avenues of evidence have been exhausted. Implementing such an expansive witness interviewing strategy may lead to interviewing those who are unaware they have witnessed something important. The present findings suggest interviewing such witnesses individually, and as soon as is possible, will provide the most information, and the greatest amount of details that will allow for investigative leads to be developed. The present study provides important information regarding recall for an unremarkable day, which future research should continue to build upon.

Notes

1. One pair did not report if they were together on the day of the event.
2. The final 11 participants were coded by a single coder.

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