Expanding Research on Investigations of Officer-Involved Shootings: An Experimental Evaluation of Question Timing on Police Officers’ Memory Recall

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Abstract:
The timing of an investigation after an officer-involved shooting (OIS) is influenced by conflicting forces. The public demands expedited resolution, but police officers are provided several protections which can delay investigations of their actions. This study conducts a randomized experiment to determine the impact of question timing after an OIS on the accuracy of police officers’ memory recall. Officers were randomly assigned to one of two groups. The treatment group completed a questionnaire after participating in a live-action, active shooter training scenario and again 2 days later, while the control group only completed the questionnaire 2 days later. Our findings suggest the timing of interviews after training did not influence officers’ recall of the scenario. There is little empirical understanding of how police officers reconstruct OIS events, further interdisciplinary research can help clarify these cognitive processes. This research could strengthen a traditional pathway to provide accountability for officers through investigations.

Keywords: officer-involved shooting, investigations, memory recall, use of force, randomized experiment

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Introduction

Officer-involved shootings (OIS) have a substantial impact on police-community relationships (President’s Task Force on 21st Century Policing, 2015). Several high-profile incidents over the past decade have reignited public criticism of police agencies’ use of force practices and policies. These incidents are difficult to investigate for several reasons including they often rely on officers’ recollections of these traumatic events (see Hatch & Dickson, 2007). The adoption of body-worn cameras (BWC) became a leading policy solution to address this problem by offering a more objective perspective of these incidents (Lum et al., 2019). While watching what happened through the lens of a camera is helpful to reconstruct events, prevailing legal precedence for OIS still prioritizes officers’ perceptions of events as the primary consideration for the justification of use of force (see *Graham v. Connor*, 1989). Footage from a BWC provides a limited view of police-civilian encounters and has been described as “watching a baseball game through a straw” (see Alpert & McLean, 2018, p. 4). In addition, not all police agencies have deployed BWC and there are various practical concerns about this technology such as cost effectiveness (Miller et al., 2014).

Police officers’ decisions are evaluated based on the totality of circumstances surrounding OIS incidents. This includes the context of several situational factors from the officer’s cognitive or decision-making perspective at the time of the incident. Using this vantage point provides various challenges given that officers’ perceptions may be skewed during these incidents (see Klinger, 2007; Klinger & Brunson, 2009; Stoughton et al., 2020). Officers make split-second, life-or-death decisions with limited information and could be motivated to tell a more favorable account of their decisions to minimize personal liability. As such, it is crucial to continue to understand the psychological context of officers’ perceptions from their point of view instead of relying exclusively on video recordings as a “one-size fits all” solution to

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investigate these complicated incidents. Today, millions of people can instantly watch videos of OIS recorded by witnesses and shared on social media platforms. These videos prompt the public to ask numerous questions about these incidents including one of the most essential: what were the police officers thinking? Unfortunately, there is a shortage of rigorous research on the reliability of police officers' memory in the aftermath of OIS. While police officers are a unique population that receives specialized training due to their frequent exposure to stressful situations (see Vredeveldt & van Koppen, 2016), there is an overwhelming body of research which raises questions about the reliability of all eyewitness' memory (Morgan et al., 2004; Toglia et al., 2017; Yuille & Cutshall, 1986).

The timing of investigations after OIS has emerged as a critical issue. There is public pressure in high-profile cases to offer an expedited resolution to these investigations (Phillips, 2018). This demand is counterbalanced by policies created through collective bargaining agreements with police unions to delay investigations, providing officers a "bill of rights" which guides their legal representation (Keenan & Walker, 2004). These differences can create two distinct tracks for investigations and there is little understanding if these counteracting forces influence the underlying efficacy of investigations. Even beyond these factors, there is no consensus from practitioners or researchers on the optimal time to interview police officers after an OIS for the purpose of memory recall (see Lewinski et al., 2016). Because many OIS incidents do not receive media coverage or additional video evidence, improving the traditional investigatory framework of police agencies offers a crucial step to strengthen the mechanisms for accountability of the use of excessive force. The present study expands scientific knowledge on officer recall after an OIS, specifically if changes in the timing of interviews between immediate and delayed periods after OIS impacts memory recall. Our goal is establishing a baseline

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representation of police officers’ memory recall after OIS training scenarios to build upon for future research which explores the influence of the unique stressors associated with these actual events. The discussion of findings presents a call to action for further collaboration between researchers in criminal justice and applied psychology to continue to uncover the nuances of how police officers reconstruct OIS incidents.

Memory Recall & OIS Investigations

Traditionally, police investigators suggested officers involved in an OIS incident should be interviewed shortly after the event for the most accurate memory recall. An alternate perspective, to delay the interview for 2 days, has gained recent attention, as the additional time allows for rest and for the officer to process the event (see Grady et al., 2016). Advocates for delayed interviews argue the extreme stress of these incidents leads to less accurate recall if interviews are conducted in the immediate aftermath. Instead, they highlight the benefits of improved memory consolidation and encoding after rest and sleep (Stickgold & Walker, 2013). Delayed recollections are thought to lead to more complete information, as research shows we fill in more details about traumatic events over time (see Campbell, 2012). Furthermore, Grady and colleagues (2016) note that the level of stress at the time of the interview is more important for memory recall accuracy than the level of stress at the time of the incident. Delayed recall provides the officer with time to calm down and “de-stress” before being interviewed about the event (Grady et al., 2016). There is little doubt that our brains process events and store memories differently in emotional or stressful situations compared to more common events (Diamond et al., 2007).

Researchers have considered whether stress disrupts memory-retention (e.g., Southwick et al., 1997) or whether it improves memory encoding (e.g., Canli et al., 2000). Additionally,

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threatening stimuli (including visual and auditory stimuli) can even distort officer perceptions, impacting recall (Alpert, 1987; Klinger, 2007; Klinger & Brunson, 2009). For example, Lewinski and colleagues (2016) found officers' recollections of their movements were different from their actual movements in a study involving simulated live-action dangerous traffic stop scenarios where suspects shot at officers. There is evidence suggesting a reduction in recall accuracy and completeness for stressful events. Deffenbacher and colleagues (2004) conducted a meta-analysis on eyewitness memory and found that research results show that stress negatively impacts the accuracy of memory recall for eyewitnesses. Hope (2016) found similar results for the impact of stress and anxiety on police officers' memory in critical incidents.

However, Beehr and colleagues (2004) found police officers focused on and had more accurate recall for "task salient" aspects of a stressful event, such as the number of armed assailants or objects in closer proximity to the immediate threat. Additionally, Hulse and Memon (2006) used video simulation of domestic violence incidents to examine the impact of stress on officer recall and found officers involved in a more threatening scenario had more accurate (but less complete) recall than officers involved in a less threatening scenario. Although there is some research on perceptual distortions and memory gaps following an OIS and how certain threatening stimuli may impact memory (Alpert, 1987; Klinger, 2007; Klinger & Brunson, 2009; Lewinski et al., 2016), research has been mostly silent on the most appropriate timing for questioning of officers to improve accurate recall.

Conversely, there remains continued support for immediate interviews of officers involved in OIS or other critical incidents. This perspective is founded on the assertion that memories can become contaminated or degraded over time. Lingering stress, in turn, may also degrade witness' and officers' ability to recall events accurately and be compounded over this

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period (Wolchover et al., 2014). Some scholars note that sleep may increase the possibility of false memories (see Payne et al., 2009). In a review of studies on the topic, Grady and colleagues (2016) report research that suggests earlier questioning improves memory retention over time, as well as evidence that memory decays over time, at least in the general population (see Campos & Alonso-Quecuty, 2006; Porter et al., 2019; Read & Connolly, 2007). Furthermore, the longer the delay between the incident and the interview, the more contamination, misinformation, or new information is likely to impact memory (Chan et al, 2009; Grady et al., 2016; Zaragoza et al., 2007). For example, officers could have discussions with family members, lawyers, and union representatives while avoiding potential media coverage of the incident. Each is a source of potential contamination which could unintentionally influence recollections. While informative, it is important to note that these findings are based on a review of general studies of memory and cognition; the findings are not necessarily transferable to our understanding of a police officer’s memory following a critical incident.

Yuille and colleagues (1994) examined the role of both stress and question timing on memory recall for police trainees in England. They found that the officers who were exposed to uncooperative and belligerent suspects (i.e., a stressful scenario) had more accurate recall after a 12-week compared to one week waiting period, but their memories were less complete, focusing primarily on the most critical aspects of the interaction. Conversely, Beehr and colleagues (2004) examined officer memory with training scenarios after 12 weeks and Alpert and colleagues (2012) examined officer memory after 3 days. Both studies found that immediate questioning could improve longer term memory for the event, with memories less accurate after the delay period. These studies suggest that the ‘rehearsal’ function of early questioning could mitigate long-term memory decay. Similarly, a more recent study (see Hartman et al., 2017) found no

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significant decay in officers' memory of a critical incident training scenario, with no significant changes between officers' immediate recall and a four- to ten-week follow-up interview.

We are only aware of two experimental studies which examine the impact of question timing on memory recall for police officers involved in OIS. The first study used a randomized control trial; Porter and colleagues (2019) provided a written questionnaire at two time points to police officers in Queensland, Australia undergoing active shooter instructor training. The officers in their study were randomly assigned to one of two groups and asked structured response questions about the incident. The first group was questioned immediately following the simulated incident and again 2 days later, and the second group was only questioned after the two-day resting period. Overall, the authors found there was some decline in memory accuracy over time, but this depends on the specific information officers are asked to recall; delayed memory (for the second group) was worse than immediate memory for "non-threat" related details, but not "threat" related details. Furthermore, in line with the rehearsal effect discussed above, officers who were questioned at both times, did not experience the same memory degradation over time. The authors concluded that their study does not support the argument that delayed interviews provide pronounced improvements in recall.

The second study used a quasi-experimental design; Phillips and colleagues (2021) interviewed police officers in upstate New York counties undergoing critical incident training at various time points. The training scenario used a video simulation where officers responded to a single suspect in a residential area. The treatment group was interviewed immediately after the training and again 3 days later, while the control group was only interviewed 3 days later. The authors were unable to randomly assign officers to each group because they were volunteers and the research team did not know how many individuals would participate. While the findings of

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the study showed a tendency for immediate recall to be superior to delayed recall, the difference between the two groups’ recall of the scenario was not statistically significant, possibly due to the small sample size of 42 officers for the between-groups analysis. There were, however, noteworthy differences within individuals’ recall of threat compared to non-threat details.

The current study explores the generalizability of Porter and colleagues’ (2019) results in the United States and expands upon Phillips and colleagues’ (2021) quasi-experimental study. The replication of previous research is an essential requirement to determine the validity of findings; this process has even been considered “the Supreme Court of science” (see Campbell & Stanley, 1963; Campbell, 1985, p. 21; Pickett, 2019). Our study is designed to establish a baseline understanding of officers’ memory recall after an OIS scenario. Once investigators have a broader comprehension of the recall capabilities of officers to remember objective details of events (e.g. do officers recall the number of shots fired?) they can further unpack the psychological nuances of officers’ recall which are more complex (e.g. why would an officer misrepresent this information?).

A wide range of reforms have been considered in response to public criticism after high-profile cases where officers used force on civilians in recent years (Alpert et al., 2017; Li & Lodhi, 2020; Lum et al., 2019). Our proposal of focusing on question timing for OIS investigations is seemingly one of the more modest reforms proposed in the wake of the social unrest surrounding these cases but it targets two major issues which can have a substantial impact on police accountability. First, this approach places the officer’s perception of the events at the forefront of inquiry. There is little scientific understanding of how police officers reconstruct events after an OIS and the current legal framework prioritizes officers’ accounts, both are potential barriers to accountability. Second, focusing on improving investigatory

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strategies can bolster the internal mechanisms by which police agencies hold officers accountable. These investigations represent a critical juncture where the broader structural policies of agencies interact with the direct accountability of individual police officers.

Method

The OIS Scenario

Our research team collaborated with the participating law enforcement agency (see Section 3.3) to create a live-action OIS simulation for their routine in-service active armed offender (AAO) training (see Armstrong et al., 2004). In the scenario, officers were tasked with responding to a domestic disturbance call for service. A detailed script of how the scenario would unfold was rehearsed prior to the training sessions by the research team and the trainers for consistency between scenarios. The scenarios were observed by the research team during the experiment to ensure quality control for the consistent reproduction of the scenario by the trainers between pairs of trainees. The scenario involved an armed suspect and two victims. Officers would approach an apartment with assistance from a landlord and resolve an incident by addressing the threat posed by the armed suspect. The scenario was designed to place officers in a situation where they would likely be required to use force against an active armed individual.

As officers approached the apartment, they heard a loud argument, and a young woman would answer the door with a visible wound on her head. The woman would describe the ongoing fight and indicate the officers should intervene. Upon entering the apartment, another wounded individual, plainly visible, was on the ground next to a man on a couch with a gun. This armed individual would threaten the officers and aggressively move towards them as they entered the apartment. Officers would be free to resolve the situation using their discretion, although each scenario ended with at least one of the two officers shooting the armed individual.

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There are several practical and ethical challenges to fully simulating the stress of OIS during a training scenario. Therefore, our study explicitly collects data in laboratory conditions which can only offer a realistic scenario and not a comparable physiological response by the officers. The goal of this study is to provide a baseline account of memory recall after these rare events. This can provide an empirical foundation for further understanding the complexities of these investigations (e.g. stress, contamination, etc.) on memory recall.

Experimental Design

The current study conducts a randomized controlled trial to examine the effect of question timing on memory recall after involvement in an OIS. The timing of questioning after the AAO scenario was manipulated between two groups. This study uses a post-test only randomized design which is a variation of the classical experiment (Cook & Campbell, 1979). The scenario was completed by pairs of officers with each participant randomly assigned to one of the groups. Officers assigned to the first group were given a questionnaire after conducting the scenario (i.e. condition 1), and again 48 hours later (i.e. condition 3). The second group was given the questionnaire only 48 hours after the scenario (i.e. condition 2). Officer-subjects were instructed by the trainers not to discuss their specific actions in the scenario with anyone and the administration of the questionnaire for both groups followed an identical procedure. This produced a between- and within subjects' research design. Comparisons among pairs of these conditions allowed for the observation of three specific contrasts or research questions on the effect of question timing; immediate and delayed (conditions 1 & 2), immediate and repeated, (conditions 1 & 3), and delayed and repeated (conditions 2 & 3).

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Data

The study was conducted by enrolling officers from the Richland County Sheriff's Department (RCSD). Richland County, South Carolina is home to the city of Columbia, the capital of South Carolina, and a large part of its surrounding metropolitan area. In 2018, the population of Richland County was 414,576 residents with a racial demographic distribution of 48.2% African American, 45.9% White, and 5.9% other races (U.S. Census Bureau, 2018). RCSD employs approximately 700 sworn officers. A total of 92 active sworn officers participated in the training scenario. However, five officers were removed from the analysis because they did not show up to complete questionnaires for the delayed or repeated condition, resulting in a final sample of 87 participants. Statistical power analyses for this study show a power level of .80 for large effects (30% difference), .50 for medium effects (21% difference) and .20 for small effects (12% difference) based upon our sample size. Sensitive designs are recommended to have a power level greater than .80 with a minimum viable threshold above .50 (see Weisburd & Britt 2007). Similar to Porter et al. (2019), the power analyses suggest our study is able to detect statistical significance for large differences between the treatment and control groups, although more caution is required if observing small or moderate effects.

Table 1 shows the demographic and employment characteristics for the 87 participants. There were no statistically significant differences between the two groups on any of the characteristics observed. The mean age of the sample was 39.91 years old with an average of 10.34 years of experience as a police officer. Most of the sample was male (78.2%), White (64.4%), with some completed education post-high school (62.1%), the rank of deputy or senior deputy (55.2%) and a plurality in the current role of patrol (44.8%). All participants were undergoing mandatory in-service training; thus, the sample is generally representative of all

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officers involved in operational duties and most likely to encounter critical incidents involving the use of force. While the AAO training was encouraged, participation in the study was voluntary and required informed consent.

[Table 1 about here]

Questionnaire Design

Interviews are the foundation of investigations where officers report their decision-making process and reconstruction of events. We created a questionnaire with both free recall and open-ended questions to approximate the post-OIS interview. The questionnaire first asked participants to provide a free recall of what they could remember about the events that occurred in the scenario. Participants were instructed to report details of events both leading up to the encounter with the armed individual and during the encounter. This was to encourage the maximum amount of narrative details, and to resemble as closely as possible the writing of an ‘incident report’ which is standard procedure for police officers after OIS incidents. We focused on the accuracy of details reported through open-ended recall questions on specifics details of the event, rather than the accuracy of free recall responses. Assessments of accuracy of free recall are difficult. These qualitative responses could vary based upon whether a participant thought a detail was relevant or the specific language each respondent used. These factors present challenges for quantitative between-subject comparisons of accuracy without a set of standardized items. Therefore, our primary recall measure was based on a set of objective, open-ended follow-up questions that were asked to each participant via the questionnaire.

Memory Recall Questions

We measured memory recall as the correct identification of 20 details from the scenario. The 20 questions, replicating Porter et al. (2019), concerned details that varied both as to the

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threat level of the information (two levels: threat or non-threat) and the sensory type of detail (three levels: visual, auditory or spatial/temporal). These categories were included because Porter and colleagues found important variation between classifications of questions. ‘Threat’ details were defined as vital information to the immediate safety and physical wellbeing of the officers or victims in responding to the incident. ‘Non-threat’ items related to details that fell outside of this definition but were contextual details potentially relevant to an investigation of the incident. Table 2 presents each of these questions. Across all the items 10 of 20 contained threat details. Of these threat details, four were visual items, incorporating details about weapons present and victim injury, three were auditory items concerning verbal threats to life and gunshots, and three were spatial items concerning the proximity of the shooter to the officers.

The remaining 10 items were determined by the research team to be non-threatening details or not immediate safety concerns, but still of potential interest to investigators. These non-threatening details included two visual items with questions about the clothing of those present, four auditory items concerned with which officer fired first, the number of shots the officers each fired at the shooter, and victim speech, and four spatial/temporal items which asked how long the scenario lasted, the number of rooms the officers searched before they encountered the shooter, and where the shooter was standing. Organizing questions under this factorial approach, therefore, ensured each question concerned either a threat or non-threat detail that was either visual, auditory or spatial/temporal in nature. All participants were questioned on all 20 details; therefore ‘threat’ and ‘sensory type’ are explored as within-subjects’ factors. The final study design is, thus, a 2 (timing) x 2 (threat) x 3 (sensory type) design, which allows for the main effect of the treatment conditions to be examined while accounting for the threat and

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sensory type of the information within the questions, as well as exploring possible interactions between each.

[Table 2 about here]

Memory Recall Assessment

This design of the questionnaire allowed for each participant’s answers to be scored as a dichotomous ‘incorrect’ or ‘correct’ response. A short observation checklist was used by training instructors during each scenario to document five items from the questionnaire that would vary between scenarios (e.g., number of shots fired by officer). The 15 remaining questions had fixed answers which were constant between scenarios (e.g. the suspect’s weapon). Each officer in the scenario was scored based upon the objective answers to these questions instead of trying to assess participant agreement within the pair (i.e. match what their partner said). The questions were assessed by the proportion of correct answers that were recalled overall (e.g., 15 of 20 total questions), and by specific category of information (e.g., 7 of 10 threat questions, 3 of 10 non-threat, etc.). The decision to code responses as a binary of correct or incorrect was more challenging for certain questions (see Hulse and Memon, 2006). For example, the non-threat question of which officer fired their weapon first had a clear, correct or incorrect answer for the purpose of coding. Other questions, such as having officers estimate the length of the entire scenario through an open-ended question, could present opportunities for officers to provide answers which are ranges such as 2-3 minutes or proximate to the specific answer such as saying a scenario lasted 2 minutes when it only lasted 1 minute and 45 seconds. Specific guidelines were established for each question on what constituted a correct or incorrect response. Regarding the above question, we established a “reasonable range” which would consider both answers as

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correct. Our main goal was to separate officers that were blatantly incorrect (i.e. saying 10 seconds for a 2-minute scenario) or did not even respond.

Analysis

The responses for all participants were double coded and inter-rater reliability exceeded 90% for each question which suggests substantial consistency among coders. Each specific inconsistency was then checked and mutually agreed upon between coders to produce a final data file. The dependent variable we modeled is the mean percentage of correct answers. Therefore, variation in the means is contrasted based upon the 2 (timing) x 2 (threat) x 3 (sensory) design. Before conducting the analysis, our dependent variable was checked for dependencies between participant pairs (i.e. all participants experienced the scenario in teams of two). Following Hope and colleagues (2016), the method of Alferes and Kenny (2009) was adopted to analyze distinguishable pairs or the effect of consistency between partners answers. Tests indicated the presence of dependency between paired responses. We therefore used linear mixed models via the Stata 15.1 “mixed” command with maximum likelihood estimation to allow individuals’ responses to be nested by ‘team’ (i.e. scenario pairs).

The 2 x 2 x 3 factorial design was analyzed, entering all independent variables (main effects) and two-way and three-way interactions as fixed effects, with random effects specified for the repeated responses of the participants nested within the participant pairs. This provides the most robust approach for the decomposition of means and resulting error structure based upon the comparison of each factorial component. Likelihood ratio tests indicated that the nested models were a better fit to the data than the non-nested models (with scenario pair accounting for 3.12%, 6.70%, and 3.16% of the variance in recall for the three models, respectively), although the actual pattern of significance across the model effects (and, therefore, the conclusions drawn)

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were unchanged between the nested and non-nested models. Significant effects were followed up with pairwise comparisons of the estimated marginal means with Bonferroni correction thus considering the model effects, rather than performing t-tests on the raw group means.

Results

The results examine the effect of timing of questioning on memory. First, findings from the free recall data are presented. Then each of the three comparisons of conditions presents a research question which is assessed to determine: 1) the effect of delay, 2) the effect of repeated questioning, and 3) the effect of prior questioning on memory recall.

Does timing affect the amount of detail mentioned in free recall narratives?

The amount of detail reported in the free recall narratives was compared between condition 1 (immediate recall) and condition 2 (delayed recall). The mean total number of threat details reported in the narratives did not differ significantly across the conditions; for condition 1 $M = 2.19$ ($SD = 1.97$) and condition 2 $M = 2.20$ ($SD = 2.24$; $t = -0.041$, $p = .968$). This was also observed when comparing only the proportion of the ten details that were later subject to specific questioning; condition 1 $M = 33.95\%$ ($SD = 11.37$) and condition 2 $M = 32.95\%$ ($SD = 11.33$; $t = 0.41$, $p = .680$). The mean total number of non-threat details reported in the narratives did not differ significantly across the conditions; condition 1 $M = 6.79$ ($SD = 5.2$) and condition 2 $M = 5.89$ ($SD = 3.57$; $t = 0.909$, $p = .366$). Additionally, the proportion of the ten non-threat details did not differ significantly: condition 1 $M = 15.12\%$ ($SD = 12.03$) and condition 2 $M = 18.64\%$ ($SD = 12.12$; $t = -1.36$, $p = .18$).

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Does timing of questioning affect memory recall?

To answer research question one, we used a linear mixed model to test the main, and interaction, effects of timing condition (condition 1: immediate, versus condition 2: delayed questioning) and question content regarding threat (threat, non-threat) and sensory type (visual, auditory, and spatial/temporal) on memory recall for the scenario. Table 3 shows the estimated marginal means. The main effect for timing was not significant ($F = 0.16, p = .693$). The main effect for threat type was significant ($F = 16.00, p < .001$), with participants tending to remember a significantly higher proportion of threat items than non-threat items. There was also a significant main effect of sensory type ($F = 24.59, p < .001$).

Pairwise comparisons showed participants remembered a significantly higher proportion of auditory details compared to spatial/temporal details, *mean difference* = -8.47 ($SE = 2.70, t = -3.14, p < .001, 95\% \text{ CI } [-13.78, -3.27]$), but not visual details, *mean difference* = -2.17 ($SE = 2.70, t = -.80, p = .422, 95\% \text{ CI } [-7.45, -3.12]$). There was not a significant two-way interaction between timing condition and threat type ($F = 0.04, p = .835$). The interaction between timing condition and sensory type was also not significant ($F = 0.11, p = .946$). In answer to research question one, then, timing of questioning did not impact overall memory recall or for threat and sensory details.

[Table 3 about here]

Repeated questioning: does delay change memory?

This section explores within-subjects' change in memory to address research question two, asking whether the individuals in group 1 who were questioned immediately after the incident (condition 1) showed a difference in their memory when questioned 2 days later (condition 3). A linear mixed model explored the condition x threat x sensory type factorial

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design, where condition represents the repeated memory test of group 1. Table 4 shows the estimated marginal means of the percentage of questions answered correctly

[Insert Table 4 about here]

There was no significant main effect of timing ($F = .09, p = .764$). Thus, participants' memory recall did not significantly change over the 2 days. There was a significant main effect of threat content of the question ($F = 17.75, p < .001$) on recall; with participants tending to remember a higher proportion of threat items than non-threat items. There was a significant main effect of sensory type of detail on recall ($F = 27.27, p < .001$). Pairwise comparisons showed that auditory details were better recognized than spatial/temporal *mean difference* = -7.17 ($SE = 2.58, t = -2.78, p < .001, 95\% \text{ CI } [-12.21, -2.12]$) details but not visual *mean difference* = -1.07 ($SE = 2.58, t = -0.41, p = .679, 95\% \text{ CI } [-6.12, 3.98]$). The hypothesized interactions for condition were not significant: condition with threat, ($F = 0.44, p = .506$); condition with sensory type, ($F = 0.37, p = .829$); or the three-way interaction between condition, threat and sensory type, ($F = 0.18, p = .913$).

However, any change in officers' answers over repeated questioning may be important in a practical sense during an investigation, even if differences are not statistically significant. Almost all the 20 questions had at least one participant who changed their answer between the two questioning times (i.e., 19 of 20). Six questions showed a change of answer by at least 20% of the sample; victim threatened, distance between partner and armed suspect if shot fired, number of weapons, location of armed suspect, number of rooms entered, and subject of dispute. Overall, from a total of 860 pairs of responses (43 participants x 20 items), 86.8% of the responses were consistent across the two questioning times; 5.1% of responses changed from a

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correct to an incorrect answer, and 8.1% changed from an incorrect to a correct answer. This averages to 2.65 answer changes per participant. In answer to research question two, then, officers who were questioned immediately after the event showed similar levels of memory recall (at the aggregate level) when questioned again 2 days later. However, there were still some differences in the participants' responses across the two time points, with some participants changing their answers for the better and some for the worse.

Does prior questioning improve later memory recall?

The final research question concerns the effect of prior questioning on memory decay; that is, do people who have previously been questioned provide more accurate responses 2 days after the event than those who have not been previously questioned? Again, a linear mixed model is used to test the 2 (timing) x 2 (threat) x 3 (sensory type) design. For this analysis, the two levels of timing are condition 2 (group 2 officers questioned after 2 days, for the first time) as compared to condition 3 (group 1 officers questioned after 2 days, for the second time). Table 5 shows the estimated marginal means of the percentage of correct answers.

[Insert Table 5 about here]

The main effect of timing condition (repeated versus delayed) was not significant ($F = 0.01, p = .915$). The main effect of threat was significant ($F = 18.88, p < .001$), with threat details recalled more than non-threat details. The main effect of sensory type was also significant ($F = 22.13, p < .001$). Pairwise comparisons showed that auditory details were better recalled than spatial/temporal information (*mean difference* = -7.60, *SE* = 2.70, $t(1, 792.04) = -2.82, p = .005$, 95% CI [-12.88, -2.31]), but not visual (*mean difference* = -4.30, *SE* = 2.70, $t(1, 792.04) = -1.59, p = .111$, 95% CI [-9.58, 0.98]). The hypothesized interactions for condition were not significant;

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condition with threat, $F(1, 792.04) = .71, p = .399$; condition with sensory type, $F(2, 792.04) = .28, p = .868$; or the three-way interaction between condition, threat and sensory type, $F(2, 792.04) = .29, p = .863$. In answer to research question three, then, officers who had been questioned immediately after the event and then re-questioned 2 days later showed no increase in memory recall than the officers with delayed questioning only. Thus, similar memory recall exists among the groups of officers with delayed and repeated questioning.

Discussion

Overall, we did not find an effect of question timing on the ability of police officers to recall information after an OIS training scenario. Our findings are closely aligned with the results from two recent experimental studies with one modest distinction. Officers in the Queensland, study experienced no difference in recall between threat and non-threat variables when comparing across all conditions (Porter et al., 2019). In our study and Phillips et al. (2021), officers recalled more threat-related questions across all conditions compared to non-threat details. Between these studies there is an emerging consensus that short-term delays of question timing do not have a major influence on memory recall. Collectively, these studies help quantify the extent to which police officers' memories can be incomplete post-OIS and begin to explore how investigations could impact recall. Our study suggests officers recall, on average, 73.5% of the threat details after OIS incidents. While this finding is encouraging, it is higher than estimates in the two other studies and still suggests on average 26.5% of the most important details required to reconstruct these events are forgotten. Therefore, this presents problems when the public begins with the expectation of a 100% memory recall baseline or that officers should recall every detail of these events. The higher average recall of threat questions by RCSD is most likely the byproduct of methodological differences between studies. Our questionnaire was

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informed by the Queensland study and we continued to improve upon their instrument. In addition, the overall memory recall including non-threat questions is comparable to other studies suggesting RCSD officers remembered roughly the same amount of total details, the distribution between categories just differed.

The first category of implications from these findings pertains to policy and investigations of OIS incidents. For more durable reform of practices, the underlying capacity of police agencies to investigate *all* OIS incidents and provide routine accountability is critical. Procedural differences in the treatment of investigations based upon the degree of public attention could negatively influence individuals' perceptions of police legitimacy (Tyler, 1990). The tragic nature of an OIS is exacerbated by the delayed accountability which draws an increasing public awareness of the vast systemic barriers to providing justice for these incidents (see Stoughton et al., 2020). Improvements in these policies could offer a modest step towards increasing the accountability of specific police officers, shifting attention from these structural concerns back to individual-level misconduct. Based upon the emerging consensus, we recommend if no other special considerations are necessary, police agencies should continue to interview officers immediately after OIS incidents. These findings do present a degree of ambiguity because the lack of differences in recall could justify delayed interviews. Our recommendation maintains precedence (Grady et al., 2016) and allows for agencies to consider other modifications of policy which could facilitate improvements in police officer memory recall. For example, whether to have officers view BWC before making a statement or writing a report (Grady et al., 2016). Police agencies must continue to explore the use of video as an investigative tool and its interaction with psychological processes rather than a one-size-fits-all solution for OIS incidents (see Lum et al., 2019). Furthermore, there are unique policy

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challenges which arise from this interaction because discrepancies between video and recall are more likely to be viewed as purposeful evasion from officers instead of natural memory decay.

The second category of implications from these findings pertains to research on OIS incidents. We believe future research should embrace interdisciplinary collaborations between researchers from criminal justice and applied psychology (see Blackburn, 1993). These collaborations can help further explicate the cognitive processes which influence the recollection of events in the aftermath of OIS incidents from two essential perspectives. Researchers with criminal justice backgrounds have expertise on the innerworkings of police agencies, the unique occupational culture, and the procedural aspects of these investigations (see Loftus, 2010). There are complexities of OIS events and investigations which have no true analog to other situations even within the field of criminal justice. Conversely, there is vast collection of psychological research on memory and decision-making that researchers with criminal justice expertise struggle to adopt. The public demand for reform of the excessive use of force by the police offers additional motivation to consider any possible collaborations to address these issues. Police agencies should further consult with psychologists to enhance policies and practices used during the investigation of OIS incidents. These specialists can provide contextual advice on observing patterns of memory lapse from officers in the recounting of events. This perspective is helpful as investigators must sort through anticipated lapses in memory based upon natural limitations of memory, varying patterns of recall across categories of details, and potentially more purposeful misrepresentation of details. Finally, psychologists can play an important role educating individuals during grand juries, civil or criminal trials, and other administrative hearings about the fallibility of memory recall after OIS incidents.

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While our findings help contribute to understanding of memory recall after OIS incidents, there are notable limitations to our study. First, the sample size was identical to the Queensland study, but should be expanded for future research. The statistical power analyses indicated a sample size of only around 100 police officers could provide a more robust estimate of a treatment effect. This limitation is common to evaluating any police training program because the number of agencies in the U.S. which can divert approximately 100 police officers for such a specific research design with a follow-up component is not particularly large. This suggests it is possible delayed questioning could have a more refined effect on memory recall than our study was able to detect. Second, a practical challenge to this research design is having police officers return to complete the delayed questionnaire. Certain officers would not return, and others could only return outside of the 48-hour window. Third, the degree to which these findings vary when accounting for stress, contamination, and purposeful manipulations by officers needs to be examined empirically before making any more generalizations. These findings only represent a baseline of memory recall capacity and accounting for these factors could provide substantial changes (see Canli et al. 2000; Diamond et al., 2007; Southwick et al., 1997). Fourth, our study relied on written questionnaires as opposed to oral interviews with officers after the completion of the training scenario. In practice, officers in Richland County are interviewed by investigators after an OIS incident occurs, rather than completing a questionnaire to assess their recollection. Fifth, the use of a gun instead of another weapon for armed individuals could have influenced how officers responded to the scenario. The use of a less-lethal weapon, creating a seemingly less threatening scenario, could impact the recollection of details by officers.

In summary, our study found delaying the timing of interviews of police officers after OIS incidents does not improve or damage their recall. Because there is a shortage of research on

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investigations of OIS, we believe examining memory recall provides a helpful contribution which can improve understanding of these events. There are natural limitations to what police officers can recall about the most important details of OIS incidents. This is a sobering reality which policymakers, investigators, and the public must confront. The widespread availability of video recording technology can help investigations of OIS but also could require a more rapid response by agencies. The social unrest ignited by several high-profile use of force incidents in the past decade contributed to increased international discourse on criminal justice reform and police accountability. Public pressure can help provide accountability for these high-profile incidents, nevertheless it is only a short-term strategy applied on a case-by-case basis and does not address broader structural inequities of police contacts. While we unquestionably believe research on race and use of force provides a vital context to consider these incidents, we maintain a path to accountability can still be pursued by improving research and policy on investigations. We now have three studies with consistent results on question timing and memory recall post-OIS. Future research should continue to examine the “black box” of how police officers reconstruct OIS events. The impact of several unique influences on memory recall after OIS events presents a crucial next step for research. Police agencies and researchers should continue to explore strategies which can improve officers’ memory recall capacity, in addition to continued efforts to reduce the occurrence of such events and hold officers accountable for their actions.

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Tables

Table 1. Sample by Group

Variable	Total	Group 1 (immediate & repeated)	Group 2 (delayed)		
	<i>n</i> = 87	<i>n</i> = 43	<i>n</i> = 44		
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>t</i> (<i>df</i>)	<i>p</i>
Age	39.91 (11.39)	39.42 (11.70)	40.39 (11.20)	-0.39 (85)	.694
Experience (yrs.)	10.34 (8.24)	9.85 (8.47)	10.82 (8.06)	-0.55 (85)	.586
	<i>Frequency</i>	<i>Frequency</i>	<i>Frequency</i>	χ^2 (<i>df</i>)	<i>p</i>
Gender					
Male	68	32	36	0.70 (1)	.404
Female	19	11	8		
Race					
White	56	23	33	5.07 (2)	.079
Black	20	14	6		
Other	11	6	5		
Education					
High School/GED	4	3	1	2.23 (3)	.525
Some College	29	12	17		
2 or 4 Year Degree	49	26	23		
Advanced Degree	5	2	3		
Rank					
Deputy	29	17	12	5.06 (4)	.281
Snr. Deputy	19	9	10		
Investigator	20	8	12		
Snr. Investigator	6	1	5		
Sgt./Lt./Cpt.	13	8	5		
Duties					
Patrol	39	21	18	1.64 (3)	.650
Civil/Code/Traffic	11	5	6		
Special Assign.	12	7	5		
Special Invest.	25	10	15		

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Table 2. Memory Recall Questions and Categorization

	Question	Category
1	Did you hear gun shots before you entered the room where the armed suspect was located?	T-A
2	Who first entered the room where the armed suspect was located, you or your partner?	T-ST
3	About how much distance was there between the armed suspect and the doorway into the room (feet)?	NT-S
4	Did the armed suspect directly threaten you or your partner?	T-A
5	Did the armed suspect directly threaten the victim while you were in the room with them?	T-A
6	What was the weapon the armed suspect reached for?	T-V
7	Who fired their service weapon first, you or your partner?	NT-A
8	How many times did you fire your weapon?	NT-A
9	How much distance was between you and the armed suspect when you fired your weapon (feet)?	T-ST
10	How many times did your partner fire his or her weapon?	NT-A
11	How much distance was between your partner and the armed suspect if your partner fired his or her weapon (feet)?	T-ST
12	Other than you and your partner, how many people in the scenario were armed?	T-V
13	Other than police issued service weapons, how many weapons of any type did you see at the scene?	T-V
14	Where was the armed suspect located within the room?	T-V
15	Where on her body was the woman who opened the door injured?	T-V
16	Overall, how long did the incident last, from the initial call to when the scenario was concluded?	NT-ST
17	How many different rooms did you enter over the course of the entire shooting scenario, from beginning to end?	NT-ST
18	What color shirt was the victim on the floor in the room wearing?	NT-V
19	What words were written on the armed suspects ball cap?	NT-V
20	What was the subject of the dispute between victims and the armed suspect?	NT-A

Note: T = Threat, NT = Non-Threat, A = Auditory, V = Visual, ST = Spatial/Temporal

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Table 3: estimated marginal means, standard errors and 95% confidence intervals for research question 1: condition (timing) x threat x sensory type.

Condition	Threat level	Visual		Auditory		Spatial/Temporal		Total	
		M (SE)	95% CI	M (SE)	95% CI	M (SE)	95% CI	M (SE)	95% CI
Immediate (cond.1)	Threat	87.95 (3.90)	[76.79, 99.12]	68.38 (3.90)	[57.21, 79.55]	62.18 (3.90)	[51.01, 73.35]	72.84 (2.32)	[67.05, 78.63]
	Non-threat	29.23 (3.90)	[18.07, 40.40]	46.67 (3.90)	[35.51, 57.84]	36.79 (3.90)	[25.62, 47.96]	37.57 (2.32)	[31.77, 43.36]
	Total	58.59 (2.80)	[51.21, 65.98]	57.53 (2.80)	[50.15, 64.91]	49.48 (2.80)	[42.10, 56.87]	55.20 (1.71)	[51.37, 59.03]
Delayed (cond.2)	Threat	87.56 (3.85)	[76.52, 98.60]	70.51 (3.85)	[59.47, 81.55]	62.94 (3.85)	[51.90, 73.98]	73.67 (2.29)	[67.94, 79.40]
	Non-threat	19.38 (3.85)	[08.34, 30.42]	47.22 (3.85)	[36.18, 58.26]	36.99 (3.85)	[25.95, 48.03]	34.53 (2.29)	[28.80, 40.25]
	Total	53.47 (2.77)	[46.17, 60.77]	58.87 (2.77)	[51.57, 66.16]	49.96 (2.77)	[42.67, 57.26]	54.10 (1.69)	[50.31, 57.89]
Combined	Threat	87.75 (2.78)	[80.42, 95.09]	69.46 (2.78)	[62.12, 76.79]	62.56 (2.78)	[55.23, 69.90]	73.26 (1.70)	[69.46, 77.06]
	Non-threat	24.25 (2.78)	[16.91, 31.58]	46.95 (2.78)	[39.61, 54.28]	36.89 (2.78)	[29.56, 44.23]	36.03 (1.70)	[32.23, 39.83]
	Total	56.00 (2.02)	[51.16, 60.84]	58.20 (2.02)	[53.36, 63.05]	49.73 (2.02)	[44.88, 54.57]	54.53 (1.45)	[51.68, 57.38]

Note: **Bold** indicates means for main effects; *Italics* indicate means for two-way interactions; ***Bold italics*** indicate the grand mean; remaining (unformatted) means are for the three-way interaction

Table 4: estimated marginal means, standard errors and 95% confidence intervals for research question 2: condition (repeated questioning) x threat x sensory type on memory accuracy.

Condition	Threat level	Visual		Auditory		Spatial/Temporal		Total	
		<i>M</i> (<i>SE</i>)	95% CI	<i>M</i> (<i>SE</i>)	95% CI	<i>M</i> (<i>SE</i>)	95% CI	<i>M</i> (<i>SE</i>)	95% CI
Immediate (cond. 1)	Threat	87.79 (3.77)	[75.25, 92.75]	68.22 (3.77)	[57.41, 79.02]	62.02 (3.77)	[51.21, 72.82]	72.67 (2.32)	[66.88, 78.46]
	Non-threat	29.07 (3.77)	[18.26, 39.88]	46.51 (3.77)	[35.70, 57.32]	36.63 (3.77)	[25.82, 47.43]	37.40 (2.32)	[31.61, 43.19]
	Total	58.43 (2.75)	[51.16, 65.70]	57.36 (2.75)	[50.10, 64.63]	49.32 (2.75)	[42.05, 56.59]	55.04 (1.78)	[51.05, 59.03]
Repeated (cond. 3)	Threat	87.20 (3.77)	[76.40, 98.02]	69.77 (3.77)	[58.96, 80.57]	65.89 (3.77)	[55.08, 76.70]	74.29 (2.32)	[68.50, 80.08]
	Non-threat	29.07 (3.77)	[18.26, 39.88]	52.91 (3.77)	[42.10, 63.71]	44.19 (3.77)	[33.38, 54.99]	42.05 (2.32)	[36.26, 47.85]
	Total	58.14 (2.75)	[50.87, 65.41]	61.34 (2.75)	[54.07, 68.61]	55.04 (2.75)	[47.77, 62.31]	58.17 (1.78)	[54.18, 62.16]
Combined	Threat	87.50 (2.75)	[80.23, 94.77]	68.99 (2.75)	[61.72, 76.26]	63.95 (2.75)	[56.69, 71.22]	73.48 (1.78)	[69.49, 77.47]
	Non-threat	29.07 (2.75)	[21.80, 36.34]	49.71 (2.75)	[42.44, 56.98]	40.41 (2.75)	[33.14, 47.67]	39.73 (1.78)	[35.74, 43.72]
	Total	58.28 (2.07)	[53.34, 63.23]	59.35 (2.07)	[54.40, 64.30]	52.18 (2.07)	[47.23, 57.13]	56.61 (1.38)	[53.89, 59.32]

Note: **Bold** indicates means for main effects; *Italics* indicate means for two-way interactions; ***Bold italics*** indicate the grand mean; remaining (unformatted) means are for the three-way interaction.

Table 5: estimated marginal means, standard errors and 95% confidence intervals for research question 3: condition (delayed versus repeated questioning) x threat x sensory type.

Condition	Threat level	Visual		Auditory		Spatial/Temporal		Total	
		<i>M</i> (<i>SE</i>)	95% CI	<i>M</i> (<i>SE</i>)	95% CI	<i>M</i> (<i>SE</i>)	95% CI	<i>M</i> (<i>SE</i>)	95% CI
Delayed (cond. 2)	Threat	87.56 (3.85)	[76.52, 98.60]	70.51 (3.85)	[59.47, 81.55]	62.94 (3.85)	[51.90, 73.97]	73.67 (2.29)	[67.94, 79.40]
	Non-threat	19.38 (3.85)	[08.34, 30.41]	47.22 (3.85)	[36.18, 58.25]	36.99 (3.85)	[25.95, 48.03]	34.53 (2.29)	[28.80, 40.25]
	Total	53.47 (2.77)	[46.17, 60.76]	58.86 (2.77)	[51.56, 66.16]	49.96 (2.77)	[42.66, 57.26]	54.10 (1.69)	[50.31, 57.89]
Repeated (cond. 3)	Threat	87.37 (3.89)	[76.21, 98.54]	69.93 (3.89)	[58.77, 81.10]	66.06 (3.89)	[54.89, 77.22]	74.45 (2.32)	[68.66, 80.25]
	Non-threat	29.23 (3.89)	[18.07, 40.40]	53.07 (3.89)	[41.91, 64.24]	44.35 (3.89)	[33.19, 55.52]	42.22 (2.32)	[36.43, 48.01]
	Total	58.30 (2.80)	[50.92, 65.69]	61.50 (2.80)	[54.12, 68.88]	55.20 (2.80)	[47.82, 62.59]	58.34 (1.71)	[54.50, 62.17]
Combined	Threat	87.47 (2.78)	[80.13, 94.80]	70.23 (2.78)	[62.89, 77.56]	64.48 (2.78)	[57.14, 71.81]	74.06 (1.70)	[70.25, 77.86]
	Non-threat	24.25 (2.78)	[16.91, 31.58]	50.11 (2.78)	[42.78, 57.45]	40.63 (2.78)	[33.29, 47.96]	38.33 (1.70)	[34.52, 42.13]
	Total	55.86 (2.02)	[51.01, 60.70]	60.17 (2.02)	[55.32, 65.01]	52.55 (2.02)	[47.71, 57.40]	56.08 (1.44)	[53.26, 58.91]

Note: **Bold** indicates means for main effects; *Italics* indicate means for two-way interactions; ***Bold italics*** indicate the grand mean; remaining (unformatted) means are for the three-way interaction.