

Evidence for Selective Emotional Memory Enhancement in a Mock Witness Paradigm

Mark D. Snow and Joseph Eastwood

Faculty of Social Science and Humanities, Ontario Tech University



Elucidating the effects of negative emotion on eyewitness memory is an important part of understanding how witnesses remember and report criminal events. Extant research in this area has been inconsistent in its methodology and conclusions, thus warranting further empirical investigation. In the current experiment, participants ($N = 204$) viewed either a Negative or Neutral version of a video of a staged social interaction and had their memory assessed either immediately or 1 week later. Memory assessment consisted of both recall and recognition (lineup identification) components. The Negative video group showed enhanced recall for some aspects of the video compared to the Neutral group, but no enhancement (or impairment) of lineup identification performance. Theoretical and practical implications are discussed.

Public Significance Statement

Witnessing a crime is often an emotional experience. Here, we found that negative emotion was associated with selectively enhanced memory. Participants who watched a negative version of a staged social interaction reported more central event details compared to those who watched a neutral version.

Keywords: emotional memory, eyewitness, lineup identification, stress, arousal

Supplemental materials: <https://doi.org/10.1037/cep0000304.supp>

Being a witness or victim of a crime is often emotionally distressing (Bornstein & Robicheaux, 2009; Shepherd et al., 1999). Understanding how criminal events are remembered and reported, therefore, requires careful consideration of the memorial consequences of witnesses' affective responses—what eyewitness researchers have variably referred to as emotion, stress, and arousal (among other terms; Bornstein & Robicheaux, 2009; Christianson, 1992; Glomb, 2022; Marr, Sauerland, et al., 2021).¹ Existing research in this area, however, has come under increased scrutiny due to limitations in methodology as well as divergent conclusions

within and between relevant bodies of research (Glomb, 2022; Marr, Sauerland, et al., 2021; Sauerland et al., 2016).

That emotionally distressing events tend to be well remembered has received extensive empirical support on multiple fronts (see McGaugh, 2003; McNally, 2003). Laboratory experiments involving emotional audiovisual stimuli (e.g., Bornstein et al., 1998; Burke et al., 1992; Houston et al., 2013) and other stress-induction procedures (e.g., Bierbrauer et al., 2021; Wiemers et al., 2013; see Shields et al., 2017, for a meta-analysis), together with several studies involving actual witnesses/victims (e.g., Dodier et al., 2021; Yuille & Cutshall, 1986) and trauma survivors (e.g., McKinnon et al., 2015) provide convergent evidence that people tend to retain strong memories for the central components of emotionally salient events (sometimes at the expense of peripheral components; see also Christianson, 1992; Kensinger, 2009; Reisberg & Heuer, 2004, 2007).

Yet, other findings appear to tell a different story. There is evidence—adduced primarily within the eyewitness literature—that stress during encoding is associated with memory impairment (e.g., Morgan et al., 2004; Valentine & Mesout, 2009). Meta-analytic

This article was published Online First December 15, 2022.

Mark D. Snow  <https://orcid.org/0000-0002-5073-0752>

Joseph Eastwood  <https://orcid.org/0000-0003-0936-4348>

Mark D. Snow was also supported, in part, by the Social Sciences and Humanities Research Council of Canada (Joseph-Armand Bombardier Canada Graduate Scholarship No. 752-2019-1596). The authors would like to thank Praveen Manickavel for his assistance with data coding and Kelly Warren for her assistance with participant recruitment. The authors have no conflict of interest to disclose.

 The experimental materials are available at <https://osf.io/ngckb/>.

Correspondence concerning this article should be addressed to Mark D. Snow, Faculty of Social Science and Humanities, Ontario Tech University, 2000 Simcoe Street North, Oshawa, ON L1G 0C5, Canada. Email: mark.snow@ontariotechu.net

¹ We concur with Lane and Houston's (2021) observation that "the literature on the effects of stress and negative emotion on memory appear to be interlinked and are often cited together" (p. 100). "Negative emotion" seems appropriate for the present purposes. However, when referring to past research, we attempt to retain the researchers' original terminology.

evidence reported by Deffenbacher et al. (2004) indicated that stress (during encoding) impairs eyewitness recall and recognition memory. While several more recent eyewitness studies appear to support this conclusion (e.g., Davis et al., 2019; Pezdek et al., 2021), others report little or no effects in either direction (e.g., Marr, Quaedflieg, et al., 2021; Price et al., 2022; Sauerland et al., 2016). As summarized in a recent review by Marr, Sauerland, et al. (2021), “previous experiments have reported impairing effects, enhancing effects, and null effects of encoding stress on recognition and recall performance” (p. 1093).

Given the mixture of findings within and between existing lines of research (i.e., basic memory research and eyewitness memory research), as well as explicit calls for increased methodological rigour (e.g., Sauerland et al., 2016), there remains a need for closer consideration of research methodology in this area. Two such methodological considerations are (a) the delay between encoding (i.e., the time of the event) and retrieval (i.e., the time of the interview and/or lineup identification procedure) and (b) the retrieval procedure (i.e., type of memory test, instructions). While eyewitness studies often consist of single-session experiments (with trivial delays between encoding and retrieval; Marr, Sauerland, et al., 2021; Sauerland et al., 2016), assessing either recall or recognition performance, here we chose to include a delay and consider multiple modes of retrieval.

Delay

The delay between encoding and retrieval is a critical consideration in eyewitness memory studies for at least two reasons. First, emotional memories appear to decay more slowly than nonemotional memories (e.g., Cellini et al., 2019; Christianson, 1992; Park, 2005; see also Burke et al., 1992, for partial support). One of the leading perspectives among emotional memory researchers outside of the eyewitness field—the modulated-consolidation model—concerns the underlying neurobiological processes that modulate memory consolidation in the interim period between encoding and retrieval (e.g., Cahill & McGaugh, 1998; McGaugh, 2018). Other researchers have similarly emphasized the passage of time between encoding and retrieval in explaining emotional memory processes (see Yonelinas & Ritchey, 2015). By contrast, many eyewitness researchers have focused less on postencoding processes and have attempted to account for emotional memory effects by pointing to differences in attentional processes during encoding, drawing heavily upon the work of Easterbrook (1959) and Yerkes and Dodson (1908; see Christianson, 1992). Contrary to encoding-based explanations, however, attentional differences during encoding cannot account for differences in emotional and nonemotional memory that emerge only after a postencoding delay (Yonelinas & Ritchey, 2015).

Second, real-world contexts often involve longer encoding-retrieval delays than are used in laboratory experiments (Flowe et al., 2018). In many criminal investigations, witnesses are asked to provide their accounts and/or make person identifications after considerable delays—possibly days, weeks, or months after an event (Christianson, 1992). Based on a comparison of the characteristics of eyewitness laboratory studies and archival felony cases, Flowe et al. (2018) found that the median delay between a criminal event and making a lineup identification in real cases is 11 days, whereas laboratory participants typically make identifications after

much shorter delays (~20 min). They argued that there is a need for eyewitness researchers to vary the retention interval (among other factors) in laboratory studies to better establish the generalizability of the phenomenon of interest. Other eyewitness researchers have argued in favour of inserting a delay because the absence of a delay conflates the effects of emotion/stress on encoding and retrieval (e.g., Marr, Sauerland, et al., 2021; Sauerland et al., 2016). The argument for including a delay is particularly salient when considered alongside previous findings of time-dependent emotional memory enhancement (Yonelinas & Ritchey, 2015) as well as recent calls for more modern emotional memory research in which memory is assessed after variable delays (Ack Baraly et al., 2017).

Retrieval Procedure

In practice and the scientific literature, the assessment of eyewitness memory generally takes one of two forms: (a) an interview (recall) and/or (b) lineup identification (recognition). Is it reasonable to assume that the effects of negative emotion on one form of eyewitness memory will generalize to the other? Perhaps not. We can observe an initial indication of discontinuity in recall and recognition effects in the meta-analytic results reported by Deffenbacher et al. (2004). Although they reported evidence of stress-based memory impairment overall, the decrement in (TP) lineup identification performance ($h = -.52$) was considerably larger than that observed for narrative recall ($d = -.20$). Providing further evidence of discontinuity between recognition and recall performance in the context of emotional eyewitness memory, Houston et al. (2013) found that emotional participants were *better* than neutral participants at describing the perpetrator but *worse* at identifying them from a lineup. Ack Baraly et al. (2017) argued that emotional memory recall may be superior to recognition due to greater usage of controlled processing; recall may involve more effortful self-initiated processing than recognition (Craik & McDowd, 1987). Yet, as Ack Baraly et al. (2017) noted, few studies have examined this hypothesis directly within an emotional memory context.

On the issue of witness recall, there is considerable variability in the instructions that have been used in research and forensic practice. One procedure that has received extensive empirical support is known as the cognitive interview (CI; Fisher & Geiselman, 1992). The CI consists of various memory-enhancement techniques that have been shown to increase information yield without jeopardizing overall accuracy (see Memon et al., 2010, for a meta-analysis). To explore the potential differences in emotional memory effects across different recall procedures, we chose to manipulate the recall instructions that participants received. Specifically, we assessed both basic free recall instructions as well as instructions that included two memory-enhancement techniques from the CI: *report everything* and *mental reinstatement of context* (see Appendix, for full instructions).

The Current Research

In the current experiment, we sought to investigate the effects of negative emotion during encoding on subsequent eyewitness memory performance (i.e., lineup identification and recall). In light of recent discussions (e.g., Marr, Sauerland, et al., 2021; Sauerland et al., 2016) regarding the potential importance of delay—both in

theory (given the differential rates of decay for emotional vs. nonemotional memories; Yonelinas & Ritchey, 2015) and in practice (given the differential delays in laboratory studies vs. criminal investigations; Flowe et al., 2018)—we sought to take a closer look at the role of delay by documenting participants' memory either immediately or after a 1-week delay. Further, given the potential discontinuity between recognition and recall effects in this context (e.g., Houston et al., 2013), we chose to consider both modes of retrieval.

Hypothesis 1: In line with emotional memory enhancement effects documented elsewhere (e.g., Kensinger, 2009), we expected participants in the Negative video condition to demonstrate superior recall compared to those in the Neutral condition, particularly in regard to central event details.

Hypothesis 2: Given the time-dependent nature of emotional memory (Yonelinas & Ritchey, 2015), the emotional enhancement effect (see Hypothesis 1) should be larger after a 1-week delay as compared to immediate recall.

Hypothesis 3: As hypothesized by Ack Baraly et al. (2017), we expected to find minimal differences in lineup identification (recognition) performance among Negative video viewers compared to Neutral viewers.

Method

Design

We used a 2 (Emotion Video: Negative vs. Neutral) $\times$ 2 (Delay: Immediate vs. 1-Week) $\times$ 2 (Retrieval Procedure: CI-based Recall/Free Recall) $\times$ 2 (Lineup: Target-Present [TP] Lineup vs. Target-Absent [TA] Lineup) between-participants design. Participants were randomly assigned to experimental condition. The retrieval procedure consisted of both a recall (either CI-based or free recall) and a lineup task (either a TP or TA lineup). Participants completed the recall and lineup tasks in a randomized order. We used variable retrieval conditions to explore the potential effects of recall instructions by comparing memory-enhancement instructions (based on the CI; Fisher & Geiselman, 1992) versus basic free recall instructions (see Appendix). Following the convention in the eyewitness identification literature, we chose to examine both TP and TA lineups (e.g., Houston et al., 2013; Sauerland et al., 2016).

Participants

Participants were undergraduate students, recruited remotely from two university campuses located in different Canadian provinces. In total, 427 responses were recorded initially in Qualtrics. We included in our final sample those who successfully completed both parts of the study a single time within the appropriate timeframe (i.e., the duration of Part 1 must have exceeded the length of the video stimuli, Part 2 must have been completed within 24 hr of Part 1 for the immediate condition and not more than 8 days later for the 1-week delay condition). The final sample consisted of 204 undergraduate students (100 males, 101 females, 3 others). The mean age of the sample was 20.51 years ($SD = 3.02$). Participants reported the ethnic/cultural origins of their ancestors (and could select all that applied): 84 (41.2%) reported Asian origins, 64 reported European

origins (31.4%), 49 reported North American origins (24.0%), 17 reported African origins (8.3%), 14 reported Caribbean origins (6.9%), three reported Latin, Central, and South American origins (1.5%), and three reported Other North American origins (1.5%). Participants also reported their year of study: 54 were in their first year of study (26.5%), 57 were in their second year (27.9%), 66 were in their third year (32.4%), and 27 were in their fourth year or above (13.2%).

Video Stimuli

We created Negative and Neutral video stimuli for the first author's doctoral research (see Snow & Eastwood, 2022b, for more information). Each video is 2 min and 26 s long, filmed from a first-person perspective, depicting a social interaction among three students (one female and two males, portrayed by local actors) in a university study space. Both negative and neutral versions consisted of three discrete segments such that the first and last segments were identical in both conditions, whereas the middle segment differed between conditions. While both versions followed the same basic sequence, the middle segment in the negative version depicted an altercation (including accusations of infidelity, explicit threats of violence), whereas the neutral version depicted a mundane interaction (including greetings and small talk). Importantly, the use of video stimuli ensured that the to-be-remembered material (i.e., the video content) was also the source of participants' emotional response. This matches the situation in the real world, where the criminal event is that which an eyewitness must attempt to remember *and* the source of distress (see Christianson, 1992; Marr, Sauerland, et al., 2021; Snow & Eastwood, 2022a, for discussion on this point).

Lineup Construction

In the current experiment, we used six-person simultaneous TP and TA photo lineups presented entirely within the online survey. The first author selected a set of potential fillers (16 photos) from the Chicago Face Database (Ma et al., 2015) based on their general physical resemblance to the suspect. Similar to the lineup construction procedure described by Houston et al. (2013), for all potential filler photos, we gathered similarity-to-suspect ratings (from 0 = *not at all similar* to 10 = *very similar*) and distinctiveness ratings (from 0 = *not at all distinctive* to 10 = *very distinctive*) from an independent group of participants ($n = 10$). The six photos with the highest similarity ratings were used as fillers. Of the selected filler photos, similarity ratings were between $M = 3.44$, $SD = 2.30$, and $M = 4.60$, $SD = 2.41$, and distinctiveness ratings were between $M = 3.40$, $SD = 1.78$, and $M = 5.70$, $SD = 1.42$. We edited the lineup photos to standardize the appearance of all visible clothing (i.e., all clothing was coloured solid black), and lineup photos appeared in a randomized order.

Survey

Survey materials are available on the Open Science Framework (<https://osf.io/ngckb/>). The experimental stimuli in the present research consisted of a two-part online survey, hosted at <https://Qualtrics.com>. The first page of the survey (Part 1) consisted of an informed consent form outlining the details of the study. Next,

participants received instructions to ensure their computer audio was turned on and to wear headphones if possible. They also received the following instructions:

You're about to watch a video of a social interaction. This video may contain scenes of violence or startling events and may contain coarse language. If you wish to stop the video and withdraw from participation, you may do so at any time by closing your internet browser. The video was filmed from a first-person perspective, and so please try to imagine yourself in the situation as if you were behind the camera. Please pay close attention to the video.

Next, participants watched either the Negative or Neutral video and were instructed to view the video a single time, in full screen, and without pausing or replaying. Following the video stimuli, participants received the following questions regarding their emotional experience: "To what extent did you feel *anxious* during the video?" (1 = *not at all* to 7 = *extremely*); "To what extent did you feel *tense* during the video?" (1 = *not at all* to 7 = *extremely*); "How would you describe your *feelings* during the video?" (1 = *very negative* to 7 = *very positive*). Then, participants received the following questions assessing their perceptions of the video: "How easy was it to imagine yourself in the situation shown in the video?" (1 = *very difficult* to 7 = *very easy*); "How believable was the situation shown in the video?" (1 = *not at all* to 7 = *extremely*). Last, participants provided basic demographic information and received debriefing information concerning Part 1. Participants indicated whether they wished to complete the second part of the study and were instructed that "Participation in Part 2 will consist of answering questions about your experiences during Part 1."

The first page of Part 2 also consisted of an informed consent form. Next, participants were instructed to "please read all instructions carefully and take as much time as you need to complete the following questions." Participants then completed the recall task and lineup identification task, presented in a randomized order. For the recall task, participants received either basic free recall instructions or more detailed instructions based on the CI (Fisher & Geiselman, 1992) and typed their responses into the provided textbox (see Appendix, for full instructions). To be clear, this was not intended to serve as an in-depth examination of the full CI; the recall procedure in the present study was text-based and self-administered. Immediately following the recall task, participants received the following questions: "How confident are you that you recalled *all* the details from the video in your written response?" (out of 100%); "How confident are you that the details you provided in your response were *accurate*?" (out of 100%); "How difficult was it to remember the details of the video?" (0 = *not at all* to 100 = *extremely*).

For the lineup task, participants received either a TP or TA lineup as described above (see Appendix, for full instructions). Immediately following the lineup task, participants received the following questions: "How confident are you in your lineup decision?" (out of 100%); "How difficult was it to remember the man from the video?" (out of 100%). Last, participants indicated whether they completed Part 1 and 2 in the same or different locations and then received additional debriefing information.

Procedure

We recruited participants from online research participation pools at two Canadian universities. We received approval from

the Research Ethics Board at each institution prior to data collection. Upon accessing the study link and providing informed consent, participants worked their way through the online survey outlined above. In the first session, participants viewed either the Negative ($n = 108$) or Neutral ($n = 96$) video and provided their subjective ratings. At the end of Part 1, participants received debriefing information and indicated whether they wished to participate in Part 2. Those who agreed to complete Part 2, automatically received the survey link via email either immediately ($M_{\text{Delay}} = 2.7$ min) or after 1 week ($M_{\text{Delay}} = 7.3$ days). Upon accessing the survey link to Part 2 and again providing informed consent, participants worked their way through the memory recall and lineup procedures (in a randomized order) as described above. As mentioned, participants received either CI-based ($n = 94$) or free recall ($n = 106$) instructions² and completed either a TP ($n = 99$) or TA ($n = 105$) lineup. At the end of Part 2, participants received additional debriefing information. All participants received course credit as compensation.

Data Coding

The first author reviewed participants' responses to the memory recall task and created a coding guide based on the reported details. We categorized details as either environmental (e.g., objects, surroundings), person (e.g., hair, clothing), critical incident (i.e., action details within the middle video segment), peripheral action (i.e., action details within the first and last video segments), or uncodable (i.e., vague or subjective statements). Details were coded as either present (1) or absent (0). The first author met with a research assistant (RA) to familiarize them with the coding process. The RA was blind to our hypotheses and otherwise uninvolved in the current research. The RA independently coded a small set of responses for training purposes ($n = 15$). After a brief follow-up session with the first author, the RA coded a substantial portion of the remaining recall responses. For the latter subset of responses ($n = 85$), we examined interrater reliability using Cohen's κ (Cohen, 1960). Mean κ values are $\kappa_{\text{correct}} = 0.80$, $\kappa_{\text{incorrect}} = 0.66$, and $\kappa_{\text{uncodable}} = 0.63$, $ps < .001$. Although the values for incorrect and uncodable details were slightly lower than for correct details, all values are indicative of substantial agreement between coders (Landis & Koch, 1977).

Results

Preliminary Analyses

Comparison of participants' self-reported emotional responses to the Negative and Neutral videos suggested that the manipulation of negative emotion was successful. A series of between-subjects analyses of variance (ANOVAs) indicated that participants who viewed the Negative video reported feeling significantly more negative ($p < .001$, $d = 1.25$, 95% CI [0.95, 1.55]), anxious ($p < .001$, $d = 0.49$, 95% CI [0.21, 0.78]), and tense ($p = .001$, $d = 0.46$, 95% CI [0.18, 0.74]) during the video compared to those who watched the Neutral version. Descriptive statistics are presented in Table 1.

Participants rated how easy it was to imagine themselves in the situation shown in the video ($M = 4.34$, $SD = 1.76$) as well as the

² We were unable to determine the recall instructions received by four participants who provided no recall response.

Table 1*Mean Emotion and Realism Ratings (With Standard Deviations) and [95% Confidence Intervals] as a Function of Video Condition*

Video condition	Anxious	Tense	Feelings	Imaginability	Believability
Negative video	4.18 (1.78) [3.84, 4.51]	4.28 (1.75) [3.94, 4.61]	2.61 (1.15) [2.39, 2.83]	4.14 (1.73) [3.81, 4.47]	4.14 (1.69) [3.82, 4.46]
Neutral video	3.32 (1.67) [2.98, 3.66]	3.48 (1.72) [3.13, 3.83]	3.81 (0.69) [3.67, 3.95]	4.56 (1.77) [4.20, 4.92]	4.64 (1.66) [4.30, 4.97]

believability of the situation shown in the video ($M = 4.37$, $SD = 1.69$). As shown in Table 1, results revealed only small differences in imaginability ratings ($p = .09$, $d = 0.24$, 95% CI [0.04, 0.52]) and believability ratings ($p = .04$, $d = 0.30$, 95% [0.02, 0.57]) between Negative and Neutral video groups. Participants also reported whether they completed both parts of the study in the same or different locations. Most participants (90%) reported completing both parts of the study in the same location. A chi-square test indicated that study location was associated with delay such that 137 participants in the immediate condition completed both parts in the same location, whereas 47 did so in the 1-week delay condition, $\chi^2(1, N = 204) = 39.76$, $p < .001$, Cramer's $V = .44$.

Recall Performance

To examine differences in recall performance we conducted 2 (Video) $\times$ 2 (Recall Instructions) $\times$ 2 (Delay) between-subjects ANOVAs for each detail category. For this analysis, we excluded participants ($n = 15$) who did not provide an appropriate response (e.g., nonresponses, responses that did not pertain to the present stimuli). These exclusions were determined independently by the first author and an RA who was otherwise uninvolved in the current research. Disagreements were resolved through discussion. The

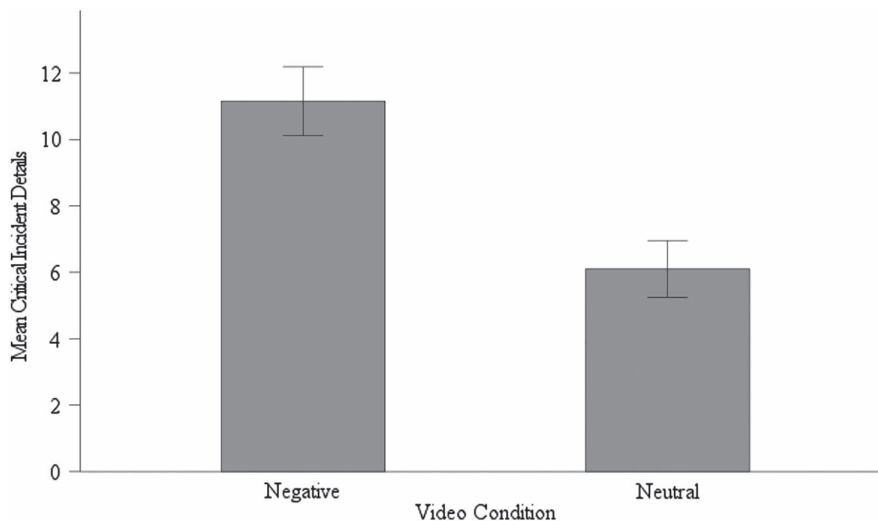
following analysis of recall performance included data from 189 participants ($n_{Free\ Recall} = 96$; $n_{CI-Based} = 93$).

Critical Incident Details

Participants reported 8.80 critical incident details on average ($SD = 5.34$). We observed a significant effect of Video condition, $F(1, 181) = 39.62$, $p < .001$. As shown in Figure 1, participants in the Negative video condition ($M = 11.16$, $SD = 5.25$) reported more critical event details than those in the Neutral condition ($M = 6.10$, $SD = 4.03$, $d = 1.07$, 95% CI [0.77, 1.38]). We also found a significant effect of delay, $F(1, 181) = 25.12$, $p < .001$. Participants in the immediate condition reported more critical incident details ($M = 9.96$, $SD = 5.44$) than those in the 1-week delay condition ($M = 5.93$, $SD = 3.82$, $d = 0.80$, 95% CI [0.47, 1.13]). These were both large effects. All other main effects and interactions were nonsignificant ($ps > .05$).

Peripheral Action Details

Participants reported 10.77 peripheral action details on average ($SD = 6.60$). We observed a significant effect of delay, $F(1, 181) = 33.10$, $p < .001$. Participants in the immediate condition reported more peripheral action details ($M = 12.40$, $SD = 6.73$) than those in

Figure 1*Mean Differences in Number of Critical Incident Details Reported as a Function of Video Condition*

Note. Error bars are 95% confidence intervals.

the 1-week delay condition ($M = 6.69$, $SD = 3.98$, $d = 0.94$, 95% CI [0.61, 1.27]). This was a large effect. All other main effects and interactions were nonsignificant ($ps > .05$).

Environmental Details

Participants reported 5.46 environmental details on average ($SD = 4.74$). We observed a significant effect of delay, $F(1, 181) = 13.88$, $p < .001$. Participants in the immediate condition reported more environmental details ($M = 6.26$, $SD = 5.03$) than those in the 1-week delay condition ($M = 3.46$, $SD = 3.18$, $d = 0.61$, 95% CI [0.29, 0.93]). This was a medium effect. All other main effects and interactions were nonsignificant ($ps > .05$).

Person Details

Participants reported 3.44 person details on average ($SD = 1.49$). Whether considered together (i.e., total person details) or separately (i.e., female, Male 1, Male 2), all main effects and interactions were nonsignificant ($ps > .05$).³

Incorrect Details

Participants reported 1.82 incorrect details on average ($SD = 1.90$). We observed a significant effect of delay, $F(1, 181) = 4.33$, $p = .039$. Participants in the immediate condition ($M = 1.64$, $SD = 1.80$) reported fewer incorrect details than did those in the 1-week delay condition ($M = 2.28$, $SD = 2.07$, $d = 0.34$, 95% CI [0.02, 0.66]). This was a small effect. All other main effects and interactions were nonsignificant ($ps > .05$).

Uncodable Details

Participants reported 2.50 uncodable details on average ($SD = 1.94$). We observed a significant effect of video, $F(1, 181) = 13.23$, $p < .001$. Participants who watched the Negative video reported more uncodable details ($M = 3.05$, $SD = 1.92$) than did those who watched the Neutral video ($M = 1.88$, $SD = 1.77$, $d = 0.63$, 95% CI [0.34, 0.93]). There was also a significant effect of recall instructions, $F(1, 181) = 9.13$, $p = .003$. Participants in the CI-based condition ($M = 3.00$, $SD = 2.06$) reported more uncodable details than did those in the free recall condition ($M = 2.02$, $SD = 1.69$, $d = 0.52$, 95% CI [0.23, 0.81]). These were both medium effects.

Recall Confidence

Confidence in Completeness

Participants reported their level of confidence that they recalled all the details from the video (from 0% to 100%). A 2 (Video) $\times$ 2 (Recall Instructions) $\times$ 2 (Delay) between-subjects ANOVA revealed that those who viewed the Negative video were more confident that they recalled all the details from the video ($M = 65.49$, $SD = 25.03$) than were those who viewed the Neutral video ($M = 49.13$, $SD = 25.92$), $F(1, 181) = 22.93$, $p < .001$, $d = 0.64$, 95% CI [0.35, 0.94]. There was also a main effect of delay such that participants in the immediate condition reported greater confidence that they recalled all of the video details ($M = 61.08$, $SD = 26.55$) than did those in the 1-week delay condition ($M = 49.83$, $SD = 25.46$), $F(1, 181) = 6.38$, $p = .012$, $d = 0.43$, 95% CI [0.11, 0.75].

However, these effects were qualified by a Video $\times$ Delay interaction, $F(1, 181) = 4.25$, $p = .041$, partial $\eta^2 = .023$. Neutral participants were significantly less confident in the completeness of their recall after a 1-week delay ($M = 35.93$, $SD = 19.53$) as compared to immediate ($M = 55.28$, $SD = 26.37$, $p = .001$, $d = 0.79$, 95% CI [0.33, 1.25]), but this did not hold for Negative participants ($p = 0.87$, $d = 0.04$, 95% CI [-0.41, 0.48]). Exploratory correlation analyses also revealed that participants' confidence in the completeness of their recall was positively correlated with the number of critical incident details reported ($r = .18$, $p = .011$, 95% CI [.04, .32]) but was not correlated any other detail category ($ps > .05$).

Confidence in Accuracy

Participants reported their level of confidence that the details they recalled were accurate (from 0% to 100%). A 2 (Video) $\times$ 2 (Recall Instructions) $\times$ 2 (Delay) between-subjects ANOVA revealed a main effect of video such that those who viewed the Negative video were more confident that the details they provided were accurate ($M = 79.56$, $SD = 19.38$) than were those who viewed the Neutral video ($M = 69.55$, $SD = 21.75$), $F(1, 181) = 12.13$, $p < .001$, $d = 0.49$, 95% CI [0.20, 0.78]. There was also the main effect of delay such that those in the immediate condition reported greater confidence that the details they provided were accurate ($M = 78.96$, $SD = 18.36$) than did those in the 1-week delay condition ($M = 64.76$, $SD = 23.98$), $F(1, 181) = 18.18$, $p < .001$, $d = 0.71$, 95% CI [0.38, 1.03]. The main effect of video was qualified by a Video $\times$ Recall Instructions interaction, $F(1, 181) = 6.59$, $p = .011$, partial $\eta^2 = .035$. Within the CI-based recall condition, Negative participants were more confident in their accuracy ($M = 81.15$, $SD = 17.10$) than were Neutral participants ($M = 62.46$, $SD = 23.42$, $p < .001$, $d = 0.94$, 95% CI [0.50, 1.37]), but this effect did not hold within the free recall condition ($p = .53$, $d = 0.13$, 95% CI [-0.27, 0.53]). Exploratory correlation analyses also revealed that participants' confidence in the accuracy of their recall was positively correlated with the number of critical incident details ($r = .37$, $p < .001$, 95% CI [.24, .49]) and peripheral action details reported ($r = .26$, $p < .001$, 95% CI [.12, .39]).

Difficulty of Recall

Participants reported how difficult it was to remember the details of the video (from 0% to 100%). A 2 (Video) $\times$ 2 (Recall Instructions) $\times$ 2 (Delay) between-subjects ANOVA revealed a main effect of delay such that those in the 1-week delay condition reported greater difficulty ($M = 56.44$, $SD = 27.92$) than those in the immediate condition ($M = 43.15$, $SD = 25.76$), $F(1, 181) = 9.11$, $p = .003$, $d = 0.50$, 95% CI [0.18, 0.82]. There was also a main effect of video such that those who viewed the Neutral video reported greater difficulty ($M = 53.76$, $SD = 26.58$) than those who viewed the Negative video ($M = 41.01$, $SD = 26.06$), $F(1, 181) = 9.45$, $p = .002$, $d = 0.49$, 95% CI [0.19, 0.77]. These were both small-medium effects. Exploratory correlation analyses revealed that participants' self-reported difficulty was negatively correlated

³ Because the video was filmed from a first-person perspective and participants were instructed to imagine themselves in the situation, some participants referenced their (or the cameraperson's) presence in the scenario. However, we chose to omit this detail as it did not affect the analysis.

with the number of critical incident details ($r = -.24, p < .001, 95\%$ CI $[-0.37, -0.10]$) and uncodable details reported ($r = -.15, p = .035, 95\%$ CI $[-0.29, -0.01]$).

Lineup Identification Performance

We analyzed TP and TA lineup performance separately. We coded TP lineup identification decisions as hits (correctly selecting the target person), false positives (incorrectly selecting a filler), or misses (incorrectly selecting “not here”). We coded TA lineup identification decisions as false positives (incorrectly selecting a filler) or correct rejections (correctly selecting “not here”). For this analysis, we excluded data from participants ($n = 23$) who provided incompatible identification responses (i.e., those who selected a lineup photo but also selected “not here”). Thirteen participants were excluded from the TP condition; 10 participants were excluded from the TA condition.

Overall, 41.6% of participants (37/89) correctly identified the perpetrator in the TP lineup (33.7% false positives, 24.7% misses) and 62.0% (57/92) correctly selected “not here” in the TA lineup (38.0% false positives). A 2 (Video: Negative vs. Neutral) $\times$ 3 (Hit vs. False Positive vs. Miss) chi-square test did not reveal a significant association between video condition and TP identification response, $\chi^2(2, N = 89) = 0.51, p = .78$, Cramer’s $V = .08$. A 2 (Video: Negative vs. Neutral) $\times$ 2 (False Positive vs. Correct Rejection) chi-square test did not reveal a significant association between video condition and TA identification response, $\chi^2(1, N = 92) = 0.34, p = .56$, Cramer’s $V = .06$.

A 2 (Delay: Immediate vs. 1-Week) $\times$ 3 (Hit vs. False Positive vs. Miss) chi-square test revealed a significant association between delay and TP identification response, $\chi^2(2, N = 89) = 11.62, p = .003$, Cramer’s $V = .36$. The TP hit rate was 53.2% in the immediate condition (vs. 14.8% in the 1-week delay condition), the TP false positive rate was 25.8% in the immediate condition (vs. 51.9% in the 1-week delay condition), and the TP miss rate was 21.0% in the immediate condition (vs. 33.3% in the 1-week delay condition). A 2 (Delay: Immediate vs. 1-Week) $\times$ 2 (False Positive vs. Correct Rejection) chi-square test did not reveal a significant association between delay and TA identification response, $\chi^2(1, N = 92) = 0.04, p = .84$, Cramer’s $V = .02$. The TA false positive rate was 37.3% in the immediate condition (vs. 39.4% in the 1-week delay condition) and the TA correct rejection rate was 62.7% in the immediate condition (vs. 60.6% in the 1-week delay condition).

Lineup Confidence

Participants reported their confidence in their lineup decision (from 0% to 100%). A 2 (Video) $\times$ 2 (Delay) between-subjects ANOVA revealed a significant effect of delay on TP lineup decision confidence, $F(1, 82) = 6.91, p = .010$. Participants reported greater confidence in the immediate condition ($M = 57.82, SD = 30.06$) than in the 1-week delay condition ($M = 41.65, SD = 22.30, d = 0.58, 95\%$ CI $[0.11, 1.05]$). Participants also reported how difficult it was to remember the man from the video (from 0% to 100%). A 2 (Video) $\times$ 2 (Delay) between-subjects ANOVA revealed a significant effect of delay on ratings of TP lineup difficulty, $F(1, 83) = 4.15, p = .045, d = 0.34, 95\%$ CI $[-0.12, 0.79]$. However, this effect was qualified by a Delay $\times$ Video interaction, $F(1, 83) = 7.68, p =$

.007, partial $\eta^2 = .085$. Within the 1-week delay condition, Neutral participants reported greater difficulty ($M = 87.09, SD = 11.99$) than did Negative participants ($M = 55.00, SD = 26.64, p < .001, d = 1.46, 95\%$ CI $[0.58, 2.32]$); however, this difference did not hold in the immediate condition ($p = 0.34, d = 0.26, 95\%$ CI $[-0.27, 0.79]$). Exploratory correlation analyses indicated that TP lineup decision accuracy correlated positively with decision confidence ($r = .44, p < .001, 95\%$ CI $[-.25, .60]$) and negatively with perceived difficulty ($r = -.47, p < .001, 95\%$ CI $[-.62, -.29]$).

A 2 (Video) $\times$ 2 (Delay) between-subjects ANOVA revealed a significant effect of delay on TA lineup decision confidence, $F(1, 87) = 11.04, p = .001$. Participants reported greater confidence in the immediate condition ($M = 50.81, SD = 26.87$) than in the 1-week delay condition ($M = 31.38, SD = 26.77, d = 0.72, 95\%$ CI $[0.28, 1.17]$). A 2 (Video) $\times$ 2 (Delay) between-subjects ANOVA revealed a significant effect of delay on ratings of TA lineup difficulty, $F(1, 87) = 9.72, p = .002$. Participants reported greater difficulty in the 1-week delay condition ($M = 81.91, SD = 23.75$) than in the immediate condition ($M = 63.95, SD = 26.82, d = 0.70, 95\%$ CI $[0.26, 1.14]$). Exploratory correlation analyses indicated that TA lineup decision accuracy was not correlated with decision confidence ($r = -.01, p = .94, 95\%$ CI $[-.21, .20]$) nor with perceived difficulty ($r = -.08, p = .47, 95\%$ CI $[-.28, .13]$).

Discussion

Consistent with Hypothesis 1 as well as previous research (e.g., Dodier et al., 2021; Kensinger, 2009), we observed a pattern of selective emotional enhancement of recall memory. Recall was not enhanced uniformly, but rather only for critical incident details (i.e., action details from the middle video segment that differed between Negative vs. Neutral conditions). This was a large effect ($d = 1.07$), and one that fits with past findings indicating that emotion enhances memory for the central elements of the target stimuli, as opposed to—and sometimes at the expense of—peripheral details (Kensinger, 2009; Reisberg & Heuer, 2004, 2007). Interestingly, despite enhanced recall of the central action details among the Negative video group, recall of the target person’s physical appearance was not enhanced. Perhaps, within the context of a negative emotional event, the central actions—including that of the target person—are more memorable than the target person’s physical appearance. However, this is contrary to Houston et al.’s (2013) observation that emotional (vs. neutral) witnesses showed enhanced (i.e., more complete) recall for the perpetrator’s physical appearance but recalled less about what the central character did. In the present study, the fact that few person details were reported *in general*, may suggest that the characters’ physical appearance was not particularly memorable for participants across the board. Concerning the relative memorability of a central character’s actions versus their physical appearance within the context of a negative emotional event, further investigation is warranted.

The Negative video group also reported more uncodable details (i.e., subjective or vague information that could not be coded as correct or incorrect) than did those who viewed the Neutral video. This included statements such as inferences regarding the potential relationship between the perpetrator and female (e.g., “... the blonde woman’s boyfriend comes into the room ...”; “... the woman’s boyfriend entered ...”). Although this information was categorized

as “uncodable” in the context of the current experiment, such statements may be of practical importance in the context of a real investigation.

Based on previous literature indicating time-dependent effects of emotion on memory (Yonelinas & Ritchey, 2015), we expected to find more pronounced emotional memory enhancement after a 1-week (vs. immediate) delay (see Hypothesis 2). Although we found strong evidence of diminished memory performance after a 1-week delay (i.e., medium-to-large effects), emotion and delay did not interact as predicted. It may be that our manipulations were too weak to observe the interaction. For example, perhaps our delay was not substantial enough to detect differential effects on Negative versus Neutral recall. Alternatively, it may be that the predicted interaction is simply not as robust as expected. Another possibility is that delay was confounded with other factors such as testing location (as indicated in our preliminary results), which may have made it harder to identify the predicted interaction. Further research is needed to identify the conditions under which the hypothesized interaction can or cannot be reliably observed.

Consistent with Hypothesis 3, although negative emotion was associated with enhanced recall memory, we did not find evidence of enhanced recognition (lineup performance). This finding is consistent with the predictions of Ack Baraly et al. (2017) and roughly in line with the recall–recognition discontinuity observed by Houston et al. (2013), in which emotional participants were better than neutral participants at describing the perpetrator but worse at identifying them from a lineup. Our data provide at least a preliminary indication that the null effects of negative emotion on lineup identification performance may be attributable to *what* was being retrieved (i.e., the target person) rather than *how* it was being retrieved (i.e., recall vs. recognition). Neither recall nor recognition of the target person differed between Negative and Neutral participants, suggesting that negative emotion simply did not convey a benefit to this particular aspect of the event (i.e., the target person’s appearance). Although we found few differences in participants’ recall performance between CI-based and free recall conditions, the current results highlight the need for caution when attempting to generalize the effects of emotion across disparate eyewitness memory tasks, in particular, recall versus lineup identification.

The null hypothesis—that there is no difference in identification performance between Negative and Neutral participants—cannot be rejected based on the present findings. This particular null finding is consonant with a growing number of studies reporting no effects of stress on identification performance (Marr, Quaedflieg, et al., 2021; Price et al., 2022; Sauerland et al., 2016). These studies, together with the current results, lend support to the conclusion that the effects of negative emotion/stress on lineup identification performance may be less robust than previously believed. However, given strong claims to the contrary (Deffenbacher et al., 2004), more research is warranted.

Exploratory measures of participants’ confidence and difficulty ratings provided additional indices of emotional memory enhancement in the present study. Participants who watched the Negative video (vs. the Neutral video) reported greater confidence and less difficulty remembering event-related details. Increased negative emotion thus appears to have increased the ease with which details were retrieved from memory, consistent with the broader emotional memory literature (Phelps & Sharot, 2008). Exploratory analyses

also indicated that participants’ confidence ratings were moderately correlated with at least some aspects of their memory performance (i.e., recollection of central details, TP-lineup accuracy), suggesting that participants had some degree of insight into the quality of their memory. However, this relationship may be weaker among Negative participants than Neutral participants, as indicated by the correlations between confidence (in completeness) and the number of critical incident details among Neutral ($r = .28, p = .009$) versus Negative participants ($r = -.11, p = .27$), and the correlations between identification confidence and TP-lineup accuracy among Neutral ($r = .58, p < .001$) versus Negative participants ($r = .36, p = .008$).

Limitations

This study has several limitations. First, our manipulation of negative emotion, while statistically significant, almost certainly pales in comparison to the levels of emotional distress experienced by actual witnesses/victims. Nevertheless, this is a ubiquitous limitation for laboratory research in this area, and it is worth noting that our results converge with that of recent work with actual witnesses/victims (Dodier et al., 2021). Second, despite our best efforts to ensure maximal similarity across Negative and Neutral videos, the two versions may have differed in aspects other than their emotionality (e.g., distinctiveness, coherence, realism). However, this “confound” is likely inherent in any real-world emotional event. As Cahill and McGaugh (1995) argued, it is unlikely that *any* study can definitively rule out these “other” factors and, moreover, the effects of emotion on memory may be attributable (at least in part) to emotion’s effects on these seemingly extraneous factors. Third, because video content differed between conditions, coders were unable to be truly blind to experimental condition. Fourth, although we believe our approach to measuring negative emotion was effective in assessing the concepts of interest, the current scale ratings have not been validated and therefore should be interpreted with caution.

Conclusion

Although only a single study, the current results speak to the selectivity with which negative emotion may affect eyewitness memory processes—both with respect to the nonuniformity of enhanced recall as well as the differential effects on recall versus facial recognition. The current findings suggest that caution is warranted when discussing the effects of negative emotion on eyewitness memory, as eyewitness memory does not appear to be an undifferentiated unidimensional process. The pattern of memory enhancement observed in the present study was rather selective and uneven. The prevailing view (at least among eyewitness researchers) has been that emotional distress generally *impairs* memory. The current results, and that of several other recent experiments in the eyewitness literature (e.g., Marr, Quaedflieg, et al., 2021; Price et al., 2022; Sauerland et al., 2016), speak against this conclusion. Given researchers’ growing awareness of such discrepancies and an increasing emphasis on appropriate methodology (see Marr, Sauerland, et al., 2021), we are optimistic that this line of research will continue to refine our understanding of how well (or poorly) witnesses remember events in the real world.

Résumé

L'élucidation des effets des émotions négatives sur la mémoire des témoins oculaires est une partie importante de la compréhension de la façon dont les témoins se souviennent et rapportent des événements criminels. Les recherches existantes dans ce domaine ont été incohérentes dans leur méthodologie et leurs conclusions, ce qui justifie une étude empirique plus approfondie. Dans cette expérience, les participants ($N = 204$) ont visionné une version négative ou neutre d'une vidéo d'une interaction sociale mise en scène et leur mémoire a été évaluée sur le champ ou une semaine plus tard. L'évaluation de la mémoire comprenait à la fois des composantes de rappel et de reconnaissance (identification d'un suspect). Le groupe ayant reçu la version négative de la vidéo a montré une meilleure mémorisation de certains aspects de la vidéo que le groupe ayant reçu la version neutre, mais pas d'amélioration (ou d'affaiblissement) de la performance au niveau de l'identification d'un suspect. Les implications théoriques et pratiques sont discutées.

Mots-clés : mémoire émotionnelle, témoin oculaire, identification d'un suspect, stress, excitation

References

- Ack Baraly, K., Hot, P., Davidson, P. S. R., & Talmi, D. (2017). How emotional arousal enhances episodic memory. In J. H. Byrne (Ed.), *Learning and memory: A comprehensive reference* (2nd ed., pp. 295–324). Elsevier BV. <https://doi.org/10.1016/B978-0-12-809324-5.21051-1>
- Bierbrauer, A., Fellner, M. C., Heinen, R., Wolf, O. T., & Axmacher, N. (2021). The memory trace of a stressful episode. *Current Biology*, 31(23), 5204–5213.e8. <https://doi.org/10.1016/j.cub.2021.09.044>
- Bornstein, B. H., Liebel, L. M., & Scarberry, N. C. (1998). Repeated testing in eyewitness memory: A means to improve recall of a negative emotional event. *Applied Cognitive Psychology*, 12(2), 119–131. [https://doi.org/10.1002/\(SICI\)1099-0720\(199804\)12:2<119::AID-ACP500>3.0.CO;2-4](https://doi.org/10.1002/(SICI)1099-0720(199804)12:2<119::AID-ACP500>3.0.CO;2-4)
- Bornstein, B. H., & Robicheaux, T. R. (2009). Methodological issues in the study of eyewitness memory and arousal. *Creighton Law Review*, 42, 525–547.
- Burke, A., Heuer, F., & Reisberg, D. (1992). Remembering emotional events. *Memory & Cognition*, 20(3), 277–290. <https://doi.org/10.3758/BF03199665>
- Cahill, L., & McGaugh, J. L. (1995). A novel demonstration of enhanced memory associated with emotional arousal. *Consciousness and Cognition*, 4(4), 410–421. <https://doi.org/10.1006/ccog.1995.1048>
- Cahill, L., & McGaugh, J. L. (1998). Mechanisms of emotional arousal and lasting declarative memory. *Trends in Neurosciences*, 21(7), 294–299. [https://doi.org/10.1016/S0166-2236\(97\)01214-9](https://doi.org/10.1016/S0166-2236(97)01214-9)
- Cellini, N., Mercurio, M., & Sarlo, M. (2019). The fate of emotional memories over a week: Does sleep play any role? *Frontiers in Psychology*, 10, Article 481. <https://doi.org/10.3389/fpsyg.2019.00481>
- Christianson, S.-Å. (1992). Emotional stress and eyewitness memory: A critical review. *Psychological Bulletin*, 112(2), 284–309. <https://doi.org/10.1037/0033-2909.112.2.284>
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20(1), 37–46. <https://doi.org/10.1177/001316446002000104>
- Craik, F. I. M., & McDowd, J. M. (1987). Age differences in recall and recognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 13(3), 474–479. <https://doi.org/10.1037/0278-7393.13.3.474>
- Davis, S. D., Peterson, D. J., Wissman, K. T., & Slater, W. A. (2019). Physiological stress and face recognition: Differential effects of stress on accuracy and the confidence–accuracy relationship. *Journal of Applied Research in Memory and Cognition*, 8(3), 367–375. <https://doi.org/10.1016/j.jarmac.2019.05.006>
- Deffenbacher, K. A., Bornstein, B. H., Penrod, S. D., & McGorty, E. K. (2004). A meta-analytic review of the effects of high stress on eyewitness memory. *Law and Human Behavior*, 28(6), 687–706. <https://doi.org/10.1007/s10979-004-0565-x>
- Dodier, O., Ginot, M., Teissedre, F., Verkampt, F., & Fisher, R. P. (2021). Using the cognitive interview to recall real-world emotionally stressful experiences: Road accidents. *Applied Cognitive Psychology*, 35(4), 1099–1105. <https://doi.org/10.1002/acp.3828>
- Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review*, 66(3), 183–201. <https://doi.org/10.1037/h0047707>
- Fisher, R. P., & Geiselman, R. E. (1992). *Memory-enhancing techniques for investigative interviewing: The cognitive interview*. Charles C Thomas.
- Flowe, H. D., Carline, A., & Karoğlu, N. (2018). Testing the reflection assumption: A comparison of eyewitness ecology in the laboratory and criminal cases. *The International Journal of Evidence & Proof*, 22(3), 239–261. <https://doi.org/10.1177/1365712718782996>
- Glomb, K. (2022). How to improve eyewitness testimony research: Theoretical and methodological concerns about experiments on the impact of emotions on memory performance. *Psychological Research*, 86(1), 1–11. <https://doi.org/10.1007/s00426-021-01488-4>
- Houston, K. A., Clifford, B. R., Phillips, L. H., & Memon, A. (2013). The emotional eyewitness: The effects of emotion on specific aspects of eyewitness recall and recognition performance. *Emotion*, 13(1), 118–128. <https://doi.org/10.1037/a0029220>
- Kensinger, E. A. (2009). Remembering the details: Effects of emotion. *Emotion Review*, 1(2), 99–113. <https://doi.org/10.1177/1754073908100432>
- Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33(1), 159–174. <https://doi.org/10.2307/2529310>
- Lane, S. M., & Houston, K. A. (2021). *Understanding eyewitness memory: Theory and applications*. NYU Press. <https://doi.org/10.18574/nyu/9781479842513.001.0001>
- Ma, D. S., Correll, J., & Wittenbrink, B. (2015). The Chicago face database: A free stimulus set of faces and norming data. *Behavior Research Methods*, 47(4), 1122–1135. <https://doi.org/10.3758/s13428-014-0532-5>
- Marr, C., Quaedflieg, C. W. E. M., Otgaar, H., Hope, L., & Sauerland, M. (2021). Facing stress: No effect of acute stress at encoding or retrieval on face recognition memory. *Acta Psychologica*, 219, Article 103376. <https://doi.org/10.1016/j.actpsy.2021.103376>
- Marr, C., Sauerland, M., Otgaar, H., Quaedflieg, C. W. E. M., & Hope, L. (2021). The effects of acute stress on eyewitness memory: An integrative review for eyewitness researchers. *Memory*, 29(8), 1091–1100. <https://doi.org/10.1080/09658211.2021.1955935>
- McGaugh, J. L. (2003). *Memory and emotion: The making of lasting memories*. Columbia University Press.
- McGaugh, J. L. (2018). Emotional arousal regulation of memory consolidation. *Current Opinion in Behavioral Sciences*, 19, 55–60. <https://doi.org/10.1016/j.cobeha.2017.10.003>
- McKinnon, M. C., Palombo, D. J., Nazarov, A., Kumar, N., Khuu, W., & Levine, B. (2015). Threat of death and autobiographical memory: A study of passengers from Flight AT236. *Clinical Psychological Science*, 3(4), 487–502. <https://doi.org/10.1177/2167702614542280>
- McNally, R. J. (2003). *Remembering trauma*. Belknap Press; Harvard University Press.
- Memon, A., Meissner, C. A., & Fraser, J. (2010). The Cognitive Interview: A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law*, 16(4), 340–372. <https://doi.org/10.1037/a0020518>
- Morgan, C. A., III, Hazlett, G., Doran, A., Garrett, S., Hoyt, G., Thomas, P., Baranoski, M., & Southwick, S. M. (2004). Accuracy of eyewitness

- memory for persons encountered during exposure to highly intense stress. *International Journal of Law and Psychiatry*, 27(3), 265–279. <https://doi.org/10.1016/j.ijlp.2004.03.004>
- Park, J. (2005). Effect of arousal and retention delay on memory: A meta-analysis. *Psychological Reports*, 97(2), 339–355. <https://doi.org/10.2466/pr0.97.2.339-355>
- Pezdek, K., Abed, E., & Cormia, A. (2021). Elevated stress impairs the accuracy of eyewitness memory but not the confidence–accuracy relationship. *Journal of Experimental Psychology: Applied*, 27(1), 158–169. <https://doi.org/10.1037/xap0000316>
- Phelps, E. A., & Sharot, T. (2008). How (and why) emotion enhances the subjective sense of recollection. *Current Directions in Psychological Science*, 17(2), 147–152. <https://doi.org/10.1111/j.1467-8721.2008.00565.x>
- Price, H. L., Sykes Tottenham, L., Hatin, B., Fitzgerald, R. J., & Rubínová, E. (2022). Effects of stress on eyewitness identification in the laboratory. *Applied Cognitive Psychology*, 36(1), 191–202. <https://doi.org/10.1002/acp.3910>
- Reisberg, D., & Heuer, F. (2004). Memory for emotional events. In D. Reisberg & P. Hertel (Eds.), *Memory and emotion* (pp. 3–41). Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195158564.003.0001>
- Reisberg, D., & Heuer, F. (2007). The influence of emotion on memory in forensic settings. In M. P. Toglia, J. D. Read, D. F. Ross, & R. C. L. Lindsay (Eds.), *The handbook of eyewitness psychology*, Vol. 1. *Memory for events* (pp. 81–116). Lawrence Erlbaum.
- Sauerland, M., Raymaekers, L. H. C., Otgaar, H., Memon, A., Waltjen, T. T., Nivo, M., Slegers, C., Broers, N. J., & Smeets, T. (2016). Stress, stress-induced cortisol responses, and eyewitness identification performance. *Behavioral Sciences & the Law*, 34(4), 580–594. <https://doi.org/10.1002/bsl.2249>
- Shepherd, E., Mortimer, A., Turner, V., & Watson, J. (1999). Spaced cognitive interviewing: Facilitating therapeutic and forensic narration of traumatic memories. *Psychology, Crime & Law*, 5(1–2), 117–143. <https://doi.org/10.1080/10683169908414997>
- Shields, G. S., Sazma, M. A., McCullough, A. M., & Yonelinas, A. P. (2017). The effects of acute stress on episodic memory: A meta-analysis and integrative review. *Psychological Bulletin*, 143(6), 636–675. <https://doi.org/10.1037/bul0000100>
- Snow, M. D., & Eastwood, J. (2022a). Examining the effects of negative emotion and interviewing procedure on eyewitness recall [Stage 1 Registered Report]. *Applied Cognitive Psychology*, 36(1), 235–244. <https://doi.org/10.1002/acp.3907>
- Snow, M. D., & Eastwood, J. (2022b). *Selective emotional memory enhancement in a mock witness paradigm*. <https://osf.io/ngckb>
- Valentine, T., & Mesout, J. (2009). Eyewitness identification under stress in the London Dungeon. *Applied Cognitive Psychology*, 23(2), 151–161. <https://doi.org/10.1002/acp.1463>
- Wiemers, U. S., Sauvage, M. M., Schoofs, D., Hamacher-Dang, T. C., & Wolf, O. T. (2013). What we remember from a stressful episode. *Psychoneuroendocrinology*, 38(10), 2268–2277. <https://doi.org/10.1016/j.psyneuen.2013.04.015>
- Yerkes, R. M., & Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit formation. *The Journal of Comparative Neurology and Psychology*, 18(5), 459–482. <https://doi.org/10.1002/cne.920180503>
- Yonelinas, A. P., & Ritchey, M. (2015). The slow forgetting of emotional episodic memories: An emotional binding account. *Trends in Cognitive Sciences*, 19(5), 259–267. <https://doi.org/10.1016/j.tics.2015.02.009>
- Yuille, J. C., & Cutshall, J. L. (1986). A case study of eyewitness memory of a crime. *Journal of Applied Psychology*, 71(2), 291–301. <https://doi.org/10.1037/0021-9010.71.2.291>

Appendix

Retrieval Instructions

Recall Instructions (Free Recall Instructions)

Please write everything you can remember about the video you watched in the previous session. When you are ready, please tell me everything you can remember about the video *in as much detail as possible*.

Recall Instructions (CI-Based Instructions)

Thanks for taking the time to provide your account of the video you watched in the previous part of the study!

Please take your time. Do not edit anything out of your account, even if it seems unimportant. However, please do not make anything up—it is okay if you don't know something. The goal is for you to report everything you can remember about the video.

Please tell us about the video you watched in the previous part of this study. It is very important that you write everything you can remember, every little detail, even if you think it is not important. Anything at all that you remember, please make sure to mention it.

In order to help with the remembering process, please take your time and carefully read the following instructions.

To begin, I would like you to try to think back to when you saw the video. Try to picture yourself in the room where you watched the video. Try to think about your mood at the time when you were

watching the video ... think about your reaction to the video ... think about how it made you feel.

Now I would like you to focus on the video itself ... think about what you saw ... think about what you heard ... think about the people in the video.

When you have a clear picture of the event in your mind, please write everything you can remember about the video *in as much detail as possible*.

TP and TA Lineup Instructions

You will be asked to view a lineup consisting of several photographs. One of the men from the video you watched in the previous part of the study *may or may not* be present in the lineup. If you see the man from the video, please select his photograph. If you do not see the man from the video, please select “not here.”

Please note: There was more than one man in the video. We are asking specifically about the *second man who entered* the room.

Received July 19, 2022

Revision received November 9, 2022

Accepted November 9, 2022 ■