Emotion

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The Emotional Eyewitness: The Effects of Emotion on Specific Aspects of Eyewitness Recall and Recognition Performance

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The present set of experiments aimed to investigate the effects of negative emotion on specific aspects of eyewitness recall and recognition performance. The experience of emotion was manipulated between subjects, with participants either viewing a crime scenario (a mugging) or a neutral scenario (a conversation). Eyewitness recall was categorized into descriptions of the perpetrator, critical incident, victim, and environmental details. The completeness and accuracy of eyewitness recall across categories of detail were measured in Experiment 1. A significant main effect of negative emotion was found for the completeness of recall. Furthermore, a significant main effect of the completeness of eyewitness statements was found, but not for their accuracy. However, these main effects were qualified by a significant interaction between emotion and category of detail recalled. Specifically, emotional participants provided a more complete description of the perpetrator than neutral participants; however, they were less able than their neutral counterparts to describe what the perpetrator did to the victim. In light of these findings, Experiment 2 investigated whether enhanced completeness of perpetrator descriptions during recall translated into an enhanced ability to recognize the perpetrator from a photographic lineup by emotional compared with neutral participants. Results from Experiment 2 suggest that while emotional participants again provide a more complete description of the perpetrator, they are less able than their neutral counterparts to recognize the perpetrator from a photographic lineup. Results are discussed in terms of a retrieval motivation hypothesis of negative emotional experience and the possible consequences for eyewitness testimony.

Keywords: emotion, memory, cognition, eyewitness testimony

The experience of emotion by an eyewitness to a crime is one of the main variables that can affect the reliability of eyewitness testimony (Wells, Memon, & Penrod, 2006). For this reason, much previous research has investigated the effects of emotion on memory recall (e.g., Clifford & Hollin, 1981; Edelstein, Alexander, Goodman, & Newton, 2004). The central argument that has developed from this research is that individuals who witness a negative emotional event may have enhanced memory for the gist or central details of the event but impaired memory for peripheral details (e.g., Reisberg & Heuer, 2004, 2007; Safer, Christianson, Autry, & Österlund, 1998; Wessel, van der Kooy, & Merckelbach, 2000, Experiment 2; see also Edelstein et al., 2004).

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However, this research is limited by a potentially confounding factor: There are two working definitions of what central and peripheral details are. For example, Christianson and Loftus (1991) defined central details as details that were spatially central or in the foreground of the scene. Thus, peripheral details were background details (Christianson & Loftus, 1991). On the other hand, Heuer and Reisberg (1990) defined central and peripheral details in terms of centrality to the plot of the scenes shown to participants. It is therefore no surprise to learn that Christianson and Loftus (1991) and Heuer and Reisberg (1990) reported conflicting results. Christianson and Loftus (1991) reported enhanced memory for central details and impaired memory for peripheral details when participants experienced negative emotion, whereas Heuer and Reisberg (1990) did not. It is largely argued that these seemingly conflicting results are due to the different definitions of central and peripheral details used (for a full review, see Reisberg & Heuer, 2004).

In spite of the expansive extant literature on emotion and memory, little is known about the effects of emotion on eyewitness memory—in particular, the way that the experience of emotion affects memory for the perpetrator of a crime. For instance, questions remain as to how the experience of emotion may affect the recall of action details (what the perpetrator did) compared with descriptive details of the perpetrator? In an eyewitness scenario, the ability to describe what the perpetrator did may be equally

important as the ability to describe the perpetrator, and, consequently, this question holds both theoretical and practical import. It is therefore more than a little surprising that only a few studies have differentiated recall for separate aspects of an event in this way (Stein & Memon, 2006; Wright & Holliday, 2007). Those experiments that have analyzed recall in this way suggest that descriptions of actions may be recalled to different levels of completeness and accuracy than person descriptions (Stein & Memon, 2006; Wright & Holliday, 2007). However, the topic of these articles was interviewing technique and not emotional experience, and therefore this remains a largely unexplored area for emotion and memory researchers.

It is well established by the eyewitness literature that describing a person, such as the perpetrator of a crime, is a very difficult task (for a recent review, see Meissner, Sporer, & Schooler, 2007). Meissner et al. (2007) argued that the difficulty of describing a person often results in nondistinct, general descriptions, meaning that they can apply to many people in the given population. However, given established links between emotion and memory for central details (Reisberg & Heuer, 2004, 2007), it seems plausible that the experience of negative emotion may enhance memory for information about a perpetrator, due to this being such a central element of the crime witnessed (therefore conforming to both spatial and plot definitions of central details). And what effect might that have on the recall of other aspects of the emotional to-be-remembered event? Could the experience of negative emotion result in the focusing of attentional resources onto the perpetrator of the crime, resulting in better descriptions of the perpetrator but poorer descriptions of his actions? Or could such attentional focus result in improved descriptions of both the perpetrator and the action details of the crime? In an attempt to answer these questions, the first experiment described in this article investigates whether the experience of negative emotion affects the recall of aspects of a crime event differently.

Eyewitnesses may also be asked to visually identify the perpetrator of the crime from an identity parade or lineup containing the suspect. Therefore, the possible effects of negative emotion on eyewitness recognition performance are of equal interest to those on recall performance, and this is addressed in Experiment 2. Research suggests that the effects of stress may greatly impair an eyewitness's ability to recognize the perpetrator of a crime, even if the perpetrator has been encountered for a considerable period of time (e.g., Morgan et al., 2004, 2007).

Morgan et al. (2004, 2007) conducted a series of experiments investigating the effects of stress on person recognition. The participant pool consisted of male soldiers who were interrogated in a well-lit room for 30 min at a time over approximately four hours as part of their interrogation resistance training. Morgan et al. (2004) investigated two scenarios: a high-stress and a low-stress interrogation. The high-stress interrogation involved physical confrontation by the interrogator toward the soldier and the low-stress condition did not. Morgan et al. (2004) found that soldiers who had taken part in high-stress interrogations were significantly worse at subsequently identifying any of their interrogators than those who had taken part in the low-stress interrogations. They thereafter argued that eyewitnesses who encounter heightened stress and personal threat while attempting to encode details of the event and/or perpetrator are likely to be highly error prone when asked to subsequently identify the perpetrator. In further support for the theory of stress impairing perpetrator recognition, a meta-analysis of the effects of stress on eyewitness memory also found impairment in recognition performance for participants who experienced stress compared with those who did not (Deffenbacher, Bornstein, Penrod, & McGorty, 2004).

Although able to inform the debate over the potential effects of negative emotion on eyewitness recognition performance, the stress that soldiers experience from repeated interrogations is likely to be very different from the types of negative emotions experienced in a more common eyewitness scenario. For instance, the extant literature on the central and peripheral effect suggests that an eyewitness may focus attention on the perpetrator, which could lead to an improved ability to recognize the perpetrator of a crime, if that crime caused the eyewitness to experience negative emotion. Therefore, the second experiment attempts to bridge this gap with an investigation of the effects of negative emotion on recognition memory performance. Thus, to summarize, Experiment 1 investigates the possible effects of negative emotion on recall memory performance. Participant recall is coded for descriptive details and action details of the perpetrator separately in order to answer the question of whether the experience of negative emotion may differently affect the descriptions of these two key elements of an eyewitness statement. Experiment 2 addresses whether negative emotion affects the ability of participants to recognize the perpetrator from a photographic lineup, as the stress literature would indicate, or whether it may improve recognition ability due to the perpetrator being a central detail, as the emotion literature may indicate.

In order to achieve this, the two experiments follow a similar methodology: one group of participants is presented with a video depicting a crime event that elicits negative emotion, and a second group is presented with an event that is very similar in most details but remains neutral. The paradigm of presenting participants with either an emotional or a highly similar and comparable neutral event has long been the preferred methodology of emotion and memory researchers (e.g., Christianson & Loftus, 1987; Clifford & Scott, 1978; Hulse, Allan, Memon, & Read, 2007; Safer et al., 1998). In order to ensure comparability between the emotion-inducing and neutral video scenarios, both videos are controlled to ensure that the actions depicted are as similar as possible, even during the critical sequence that either depicts a mugging (emotion-inducing) or an altruistic act and a conversation (neutral).

Finally, recent reviews of the emotion and memory literature (e.g., Levine & Edelstein, 2009; Levine & Pizarro, 2004) have called for a greater delineation and specification of our concept of "emotion." Researchers have argued that negative emotion is not a single construct, but rather that we may experience more than one emotion at a time and that the eyewitness literature, in particular, would benefit from delineating the experience of emotion in this way (Levine & Edelstein, 2009; Levine & Pizarro, 2004). Therefore, in this study, we investigate the types of negative emotions experienced by eyewitnesses to a crime via participant ratings of their experience of 13 separate emotions.

Experiment 1

As it is important for an eyewitness to provide a complete and accurate description of what they encountered, both of these constructs of memory are assessed. In line with the current literature

(e.g., Reisberg & Heuer, 2007), it is predicted that participants in the negative emotion condition will provide a more complete and accurate description of the perpetrator of the crime event than participants who experience the neutral condition, as the perpetrator is central both to the plot and spatially in the videos (therefore conforming to both definitions of central details). Participant recall is also be analyzed in terms of recall for the environmental details, description of the victim, and the actions the perpetrator commits. For these other detail categories, competing hypotheses can be entertained. If the perpetrator is a central detail under emotional conditions, then his actions may also be central to attention, therefore resulting in enhanced recall of the action details of the critical incident for emotional compared with neutral participants. On the other hand, if the attentional focus is on the descriptive details of the perpetrator only, it may be that his actions are not encoded in depth by negatively emotional participants. The same predictions could be made for recall of the victim—as she shares close spatial proximity to the perpetrator during the videos, descriptions of her may benefit, or be at a disadvantage, because of the experience of negative emotion. Finally, it is unclear whether environmental details would be classified as central or peripheral—as they are spatially central throughout the video, however, one would not classify them as central to the plot of the scenario. In sum, it is predicted that the experience of negative emotion will enhance the completeness and accuracy of perpetrator descriptions for negatively emotional participants in comparison with neutral participants, whereas competing hypotheses are entertained for the recall of other aspects of the crime event, as outlined previously.

Method

Participants and design. Psychology students were recruited from the University of Aberdeen in the United Kingdom and awarded course credit for participation. In total, 101 participants took part, of whom 51 viewed the emotion-inducing video and 50 viewed the neutral video. There were 30 males and 71 females, ages 17 to 46 years ($M = 19.5$, $SD = 3.1$). All spoke English as their first language. A 2×4 mixed design was employed, with the between-subjects factor of the emotion-inducing or neutral video and the within-subjects factor of category of detail (environmental, critical incident, victim, and perpetrator). The dependent variables were the completeness and accuracy of recall.

Materials and apparatus: Videos. The scenarios utilized in this experiment were staged events involving the same actors. In both videos, the participants view an older woman withdrawing money from a cash machine and then walking down a road and entering a wooded area. A young man is also shown to be entering the wooded area. What follows next is the critical incident, which differs slightly between scenarios. In the mugging scenario, the man approaches the woman and shouts at her, grabs hold of her handbag, and attempts to remove it from her shoulder. The woman shouts at the man, but he successfully removes the woman's handbag and runs off. The woman then calls a friend on her mobile phone to say that she has been mugged. In the conversation scenario, the man approaches the woman and asks her for the time. When checking her watch, the woman's handbag falls off her arm and onto the ground. The young man picks up the woman's handbag and holds it while she tells him the time, after which he gives the bag back to the woman and runs off to catch his bus. The older woman then calls a friend to arrange to meet for tea. The mugging and conversation critical incidents were stringently controlled so that in both scenarios the young man and the older woman exchanged words, the man handled the woman's handbag and ran away at the end of the interaction, after which the woman makes a phone call. For ease of exposition, regardless of whether referring to the mugging or conversational scenario, the man is labeled as the "perpetrator" and the woman as the "victim."

Pilot testing utilizing the postevent emotion rating scale (see description for full details, scale ranging numerically from 0 to 3) revealed a mean negative emotion rating for the mugging scenario of $M = 1.03$, $SD = 0.64$, and a negative emotion rating of $M = 0.20$, $SD = 0.08$ for the conversation scenario. As this difference is statistically significant, $t(8) = 2.54$, $p = .035$, $d = 1.82$, 95% CI [0.07, 1.59], the film clips were deemed suitable for use in the present study, and hereafter, the mugging scenario is referred to as the "emotion-inducing scenario" and the conversation scenario as the "neutral scenario."

Postevent emotional rating scale. This scale required participants to rate their level of experience of irritation, annoyance, outrage, anger, happiness, sadness, sympathy, disgust, upset, fright, anxiety, relief, and also an option of "I feel nothing." The level of each option was measured on a 4-point scale ranging from *not at all* to *very much so* (scored on a scale from 0 to 3). Ratings of happiness, relief, and feeling nothing are reported separately from ratings of negative emotions.

Filler tasks. In order to introduce a delay between viewing the video and completion of the recall measures (20 min), participants completed questionnaires on likes and dislikes. As these measures were filler items, they are not discussed further.

Recall. Participants were given a recall sheet with the following instructions: "Please write down all the details that you remember from the video you have just watched." Participants were told that they could continue on the other side of the sheet, if necessary. Participants were also given a cued-recall test; however, those results are not reported herein.

Procedure. All participants were tested individually and informed that the purpose of the experiment was to investigate how general visual ability can affect memory. After completion of the consent form, participants viewed one of the two video scenarios. After viewing the video, participants were given a booklet containing the postevent emotion rating scale and a range of other questionnaires and tasks. Completion of these measures resulted in a lag of approximately 20 min between viewing the video and completing the recall measures. The recall task was then given, after which all participants were debriefed and told the true nature of the experiment.

Data coding and analysis for the recall tasks. Prior to the commencement of testing, detailed transcripts of the videos were generated by two independent coders who were unaware of the experimental manipulation. From these descriptions key, potentially forensically relevant information across the four categories of details (environmental, critical incident, perpetrator and victim) was selected (see Table 1 for the total number of details in each category for each video). Following testing, participant recall was coded in terms of completeness, which reflected the total number of correct details participants recalled, and accuracy (the proportion of a participants' total recall that was accurate). Given that the number of recallable correct details differed slightly across emo-

Table 1
Total Number of Forensically Relevant Details for Each Detail Category in the Emotion-Inducing and Neutral Videos

Detail category	Emotional	Neutral
Environmental	160	171
Critical incident	81	67
Victim	45	45
Perpetrator	42	42

tional and neutral scenarios (see Table 1), the data were transformed into proportions to enable comparisons across scenarios. The proportion completeness of recall was calculated by dividing the number of correct details a participant recalled by the possible number of correct details they could have recalled, based upon the totals in Table 1. Proportion accuracy was calculated by dividing the number correct details a participant recall by the total number of details they recalled. A measure of intercoder agreement was calculated between the experimenter (K.A.H.) and an additional coder who had not created the video transcripts and was therefore blind to the experimental procedure and had not viewed either video previously. The blind coder was provided with a copy of the video transcripts to facilitate coding of accuracy. Agreement was based on a random sample (20%) of participant booklets. Intercoder agreement across all categories of detail in the recall was high (all rs $> .8$), with all disagreements resolved through discussion.

The completeness and accuracy of recall were coded and analyzed separately with analysis of variance (ANOVA). Follow-up t tests with Bonferroni correction were also conducted to further investigate the effects of negative emotion on memory recall. As a Bonferroni correction is a highly conservative correction, follow-up comparisons were divided into two families to correct for the possibility of Type II errors (see Tabachnick & Fidell, 2007). As clear directional predictions exist about perpetrator recall, one planned comparison of the completeness and accuracy of the perpetrator descriptions was run, thus, $\alpha/1 = .05$. One further family of unplanned comparisons of the completeness and accuracy of environmental, critical incident, and victim descriptions was also conducted, thus, $\alpha/3 = .016$.

Results

Manipulation check. An independent samples t test on the ratings from the postevent emotion rating scale supported the result from the pilot data: Participants who viewed the emotion-inducing video rated their experience of negative emotions as significantly higher ($M = 1.08$, $SD = 0.65$) than participants who viewed the neutral video ($M = 0.13$, $SD = 0.18$), $t(99) = 10.05$, $p < .001$, $d = 1.99$, 95% CI [0.76, 1.14]. Furthermore, to ensure that neutral participants did not experience any emotions (as positive emotions were also included in the postevent emotion rating scale), these scores were also considered. All participants who viewed the neutral video rated below 1 for all possible emotion ratings ($M = 0.36$, $SD = 0.15$), thus suggesting that they did not have any emotional experience throughout the video.

These data confirm that (a) the emotion manipulation was successful in inducing negative emotion in those who viewed the emotion-inducing video, and (b) participants who viewed the neutral video remained neutral. Therefore, participants who viewed the emotion-inducing video will hereafter be referred to as emotional participants and those who viewed the neutral video will be referred to as neutral participants.

Breakdown of emotion ratings for those viewing the crime. The experience of emotion was further analyzed in terms of the individual emotions experienced by participants. The highest emotion rating by participants who viewed the emotion-inducing video was for sympathy ($M = 2.25$, $SD = 0.76$), followed by disgust ($M = 1.41$, $SD = 1.08$), annoyance ($M = 1.25$, $SD = 1.02$), irritation ($M = 1.24$, $SD = 0.99$), anger ($M = 1.20$, $SD = 1.02$), and sadness ($M = 1.18$, $SD = 0.93$). The remaining emotions of upset ($M = 0.90$, $SD = 0.83$), outrage ($M = 0.90$, $SD = 0.94$), experiencing nothing ($M = 0.67$, $SD = 0.95$), anxiety ($M = 0.25$, $SD = 0.56$), fright ($M = 0.22$, $SD = 0.50$), happiness ($M = 0.18$, $SD = 0.43$), and relief ($M = 0.08$, $SD = 0.38$) were all scored below 1 one the scale.

Analysis of the recall tasks. Completeness and accuracy mean proportions, standard deviations, and confidence intervals for emotional and neutral participants across all categories of details can be found in Table 2.

Completeness of recall. A 2 (emotional vs. neutral) × 4 (environmental, critical incident, victim, perpetrator) mixed design ANOVA was run on the completeness data from the recall task. A main effect of emotion was found, with neutral participants producing more complete recall, $F(1, 98) = 13.31$, $p < .001$, partial $\eta^2 = .12$. A main effect of category of detail recalled was also found, $F(3, 294) = 154.91$, $p < .001$, partial $\eta^2 = .61$, with descriptions of environmental details more complete than of the victim ($p < .001$) or perpetrator ($p < .001$). Descriptions of the critical incident were also more complete than of the victim ($p < .001$) and the perpetrator ($p < .001$), and descriptions of the victim were more complete than of the perpetrator ($p < .001$). The completeness of the environmental and critical incident descriptions did not differ significantly from each other ($p = 1.00$). Critically, a significant interaction between the experience of emotion and category of detail was observed, $F(3, 294) = 71.77$, $p < .001$, partial $\eta^2 = .42$.

Planned comparisons revealed that emotional participants provided a more complete description of the perpetrator than neutral participants, $t(99) = 2.25$, $p = .014$ (one-tailed), $d = 0.36$. Post hoc testing, on the other hand, revealed that neutral participants provided a more complete description of the critical incident than the emotional participants, $t(99) = 11.18$, $p < .001$, $d = 2.25$. Further, there were no significant differences between emotional and neutral participants in the completeness of the victim, $t(99) = 1.53$, $p = .129$, $d = 0.31$, or environmental descriptions, $t(98) = 0.15$, $p = .884$, $d = 0.00$. Interestingly, within the emotional group, the degree of emotion experienced did not correlate with the degree of perpetrator or critical incident recall in any linear way (critical incident: $r = .15$, $p = .249$; perpetrator: $r = .10$, $p = .433$, respectively).

Accuracy of recall. A further 2 (emotional vs. neutral) × 4 (environmental, critical incident, victim, perpetrator) mixed design ANOVA was run on the proportion accuracy of recall. The main effect of emotion was nonsignificant ($F < 1$). A main effect of category of detail was found, $F(3, 294) = 7.74$, $p < .001$, partial $\eta^2 = .07$, with the critical incident the most accurately recalled

Table 2
Mean Proportion Recall of Emotional and Neutral Participants in Terms of Completeness and Accuracy Across All Detail Categories

	Completeness				Accuracy			
	Emotional		Neutral		Emotional		Neutral	
Detail category	*M*, *SD*	95% CI	*M*, *SD*	95% CI	*M*, *SD*	95% CI	*M*, *SD*	95% CI
Environmental	0.35, 0.19	[0.30, 0.39]	0.35, 0.12	[0.31, 0.40]	0.97, 0.04	[0.96, 0.99]	0.94, 0.06*	[0.96, 0.96]
Critical incident	0.18, 0.10	[0.14, 0.22]	0.49, 0.18**	[0.46, 0.54]	0.98, 0.05	[0.97, 0.99]	0.99, 0.02	[0.98, 1.00]
Victim	0.18, 0.10	[0.15, 0.21]	0.15, 0.08	[0.12, 0.17]	0.92, 0.11	[0.89, 0.96]	0.94, 0.12	[0.90, 0.97]
Perpetrator	0.11, 0.10	[0.09, 0.14]	0.08, 0.06*	[0.05, 0.10]	0.87, 0.28	[0.80, 0.94]	0.92, 0.21	[0.85, 0.99]

Note. Scores range from 0 to 1, with 0 denoting no recall and 1 denoting 100% recall. Asterisks denote significant differences between emotional and neutral participants.
* $p < .05$. ** $p \leq .001$.

detail category (all ps $< .005$); the three other categories did not differ significantly from each other (all ps $> .066$). The interaction between emotion and category of detail was nonsignificant, $F(3, 294) = 1.47$, $p = .223$, partial $\eta^2 = .01$.

Planned comparisons revealed that emotional and neutral participants' descriptions of the perpetrator were equally accurate, $t(99) = 0.97$, $p = .334$, $d = 0.16$. Post hoc t tests revealed that emotional participants' environmental descriptions were more accurate than neutral participants', $t(98) = 2.96$, $p = .004$, $d = 0.59$. However, emotional and neutral participants descriptions of the victim, $t(99) = 0.44$, $p = .657$, $d = 0.08$, and critical incident, $t(99) = 1.17$, $p = .245$, $d = 0.02$, were equally accurate. Finally, within the emotional group, the degree of emotion experienced did not correlate with the accuracy of environmental detail recall in a linear way, $r = .12$, $p = .410$.

Discussion

The current experiment aimed to investigate the effects of negative emotion on eyewitness recall memory for the perpetrator of a crime in comparison with other aspects of the event. It was predicted that participants who viewed the emotionally arousing video would focus their attention on to the perpetrator of the crime, given he was both spatially central and central to the plot of the emotional video. It was further argued that such attentional focus would be likely to result in a more complete and accurate description of the perpetrator by emotional compared with neutral participants. In line with predictions, emotional participants provided a more complete description of the perpetrator than neutral participants. This suggests that the perpetrator was central to attention for emotional participants but not for their neutral counterparts. However, the experience of emotion had no effect on the accuracy of perpetrator descriptions. This may be because both emotional and neutral participants were monitoring their memory and only reporting those details about which they were very confident in their accuracy (e.g., Koriat & Goldsmith, 1996). Indeed, accuracy levels were generally quite high.

Neutral participants provided a more complete description of the action details of the critical incident than emotional participants did, although, again, with no significant differences in the accuracy of recall. No significant differences were found in the completeness or accuracy of victim recall by emotional and neutral participants. Emotional participants did provide a more accurate description of the environmental details than their neutral counterparts; however, both emotion conditions resulted in similar levels of completeness of recall about environmental information. These results add to the literature on links between emotion and recall of central and peripheral details (Reisberg & Heuer, 2004). In particular, they indicate that negative emotions experienced when witnessing a crime improved memory for one aspect of the central details about the crime (description of the perpetrator) while impairing memory for another aspect (what the perpetrator did) in comparison with neutral participant recall. The current data suggest that it may only be the descriptive details of the perpetrator that are central to attention for emotional participants, and this may inhibit their ability to describe the perpetrator's actions.

The final task of Experiment 1 was to analyze the emotional experience of participants who viewed the emotion-inducing video. Emotional participants appeared to experience sympathy- and anger-related emotions (see Ortony, Clore, & Collins, 1988, for a conceptualization of the categories of emotional groups). These findings suggest that an eyewitness to a mugging crime may experience a range of emotions during the event rather than one emotion in isolation (e.g., Levine & Edelstein, 2009; Levine & Pizarro, 2004).

The current experiment indicates that it is the descriptive details of the perpetrator of a crime that emotional participants appear to centralize when viewing the crime event. Therefore, could this improve the ability of emotional participants to accurately recognize the perpetrator from a photographic lineup—a task that is known to be very difficult? This question is the focus of Experiment 2.

Experiment 2

Findings from Experiment 1 indicate that emotional participants are able to describe the perpetrator of a mugging crime more fully, but not more accurately, than neutral participants. The central and peripheral effect literature argues that this is likely due to a narrowing of attention on the perpetrator, given he is central to both the plot and spatially (e.g., Reisberg & Heuer, 2004, 2007). This finding raises a very interesting question: Could the experience of emotion during encoding offset the difficulty of recognizing a perpetrator in a photographic lineup? The current literature on stress and recognition memory suggests that stress impairs the ability of an eyewitness to successfully recognize the perpetrator from a photographic lineup (e.g., Deffenbacher et al., 2004; Morgan et al., 2004, 2007). However, it is not clear how these results

might extend to other types of eyewitness situations in which a different range and intensity of emotions might be experienced.

Therefore, the aim of Experiment 2 is to investigate the possibility that the experience of negative emotion by participants may enhance their ability to recognize the perpetrator from a photographic lineup. Two forms of photographic lineup are shown to participants—one is a "target present" (TP) lineup, and is so-called because it contains a photograph of the perpetrator of the crime (the target). The second version is called a "target absent" (TA) lineup, which does not contain an image of the perpetrator and instead, in his place, contains an image of a person who looks highly similar to the perpetrator. The construction of the lineups is fully described in the Method section.

Finally, as in Experiment 1, recall data were collected from participants—this is to ensure that we replicate the finding of enhanced descriptive recall of the perpetrator, upon which our recognition-based questions are predicated. The emotional experience of participants was also measured in the same way as in Experiment 1, in order to ensure consistency of the emotional experience between experiments.

Method

Participants and design. In total, 233 psychology students were recruited from the University of Aberdeen in the United Kingdom and were awarded course credit for participation; 61 were male, 172 were female, and all were between 17 and 53 years old ($M = 20.07$, $SD = 4.84$).

Recognition. A 2 × 2 between-subjects design was employed with factors of emotion (emotion-inducing or neutral video) and lineup type (TP or TA). Of the 233 participants who took part, 118 participants viewed the emotion-inducing video and 115 viewed the neutral video. One hundred sixteen participants viewed TP lineups and 117 viewed TA lineups.

Recall. Of the 233 participants who were tested, the first 116 participants' (roughly half) recall for details of the video were analyzed, as a G*Power analysis indicated this was a sufficient number to detect significant effects. Of those 116, 34 were male and 82 were female, with an age range of 17 to 53 years ($M = 20.43$, $SD = 5.52$). Further, 59 viewed the emotion-inducing video and 57 viewed the neutral video. A 2 × 4 mixed design was used with the between-subjects factor of emotion (emotion-inducing or neutral video) and the within-subjects factor of category of detail (environmental, critical incident, victim, perpetrator).

Materials and apparatus. All materials and apparatus are the same as in Experiment 1, except for the photographic lineups, which are described next.

Photographic lineups. The present experiment utilized simultaneous TP and TA lineups for the perpetrator depicted in the videos. A correct response to a TP lineup is recorded when an eyewitness correctly identifies the perpetrator (a hit), whereas the choice of a foil is incorrect (a false-positive), as is the response that the perpetrator is not present (a miss). In TA lineups, an accurate response is recorded when an eyewitness states that the perpetrator is not present (also known as a correct rejection). The choice of a foil from a TA lineup is incorrect and is known as a false identification (or false-positive).

Perpetrator lineups comprised six color photographs on a white sheet of A4 paper. The photographs, each approximately 8 × 6 cm in size, were arranged in a 2 × 3 array. Each photograph featured a frontal view head-and-neck shot of either a foil (innocent lineup member) or the target (the perpetrator depicted in the videos who is only present in the TP lineup).

Construction of the lineups: Selection of foils. Foils for the perpetrator lineups were selected on the basis of resemblance to the target. This method was utilized, as it is the method recommended by the Police and Criminal Evidence Act (PACE 1984, Code D: 3.7; The Home Office, 2008) for constructing lineups in the United Kingdom.

Pools of 184 neutral head-and-shoulder photographs of young males (early to mid-20s) originally employed by Meissner, Brigham, and Butz (2005) were used for the selection of perpetrator foils. A smaller pool of potential foils was selected by the experimenter on the basis of similar facial characteristics as the target in the videos (hair color and style, face shape, and facial features).

Standardization of the lineups. Independent judges rated how similar each of the potential foils were to the target on a 10-point scale ranging from *not at all similar* to *very similar*. The judges also rated how distinctive each face was (including the target) on a 10-point scale ranging from *not at all distinctive* to *very distinctive*. The six faces that were rated most similar to the perpetrator and of a similar level of distinctiveness to the perpetrator by the independent raters were selected as foils for the lineups.

All similarity ratings for selected perpetrator foils were between $M = 4.83$, $SD = 1.83$, and $M = 7.00$, $SD = 0.89$ (scale of 0 to 10), which suggests that no foil was perceived as extremely similar or dissimilar to the target. Two-tailed paired samples *t* tests were used to explore the differences between similarity ratings for the chosen foils and the perpetrator. Comparisons of all chosen foil and perpetrator combinations (i.e., Pair 1 with Pair 2, Pair 1 with Pair 3, and so on) revealed no significant differences (all $ps > .1$), suggesting that all chosen foils were perceived as equally similar to the perpetrator, thus minimizing lineup bias. All distinctiveness ratings for the chosen foils and the perpetrator were between $M = 3.20$, $SD = 1.79$, and $M = 4.40$, $SD = 1.94$, which suggests that neither the foils nor the target were perceived as very distinctive or not at all distinctive. Two-tailed paired samples *t* tests were used to explore the differences between the distinctiveness ratings for the chosen foils and the perpetrator. Comparisons of all foil and perpetrator combinations (i.e., Foil 1 and target, Foil 1 and Foil 2, Foil 2 and target, Foil 2 and Foil 3, and so on) revealed no significant differences (all $ps > .09$), suggesting that the foils and the perpetrator were perceived as being of an equal level of distinctiveness, thus once again minimizing lineup bias.

Counterbalancing/position effects. In line with recommendations by McQuiston-Surrett, Malpass, and Tredoux (2006), two versions of the TP lineups were created, one with the target in Position 2 and one with the target in Position 5. This counterbalancing procedure aims to control for position effects and counteracts the possibility that participants may communicate to each other about which position the target is in (see McQuiston-Surrett et al., 2006).

Procedure. The procedure employed is highly similar to the procedure in Experiment 1, with the addition of photographic lineups that occurred at the end of the experimental session. On completion of the booklet that contained the recall protocol, all

participants were administered with a TP or TA perpetrator lineup and a lineup response sheet. After marking their identification decision, all participants were debriefed and told the true nature of the experiment and allowed time to ask any questions. Participants were then thanked before leaving the laboratory.

Data coding and analysis of the recall and recognition tasks. Intercoder agreement for the completeness and accuracy of the recall task was calculated between the experimenter (K.A.H.) and a second coder blind to the experimental manipulations and research questions, who was not the same person who was the blind coder in Experiment 1. The blind coder was provided with a copy of the video transcripts to facilitate coding of accuracy. Agreement was based on a random sample (20%) of participant booklets. Intercoder agreement across all categories of detail in the recall was high (all rs $> .7$), with all disagreements resolved through discussion

The recognition data are categorical and so were analyzed with the chi-square test. Completeness and accuracy of recall data were analyzed with mixed design ANOVA, followed-up by planned comparisons of the completeness and accuracy of emotional and neutral participants' perpetrator descriptions (thus, $\alpha/1 = .05$). Post hoc t tests with Bonferroni correction were also conducted on the completeness and accuracy of emotional and neutral participants descriptions of the remaining detail categories ($\alpha/3 = .016$). Effect sizes used are partial eta-squared and Cohen's d for ANOVA and t tests, respectively, and Cramér's ø' (range 0 to 1) for the chi-square (Cohen, 2009).

Results

Manipulation check. An independent samples t test on the ratings from the postevent emotion rating scale showed that participants who viewed the emotion-inducing video rated their experience of negative emotions as significantly higher ($M = 1.28$, $SD = 0.73$) than participants who viewed the neutral video ($M = 0.20$, $SD = 0.25$), $t(114) = 10.64$, $p < .001$, $d = 1.98$, 95% CI [0.88, 1.28]. Furthermore, all participants who viewed the neutral video had a mean rating below 1 for all possible emotion ratings (including positive emotions) on the postevent emotion rating scale ($M = 0.50$, $SD = 0.30$), thus suggesting that participants who viewed the neutral video did not experience any of the listed emotions during their viewing of the video.

These data confirm that (a) the emotion manipulation was successful in inducing negative emotion in those who viewed the emotion-inducing video, and (b) participants who viewed the neutral video remained neutral. Therefore, participants who viewed the emotion-inducing video will hereafter be referred to as emotional participants, and those who viewed the neutral video will be referred to as neutral participants.

Breakdown of emotion ratings for those viewing the crime. The experience of emotion by participants who viewed the emotion-inducing video was further analyzed in terms of the individual emotions experienced by participants. The highest emotion rating was for sympathy ($M = 2.34$, $SD = 0.08$), followed by disgust ($M = 1.69$, $SD = 1.05$), annoyance ($M = 1.54$, $SD = 1.01$), anger ($M = 1.53$, $SD = 1.07$), irritation ($M = 1.42$, $SD = 1.02$), sadness ($M = 1.32$, $SD = 1.02$), outrage ($M = 1.19$, $SD = 0.97$), and upset ($M = 1.10$, $SD = 0.98$). The remaining ratings of experiencing nothing ($M = 0.46$, $SD = 0.79$), and emotions of fright ($M = 0.36$, $SD = 0.61$), anxiety ($M = 0.34$, $SD = 0.58$), happiness ($M = 0.12$, $SD = 0.05$), and relief ($M = 0.10$, $SD = 0.35$) were all below 1 on the scale.

Recognition data. As no significant differences were found between the performance of participants on either position-of-target versions of the TP lineup ($p > .2$), for the purposes of analysis, the results were collapsed into one category of TP lineup. Table 3 shows the frequency of lineup response across lineup type for emotional and neutral participants.

As it could be argued that a correct response to a TP lineup (choosing the target) and a correct response to a TA lineup (rejecting the lineup) are psychologically different decisions or responses, separate chi-squares were run on TP and TA lineups, with their responses coded as Hit, False-Positive, Miss (TP) and False-Positive, Correct Rejection (TA), respectively.

Target present. A 2 (emotional vs. neutral) × 3 (hit, false-positive, miss) chi-square was run to test the association of the experience of emotion and lineup response. There was a significant association between performance on the lineup and the experience of emotion $\chi^2(2) = 6.60$, $p = .037$, Cramér's ø' = 0.24. Emotional participants were more likely to incorrectly identify an innocent foil (false-positive, 47.5% of the time) than to correctly identify the perpetrator of the crime (a hit, 27.1% of the time), or to claim that the perpetrator was not present in the lineup (a miss, 25.4% of the time). Neutral participants were more likely to correctly identify the perpetrator of the crime (40.4% of the time) than any other response option (false-positive, 24.6%; miss, 35.1% of the time). Therefore, neutral participants were more likely to correctly identify the perpetrator from a TP lineup than emotional participants (hit, 40.4% vs. 27.1%), whereas emotional participants were more likely to incorrectly identify an innocent foil from a TP lineup than neutral participants were (false-positive, 47.5% vs. 24.6%, respectively).

Target absent. An additional 2 (emotional vs. neutral) × 2 (false-positive, correct rejection) chi-square was run on the TA lineup data to investigate whether the experience of emotion had an effect on the response of participants to a TA lineup. The chi-square showed that there was no association between the experience of emotion and lineup decision, $\chi^2(1) = 0.72$, $p = .393$, Cramér's ø' = 0.08.

Recall. Completeness and accuracy mean proportions, standard deviations, and confidence intervals for emotional and neutral participants across all categories of details are shown in Table 4.

Table 3
Response Frequencies for Perpetrator TP and TA Lineups Across Emotion Conditions

	Response	
Lineup type	Emotional	Neutral
TP Lineup	$n = 59$	$n = 57$
Hit	16	23
False-positive	28	14
Miss	15	20
TA Lineup	$n = 59$	$n = 58$
False-positive	42	37
Correct rejection	17	21

Note. TA = target absent; TP = target present.

Table 4
Mean Proportion Recall of Emotional and Neutral Participants in Terms of Completeness and Accuracy Across All Detail Categories

	Completeness				Accuracy			
	Emotional		Neutral		Emotional		Neutral	
Detail category	*M*, *SD*	95% CI	*M*, *SD*	95% CI	*M*, *SD*	95% CI	*M*, *SD*	95% CI
Environmental	0.29, 0.15	[0.25, 0.33]	0.25, 0.14	[0.21, 0.29]	0.91, 0.13	[0.87, 0.94]	0.92, 0.12	[0.89, 0.95]
Critical incident	0.35, 0.12	[0.31, 0.39]	0.74, 0.18**	[0.70, 0.78]	0.93, 0.11	[0.90, 0.95]	0.95, 0.08	[0.92, 0.97]
Victim	0.14, 0.09	[0.12, 0.16]	0.15, 0.17	[0.12, 0.17]	0.87, 0.18	[0.83, 0.91]	0.89, 0.12	[0.85, 0.93]
Perpetrator	0.15, 0.10	[0.13, 0.17]	0.11, 0.07*	[0.09, 0.14]	0.90, 0.14	[0.86, 0.94]	0.89, 0.07	[0.85, 0.94]

Note. Scores range from 0 to 1, with 0 denoting no recall and 1 denoting 100% recall. Asterisks denote significant differences between emotional and neutral participants.
* $p < .05$. ** $p \leq .001$.

Completeness of recall. A 2 (emotional vs. neutral) × 4 (environmental, critical incident, victim, perpetrator) mixed design ANOVA was run on the completeness data from the free recall. In line with Experiment 1, a significant main effect of emotion was found, with neutral participants providing more complete descriptions than emotional participants, $F(1, 108) = 35.62$, $p < .001$, partial $\eta^2 = 0.25$. A significant main effect of category of detail, $F(3, 324) = 314.99$, $p < .001$, partial $\eta^2 = 0.74$, was also found, with the critical incident described more completely than all other detail categories (all $ps < .001$), and with environmental descriptions more complete than victim ($p < .001$) or perpetrator descriptions ($p < .001$). Completeness of victim and perpetrator descriptions did not differ significantly from each other ($p = .966$). Critically, a significant interaction between the experience of emotion and the category of detail was found, $F(3, 324) = 93.55$, $p < .001$, partial $\eta^2 = 0.46$.

Planned comparisons revealed that emotional participants provided a more complete description of the perpetrator than their neutral counterparts, $t(109) = 2.19$, $p = .015$ (one-tailed), $d = 0.35$. Post hoc t tests also revealed that neutral participants provided a more complete description of the critical incident than emotional participants, $t(108) = 13.65$, $p < .001$, $d = 2.55$. However, emotional and neutral participants provided similarly complete descriptions of environmental, $t(109) = 1.33$, $p = .187$, $d = 0.28$, and victim, $t(109) = 0.41$, $p = .683$, $d = 0.11$, details.

Accuracy of recall. A 2 (angry vs. neutral) × 4 (environmental, critical incident, victim, perpetrator) mixed design ANOVA was run on the accuracy data from the free recall. The main effect of emotion was nonsignificant, $F(1, 113) = 1.07$, $p = .303$, partial $\eta^2 = .01$. A significant main effect of category of detail was found, $F(3, 339) = 3.61$, $p = .014$, partial $\eta^2 = .031$, with the critical incident recalled more accurately than the victim details ($p = .006$). All other detail categories were not significantly different from one another (all $ps > .149$). The interaction between emotion and category of detail was nonsignificant ($F < 1$). Planned comparisons revealed that emotional and neutral participants were equally accurate when describing the perpetrator, $t(113) = 0.25$, $p = .803$, $d = 0.06$, and post hoc t tests revealed that emotional and neutral participants were equally accurate when describing all remaining categories of detail (environmental, $t[113] = 0.58$, $p = .563$, $d = 0.07$; critical incident, $t[113] = 1.08$, $p = .280$, $d = 0.21$; victim, $t[113] = 0.86$, $p = .390$, $d = 0.13$).

Discussion

The aim of the present experiment was to investigate whether the experience of negative emotion may offset the difficulty that has been demonstrated in previous investigations of eyewitness identification (e.g., Meissner et al., 2007). First, the recall and emotion data replicated from Experiment 1, with participants experiencing a similar reaction to the emotion-inducing and neutral scenarios, both in terms of the intensity and composition of their emotional response. Furthermore, emotional participants reported a more complete description of the perpetrator and a less-complete description of his actions than their neutral counterparts. This again suggests that emotional participants focused their attention on what the perpetrator looked like rather than what he did, and therefore this may prove advantageous when asked to identify the perpetrator.

However, the results from the TP photographic lineup show that emotional participants were less accurate than their neutral counterparts when attempting to identify the perpetrator from the videos. These findings support the extant literature on stress and eyewitness identification performance (that stress greatly impairs an eyewitness's ability to recognize the perpetrator), extending them to encompass other experiences of negative emotion accompanying different types of eyewitness events. Interestingly, these results suggest that the experience of negative emotion can have different effects on memory for the same individual—depending on whether one is measuring recall or recognition performance. Emotion was not found to affect performance of participants on the TA lineup. A lineup task is very difficult and this difficulty is further exacerbated if the perpetrator is not present, as is the case for a target-absent lineup. For this reason, target-absent lineups usually produce very high rates of false-positive responses (Steblay, Dysart, Fulero, & Lindsay, 2001), and this was also the case in the current study.

General Discussion

In both Experiments 1 and 2, emotional participants provided a more complete description of the perpetrator than neutral participants. The data also show that emotion had no effect on the accuracy of perpetrator descriptions, with emotional and neutral participants being equally accurate in their perpetrator descriptions. Thus, the hypothesis that negative emotion would result in a more complete and accurate description of the perpetrator was

only supported for the completeness of recall. Furthermore, increased completeness of perpetrator descriptions by emotional participants did not translate into improved recognition of the perpetrator in a photographic lineup. Indeed, negative emotion impaired recognition.

How can this partial support for our main hypothesis be explained? The literature on the central and peripheral effect argues that an emotional stimulus will result in the narrowing of attention onto central information to the detriment of peripheral information (Easterbrook, 1959). However, the current findings do not support a straightforward classification of the effects of negative emotion in terms of central versus peripheral detail recall (e.g., Reisberg & Heuer, 2007). Although the emotional participants provided a more complete description of the perpetrator (which could be classified as a central detail), they also remembered less about the critical incident, that is, what the perpetrator actually did (which could also be classified as central). Further, there were no effects of emotion on descriptions of the victim in either experiment. For the information tested here that was most likely to fit into a classification of "peripheral" (environmental details), the results did not support the literature that emotion would impair recall for this type of information. Indeed, emotion improved accuracy of environmental detail recall in Experiment 1, though this result did not replicate in Experiment 2 and therefore should be treated with caution, as it may not be a reliable effect. On the other hand, the data also do not support a holistic enhancement or impairment of memory when encoded under negatively emotional conditions (see Edelstein et al., 2004).

Previous work by Laney and colleagues (e.g., Laney, Campbell, Heuer, & Reisberg, 2004) found that a central and peripheral effect was not observed when emotions were thematically induced (induced via a series of unfolding events rather than through still images). This finding led Laney et al. (2004) to argue that a central and peripheral effect may be a phenomenon of a so-called pictorial emotional experience and may not translate to the way real events are encoded and retrieved. The current results appear to provide partial support for Laney et al.'s (2004) argument, as the effects of emotion on the current memory tasks cannot by fully explained by the central and peripheral effect.

Thus, if the central and peripheral effect cannot fully explain the current findings, then how do we explain them? Negative emotions evoked by witnessing a crime may result in a motivation during recall to describe the perpetrator, hereafter referred to as the retrieval motivation hypothesis. This is supported by the work of Koriat and Goldsmith (Goldsmith & Koriat, 1999; Koriat & Goldsmith, 1996). They argue that free recall is an example of internally directed retrieval, whereby participants retrieve information they deem pertinent to successful completion of the task at hand. When self-motivating which details should be retrieved under the current paradigm, emotional participants may prioritize the retrieval of perpetrator details more than neutral participants.

A question that remains is whether there is a focus on the perpetrator during encoding as well as retrieval. One possible explanation is that the emotional participants focused their attention on the descriptive details of the perpetrator during encoding and therefore simply did not encode the actions of the perpetrator in any depth (e.g., Brown & Craik, 2005). Another explanation is that a focus on the descriptive details of the perpetrator during retrieval may result in the suppression of the action details of the event—in order to free-up more retrieval resources for the descriptive information (see MacLeod & Macrae, 2001; MacLeod & Saunders, 2008). As neither of these possible explanations can be investigated by the current paradigm, it is recommended that future studies investigate the encoding and retrieval mechanisms of these effects, possibly by dividing attention during encoding.

The recognition data from Experiment 2 appear to support the extant literature (Morgan et al., 2004; Valentine & Mesout, 2009), as emotional participants are less able than their neutral counterparts to accurately identify the individual whose actions provoked their emotional response. What is interesting about the present data is the apparent dissociation in recall and recognition performance for the same individual by emotional participants: Emotional participants are better than their neutral counterparts at describing the perpetrator but worse at recognizing him. Taken together, the recall and recognition findings suggest that enhanced verbal recall performance of emotional participants when describing the perpetrator is not predictive of an enhanced ability to recognize the perpetrator. This finding ties in with a recent review of the eyewitness description and identification literature, which suggests that a complete and accurate description of an individual may not translate to accurate recognition of that same individual (Meissner et al., 2007).

The breakdown of the emotional experience of participants provides support for the argument that an emotional experience is a highly complex one, and this may have implications for the sometimes contradictory findings in the emotion–memory literature (Levine & Edelstein, 2009; Reisberg & Heuer, 2004). It is possible, for instance, that participants who are all branded as experiencing "negative emotion" in fact experience a different medley of emotions and these, in turn, have differing consequences for their cognitive performance.

One limitation of the current study is the reliance on self-report measures of emotional experience. One could argue that the use of physiological measures, such as heart rate and/or skin conductance, would have been an objective way to support or validate the self-report measures. However, physiological measures cannot be used to differentiate the experience of one emotion from the experience of other emotions. Physiological measures are only able to provide data on whether a participant's heart rate increased or decreased, whether their sweating levels rose or declined, or whether muscle tone increased or decreased during the emotional-inducing video, depending upon whether an activation mode or an arousal mode of attention control was induced (Deffenbacher et al., 2004).

One final concern could be that the critical incident differed between emotional and neutral videos. Therefore, some of the memory differences reported might be due to one video being more interesting or attention grabbing than the other. However, a postviewing question predicated upon the possibility that the two videos may differ in interestingness by virtue of simply being different revealed no differences on this dimension between the two groups, $\chi^2(9) = 10.96$, $p = .278$, Cramér's ø' = .35.

To our knowledge, this is the first study to examine the effects of emotion on remembering specific details about events and people within an eyewitness paradigm. Therefore, this paradigm lends a new methodology to the investigation of the effects of emotion on specific components of memory performance to a literature that has previously investigated the effects of emotion on

the overall completeness and accuracy of the entire memory report. Under this paradigm, we can detect the subtle effects of emotion on memory retrieval in a finer-grained detail than has previously occurred and thus may be able to bring about some cohesiveness to the literature on the effects of emotion on memory performance in an eyewitness context.

It would be useful in future research to further delineate the effects of specific emotions such as anger, fear, sadness, or joy on retrieval of different types of information. It is anticipated that such studies would exhibit subtle and focused effects, as are predicted by the theoretical literature on this subject (e.g., Levine & Edelstein, 2009; Levine & Pizarro, 2004). What research of this nature can do is focus on a specific aspect of human experience and uncover subtle differences in motivation, cognitive processing, and reporting as a function of emotion, which can have implications for the criminal justice system.

It would also be interesting for future researchers to investigate whether the effects of emotion on memory performance observed herein may change under certain conditions. For example, although exploratory analysis revealed no sex differences in our data, an interesting question remains concerning whether the sex of the participant may play a role in the effects of negative emotion on memory performance? Early work on possible differences in the emotional experience of men and women to negative videos in the media suggests that differences may exist in the intensity of the emotional experience for males and females (e.g., Furnham & Gunter, 1985). However, how gender differences in emotional experience may translate to effects on memory performance within the forensic scenario is still a matter of debate.

In a related vein, a further question that arises from the literature and the present studies is whether the effects of emotion on memory performance would alter if one were to increase or decrease the intensity of the emotion experienced? Our analyses indicated a threshold effect rather than a linear effect, given that the level of recall did not increase with an increase in emotional intensity within the emotional group, but the emotional group did differ from the nonemotional (control) group. However, if participants were exposed to a highly emotive scenario, would their description of the perpetrator become even more complete in comparison with neutral participants' descriptions? Would the highly emotional participants' descriptions of what the perpetrator did become even vaguer? Alternatively, would the effects of emotion on memory performance stay the same regardless of the intensity of the emotional experience? These are all questions still under debate in the literature (for a review of these questions, see Levine & Edelstein, 2009; Levine & Pizarro, 2004). In short, further research is required on both the effects of different levels of emotion experienced following the viewing of an emotional scene, and the effects of viewing differently emotive stimuli, on memory performance.

In conclusion, the current research indicates that the emotions elicited when witnessing a crime may have contrasting effects on different aspects of eyewitness testimony. While the emotional witnesses recalled more information describing a protagonist, they were less likely to recognize him in a subsequent lineup. The emotional witnesses also recalled fewer details about the crime itself. Emotions associated with witnessing a crime are likely to impair memory for the incident and recognition of the perpetrator. These findings could have implications for how statements from emotional eyewitnesses are interpreted and the weight that is given to specific aspects of a witness's evidence, depending on their emotional state.

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