Blinded by Emotion? Effect of the Emotionality of a Scene on Susceptibility to False Memories

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Abstract

Although distortion is commonly present in memory, the relation between the emotionality of a witnessed scene and susceptibility to mistaken memories is controversial. Participants (N = 90) were recruited for research focusing on "emotional processing" and were not informed that their memories were being investigated. Then, they viewed either a highly positive, neutral, or highly negative emotional scene (e.g., graphic fatal accident) from the International Affective Picture System (e.g., Lang, Bradley, & Cuthbert, 1999). Half of participants were exposed to misleading questions – one of which included a major false suggestion (i.e., large animal in the scene). An hour later all participants were asked to recall the scene and asked 10 direct questions, five of which related to the misinformation provided earlier. Overall, misleading questions impaired recall accuracy by 37%. Further, negative emotion increased susceptibility to false memories for the major misinformation. Whereas 0% of non-misled participants in any condition recalled seeing the major false detail, misled participants in the negative condition recalled seeing the major false detail more often (80%) than those in the positive (40%) and neutral (40%) conditions.

Résumé

Même si la distorsion est communément présente dans la mémoire, le rapport entre l'émotivité d'une scène vécue et la susceptibilité aux souvenirs faussés n'est pas claire. Des participants (au nombre de 90) ont été recrutés dans le cadre d'une recherche portant sur le « traitement des émotions ». Ils n'ont pas été informés que leur mémoire était à l'étude. On leur a ensuite présenté une scène soit très positive, neutre ou très négative (par ex., un accident fatal illustré) tirée du International Affective Picture System (par ex., Lang, Bradley & Cuthbert, 1999). La moitié des participants ont été exposés à des questions trompeuses - dont l'une comportait une suggestion fausse très importante (c.-à-d. un gros animal dans la scène). Une heure plus tard on a demandé aux participants de se rappeler la scène et on leur a posé 10 questions directes, dont cinq portaient sur la mésinformation présentée

auparavant. Dans l'ensemble, les questions trompeuses ont entravé l'exactitude du souvenir de 37 % des participants. De plus, l'émotion négative a accru la susceptibilité aux souvenirs faussés relativement à la mésinformation. Alors qu'aucun des participants non exposés aux questions trompeuses dans toutes les conditions se sont souvenu d'avoir vu le détail fautif important, les participants qui ont été trompés dans la condition négative se sont souvenu plus souvent (80 %) du détail fautif que les participants dans des conditions positives (40 %) et neutres (40 %).

Memory is affected in powerful ways by the conditions under which an individual experiences and later remembers information and events (Bartlett, 1932; Loftus, 1979, 1993, 1997; Porter, Birt, Yuille, & Lehman, 2000; Schacter, 1996, 1999). Remembering is now regarded as being largely a constructive activity rather than a process of retrieving information from a permanent "storehouse" of experience, as once believed. Memories are highly malleable and often deviate from the objective truth, as they are influenced by numerous internal and external factors surrounding encoding and subsequent recollections of the event (e.g., Koriat & Goldsmith, 1996). In fact, mistaken memories are readily induced in many people through exposure to misinformation (e.g., Hyman, Husband, & Billings, 1995; Loftus & Pickrell, 1995; Porter, Yuille, & Lehman, 1999; Roediger & McDermott, 2000), and are a normal part of human cognition (e.g., Schacter, 2001).

The constructive nature of memory has much relevance in applied settings. For example, the reliability of eyewitness testimony – one of the most powerful and compelling types of evidence in the courtroom – has been brought into question in numerous studies (see Loftus, 1993, 1997; Wells et al., 2000). A robust finding is that the quality of the information to which an eyewitness is exposed after a witnessed event can strongly influence the accuracy of the memory. For example, the types of questions asked, the way in which they are phrased, and information heard from

others all can have biasing effects on subsequent recall (e.g., Wells & Bradfield, 1998). The incorporation of erroneous information into a witnesses' memory is known as the misinformation effect (e.g., Loftus, Miller, & Burns, 1978).

An important issue in forensic settings that has received limited empirical attention is the influence of emotion on the incorporation of such misinformation. In some cases, an eyewitness may be asked to recall (and be exposed to misinformation concerning) an episode of minimal emotional arousal (e.g., a clerk being handed a bad cheque), whereas many other witnessed criminal events are, of course, much more distressing (e.g., witnessing a bank robbery or an assault). There has been a long-standing debate over whether emotional stimuli are remembered more or less accurately than other events (e.g., Kihlstrom, 1996; Porter & Birt, 2001; Shobe & Kihlstrom, 1997). In studies of autobiographical memories, it has been found that memory clarity is related to the degree of emotional arousal associated with the event (e.g., Conway, 1990; Pillemer, Rhinehart, & White, 1986). In laboratory studies in which participants view an emotionally laden film or staged incident, results typically show clear facilitatory effects of emotional arousal on memory (e.g., Christianson & Loftus, 1991). In a field investigation, Yuille and Cutshall (1986) examined the memories of 13 witnesses of a fatal shooting five months after the event. They found that despite an exposure to misleading questions, all witnesses retained high levels of accuracy over time. However, the effect of emotional arousal on memory appears to be complex. For example, Christianson and Hubinette (1993) showed that the facilitative effect of emotional arousal is limited to recall for central but not peripheral details. Thus, emotion may serve to influence memory differently depending on what aspect of the stimulus is considered. By monitoring the eye movements of individuals witnessing emotional scenes, Christianson, Loftus, Hoffman, and Loftus (1991) concluded that people tend to fixate more often and for longer periods on objects that are informative, distinctive, or emotional, which leads to better memory for these stimuli. Other research suggests that attention is focused on aspects of a scene that cause the most distress specifically (e.g., Bower, 1992; Easterbrook, 1957). Thus, it may be the case that the type of emotion experienced (positive or negative) could influence the quality of recall. Although several studies have investigated the effects of negative arousal on memory, few have examined whether positive emotional arousal similarly affects memory. Some have argued (e.g., Pillemer et al., 1986) that both positive

and negative emotional arousal facilitate memory. Bradley, Greenwald, Petry, and Lang (1992) investigated the retention of pleasant visual information and concluded that, while arousal significantly enhanced memory, pleasantness alone had no significant impact. The best predictor of future memory performance was emotional intensity rather than emotional valence.

The present study was designed to address whether witnesses are, in fact, more susceptible to postevent misinformation when the target stimulus is highly emotional than when it is ordinary and banal, and whether it makes a difference if the emotional material is positively or negatively valenced. The impact of emotion on the probability of incorporating into memory a major piece of misinformation pertaining to the scene also was examined. Using photographic scenes with well-established emotional rating norms (e.g., Bradley, Cuthbert, & Lang, 1996; Christianson & Faellman, 1990; Lang & Ohman, 1988), the effects of misinformation on memory for stimuli with either positive, negative, or neutral emotional content were compared.

Method

Participants

Ninety undergraduate students (21.1% male, 78.9% female) participated in this study in exchange for course credit. The mean age was 20.93 years (range of 17-43 years). All participants reported having normal or corrected-to-normal vision and hearing.

Materials and Design

The basic design of this study was a 3 (positive, neutral, and negative emotional scene) x 2 (misinformation versus no misinformation) between-subjects design. The primary dependent variables concerned accuracy of the memory reports and whether misinformation was incorporated into those reports. Specifically, memory for misleading information (following misleading questions) and accuracy of memory for nonmisleading information were assessed. These dependent variables were then further divided into accuracy of recall for central and peripheral information and whether the participants incorporated a *major* piece of misinformation (e.g., an animal that was not present in the scene) into their memory accounts.

Photographed scenes used as memory stimuli. The memory stimuli consisted of detailed colour photographs presented on a computer screen. Eight photographs were used: three depicting highly positive

emotion/arousal, three displaying highly negative emotion/arousal, and two nonemotional, nonarousing neutral scenes, all taken from the "International Affective Picture System" (IAPS; Lang, Bradley, & Cuthbert, 1999; Lang, Greenwald, Bradley, & Hamm, 1993; Lang & Ohman, 1988). The IAPS is a large CD database of 700 photographed scenes developed for use in the experimental investigation of emotion and attention, but also has been adopted in a wide variety of psychological studies. The original goal of the IAPS was to develop a large set of standardized, emotionally evocative colour photographs with a wide range of contents. Normative data from large, diverse samples of judges who rated the emotional valence and level of arousal associated with each picture are included. In collecting norms, participants were asked to rate each picture according to its emotional valence and arousal each on a 9-point Likert scale. These ratings are stable when assessing either within- or between-subjects reliability and are highly internally consistent (e.g., Lang et al., 1999). The split-half coefficients for the valence and arousal dimensions are highly reliable (Lang et al., 1999). The stimuli in this study were first selected on the basis of emotion ratings (9 being the most positive) and arousal level rating (9 being the most arousing), and then by appropriateness for the research. For the negative scenes, a pool of pictures with both the highest negative emotional ratings and the highest arousal ratings were selected for potential use. Similarly, for the positive scenes, the pictures with the highest positive emotional ratings and highest arousal ratings were chosen. For the neutral scenes, photos with emotional ratings that were neutral and arousal ratings that were low were selected. From this pool of potential scenes, pictures were eliminated if they did not have a visible background or did not include any people. Then eight photographs were randomly selected from the remaining photos. This resulted in three positive (mean emotional level = 6.98, mean arousal level = 4.88) and three negative (mean emotional level = 2.49, mean arousal level = 5.49), and two neutral pictures (mean emotional level = 4.90, mean arousal level = 3.91) being selected for use as stimuli.

The definitions of central and peripheral details employed here were similar to those proposed by Christianson and colleagues (e.g., Christianson, 1992; Christianson et al., 1991). We identified the central details in the eight different scenes, both physically and conceptually. Central details were defined as the source of the emotion and the details immediately surrounding the source. Three "judges" judged the pictures by drawing lines around the central area physically and conceptually. Then the average central

area of the three judges was considered to be the central area. All details outside of or within the background of the central area were then considered peripheral. To ensure that this coding scheme was reliable, two independent coders coded the number of central and peripheral details in the free recall accounts for all 90 participants. This scheme was highly reliable with α (90) = .93 for total number of details, α (90) = .89, $p < .0001$ for central details, and α (90) = .88, $p < .0001$ for peripheral details.

Measures of mood and emotion. To assess whether mood would influence the processing and remembering of the various emotional scenes, a measure of mood, the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), was administered to participants at the beginning of the study. The PANAS is a self-report scale measuring degree of positive and negative mood for a variety of timelines (the time of interest for the current study was "current mood"). It has high internal consistency and stability (Watson et al., 1988).

As there are wide individual differences in the magnitude of affective response to emotional stimuli, it was possible that participants would vary in their interpretation of the depth of the emotion depicted in the scenes presented. The Emotional Contagion Questionnaire (ECQ; Doherty, 1997) measures the level of affect that individuals tend to feel upon witnessing others' emotions and was administered to explore possible relations with memory accuracy. The ECQ is a self-report scale measuring five subscales of emotional contagion: love, happiness, fear, anger, and sadness. The ECQ has been shown to be valid and reliable (Doherty, 1997).

Procedure

All participants were tested individually in a small laboratory room. After giving informed consent to participate, each participant was asked to indicate the status of his/her current mood by completing the PANAS. Participants were randomly assigned to view a positive, negative, or neutral scene. Participants were not informed that they would later be given a test of their memory for the scene. The scenes were presented on a computer screen and participants were seated approximately three feet away from the monitor. For the encoding phase, participants were instructed to look at the computer screen and: "Take the next minute and tell me what is happening in the scene." All responses were recorded on audiocassette. When participants finished describing the scene (with a time limit of 30 seconds), it was removed from view. All participants then were administered a

filler task (a personality questionnaire) for approximately 20 minutes. Although the main point of interest was the effect of emotion of susceptibility to misinformation, a second point related to the effect of the single versus multiple recall attempts on memory for an emotional scene. Half of the participants in each emotional valence condition (randomly selected) were then asked 10 direct questions (presented verbally) about the scene they had witnessed, five of which included misleading information (misled group). For each emotion condition, the misleading information related to three details concerning persons in the scene and one to a vehicle in the scene. The fifth false detail was a relatively major detail relating to an entire object (e.g., an animal) that was allegedly present in the scene's background (see Appendix). The items were selected and the questions phrased to be as similar as possible for the three conditions. Following the question phase, all participants completed the ECQ and a second filler task (another personality questionnaire). The nonmisled half of the participants proceeded directly to the ECQ and second filler task, without being exposed to misinformation.

Following the completion of these questionnaires, participants were informed that the final part of the study involved a test of their memory for the original scene they witnessed (about one hour after viewing the original photographed scene). For this free recall test, all participants were asked to provide as much information as possible about their memory for the scene and their responses were audiotaped. When finished reporting all they could remember about the scene, participants were given a set of 10 direct questions, very similar to the first set, but without the misinformation. For example, at this time instead of being asked, "Was the large German Shepherd dog in the background lying down or standing?" (when there was no dog in the scene), they were asked "Was there a dog in the scene?" Both groups (misled and nonmisled) received the same direct, nonleading questions. Half of the questions addressed the misleading information originally presented to the misled group, while the other half of the questions concerned details that had been present in the scene. After responding to these questions, participants were debriefed and the true purpose and rationale of the experiment were explained in detail.

All audiotapes of the encoding and free recall reports were transcribed, and then coded by two independent "blind" coders. The reports were coded for number of words, details, central details, peripheral details, correct details, verbal hedges (i.e., "I think...," "I believe...," "It seems..."), and references to emotion. The free recall accounts were also coded for accuracy of the nonmisled details and misled details.

Results

Effect of Emotionality on Information Encoded

First, a multivariate analysis of variance (MANOVA) was conducted with emotion condition (positive, negative, and neutral) as the independent variable and number of central details, peripheral details, verbal hedges, and references to emotion in the initial encoding report as dependent measures. The MANOVA was significant, $F(14, 164) = 4.81$, $p < .001$. The number of central details, $F(2, 87) = 4.89$, $p < .01$, peripheral details, $F(2, 87) = 4.77$, $p < .05$, verbal hedges, $F(2, 87) = 3.66$, $p < .05$, and emotion-oriented details, $F(2, 87) = 12.72$, $p < .001$, each varied as a function of emotional valence. Specifically, participants in the negative emotion condition reported fewer central details, $M = 5.93$, $SD = 3.45$, than those in the positive condition, $M = 9.40$, $SD = 4.89$. In contrast, participants in both the negative, $M = 7.20$, $SD = 4.56$, and neutral conditions, $M = 7.47$, $SD = 3.66$, reported more peripheral details than those in the positive condition, $M = 4.70$, $SD = 3.13$. In addition, participants in the negative condition reported more emotion-oriented details, $M = 2.17$, $SD = 1.74$, than those in the positive condition, $M = 0.80$, $SD = 0.71$. Participants in the neutral condition used more verbal hedges, $M = 4.90$, $SD = 2.56$, than those in the positive condition, $M = 3.43$, $SD = 1.41$.

Effect of Emotion and Misinformation on Details Provided in Free Recall

To examine whether the emotionality of the scene and/or the provision of misinformation influenced the information reported in free recall, a MANOVA was performed with Emotion Condition and Question Condition (misled and nonmisled) as the independent variables. Number of words, central details, peripheral details, verbal hedges, incorrect details, misleading information details, and emotion-oriented details were the dependent measures. The MANOVA yielded significant main effects for both Emotion, $F(14, 154) = 3.30$, $p < .001$ and Question Condition, $F(8, 77) = 2.92$, $p < .01$, but no interaction effects.

Emotion Condition was related to the number of central details, $F(2, 84) = 6.75$, $p < .01$, peripheral details, $F(2, 84) = 3.18$, $p < .05$, and emotion-oriented details, $F(2, 84) = 4.76$, $p < .05$, recalled. Specifically, participants in the negative emotion condition recalled fewer, $M = 9.00$, $SD = 4.24$, central details than those in the positive condition, $M = 14.50$, $SD =$

6.79. Participants in the negative emotion condition recalled more, $M = 13.17$, $SD = 8.13$, peripheral details than those in the neutral condition, $M = 10.13$, $SD = 4.13$. Participants in the negative emotion condition recalled more, $M = 1.37$, $SD = 1.96$, emotion-oriented details than those in the neutral condition, $M = 0.37$, $SD = 0.49$.

The Question condition manipulation was related to the number of words in the memory report, $F(1, 84) = 4.74$, $p < .05$, as well as the number of peripheral details, $F(1, 84) = 3.18$, $p < .05$, incorrect details, $F(1, 84) = 11.43$, $p < .001$, and pieces of misleading (suggested) information, $F(1, 84) = 13.51$, $p < .001$, recalled. Specifically, misled participants used more, $M = 166.38$, $SD = 93.43$, words in their accounts than participants in the nonmisled condition, $M = 132.36$, $SD = 51.63$. Misled participants recalled more, $M = 12.42$, $SD = 7.52$, peripheral details than those in the nonmisled condition, $M = 9.40$, $SD = 4.61$. Misled participants recalled more incorrect details, $M = 1.36$, $SD = 1.61$, than those in the nonmisled condition, $M = 0.47$, $SD = 0.76$. Further, misled participants recalled more, $M = 0.44$, $SD = 0.76$, misleading information than those in the nonmisled condition, $M = 0.02$, $SD = 0.15$.

Effect of Emotion and Misinformation on Accuracy of Question Recall

To examine the relationship between emotion and the provision of misinformation on susceptibility to mistaken memories, a MANOVA was performed. The two major independent variables were Emotion Condition and Question Condition. Thus, a 3 x 2 between-subjects design was performed with two dependent variables relating to memory accuracy: accuracy rates of nonleading and misleading details (five of each within the total set of 10 direct questions). The MANOVA revealed a significant effect, Pillai's Trace $= .32$, $F(2, 83) = 19.81$, $p < .001$, with a significant effect for Question Condition, $F(1, 84) = 40.06$, $p < .01$, but not for Emotion Condition, $F(2, 84) = 2.12$, $p > .05$. Specifically, there was a significant effect for Question Condition for misleading details. Misled participants were significantly less accurate to questions pertaining to misinformation, $M = 2.13$ (42.6%), $SD = 1.67$, than the Nonmisled Group, $M = 3.98$ (79.5%), $SD = 1.03$ (out of a possible five correct answers). Overall, the Nonmisled group were 37% more accurate than the Misled group. In contrast, response accuracies were not significantly different for the nonleading questions, $F(1, 84) = 1.05$, $p > .05$. The Misled group showed a mean of 3.49 correct answers to the nonleading questions ($SD = 0.92$) and the Nonmisled group showed a mean of 3.69 correct
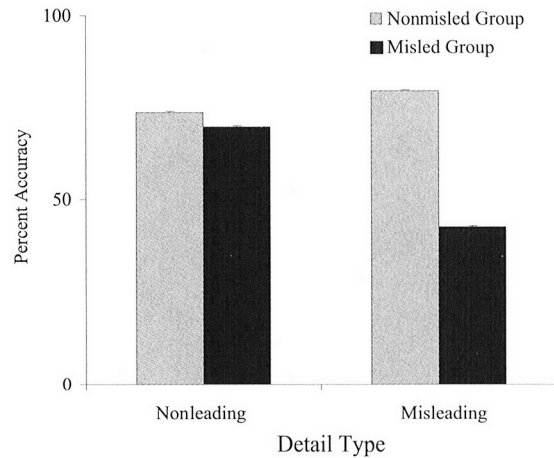

Figure 1. Accuracy rates for nonleading and misleading details as a function of Question Condition (nonmisled and misled).

($SD = 0.92$) (again, out of a possible five correct answers) (see Figure 1).

There were no significant effects of Emotion for either the misleading details, $F(2, 84) = 2.12$, $p > .05$ or nonleading details, $F(2, 84) = 0.17$, $p > .05$. However, there was a trend for lower accuracy for questions pertaining to the misleading details in the negative group ($M = 2.70$) than in the neutral ($M = 3.03$) or positive ($M = 3.43$) groups ($p = .10$). This did not hold for the nonleading details: negative ($M = 3.67$), neutral ($M = 3.53$), and positive ($M = 3.57$).

Analysis of Central and Peripheral Details

A two-way MANOVA was conducted to examine the effect of Emotion Condition and Question Condition on accuracy for the nonleading and misleading details with respect to peripheral and central detail content in the free recall accounts. The 3 x 2 MANOVA with four dependent variables (central misleading, central nonleading, peripheral misleading, and peripheral nonleading detail accuracy) was significant. The Question condition showed a significant effect, $F(4, 83) = 8.86$, $p < .01$, while the Emotion condition did not, $F(4, 84) = 1.96$, $p = .10$. Follow-up ANOVAs revealed that Question Condition was significant only for the peripheral misleading details, $M = 65.93$, $SD = 31.82$; $F(1, 86) = 34.57$, $p < .01$, and the central misleading details, $M = 56.11$, $SD = 44.39$, $F(1, 86) = 12.52$, $p < .01$, but not for peripheral nonleading details, $M = 68.98$, $SD = 31.85$, $F(1, 86) = 0.01$, $p > .01$, or for central nonleading details, $M = 79.35$, $SD = 29.75$, $F(1, 86) = 4.82$, $p < .05$. Figures 2 through 5 show the pattern of these results. Tukey's HSD comparisons revealed a trend for differences between the emotional groups. For the peripheral misleading
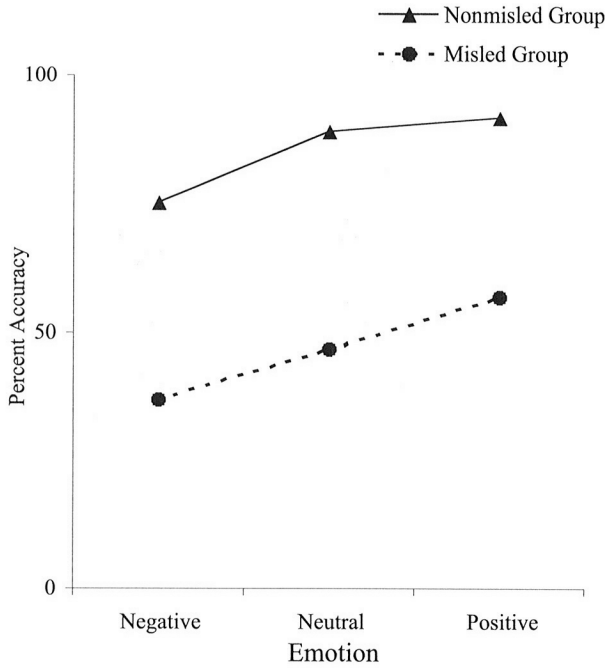
Figure 2. Percent accuracy of misleading peripheral details as a function of Question Condition and Emotion Condition.
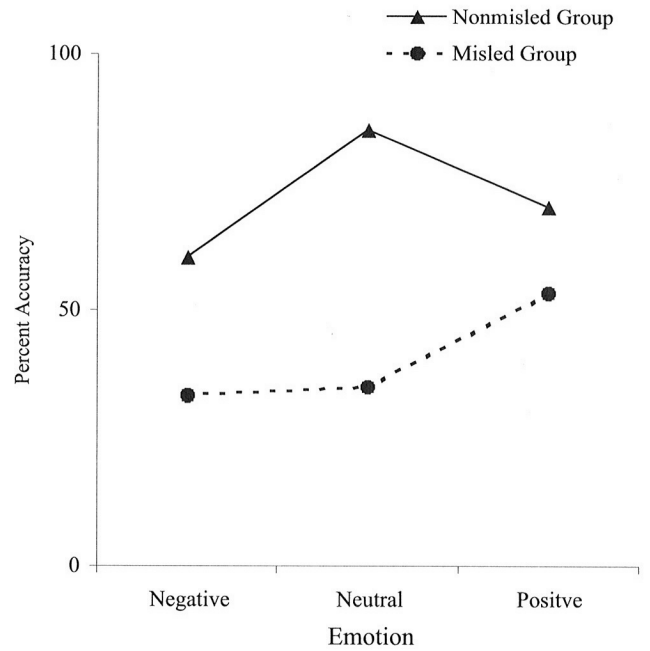

Figure 3. Percent accuracy of misleading central details as a function of Question Condition and Emotion Condition.
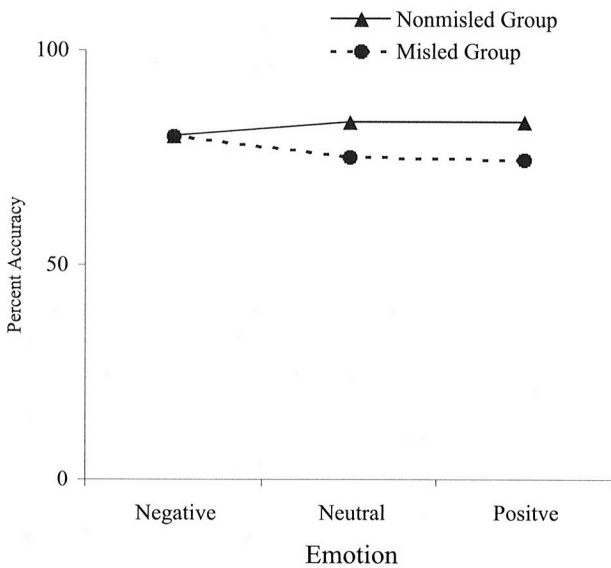

Figure 4. Percent accuracy of nonleading central details as a function of Question Condition and Emotion Condition.
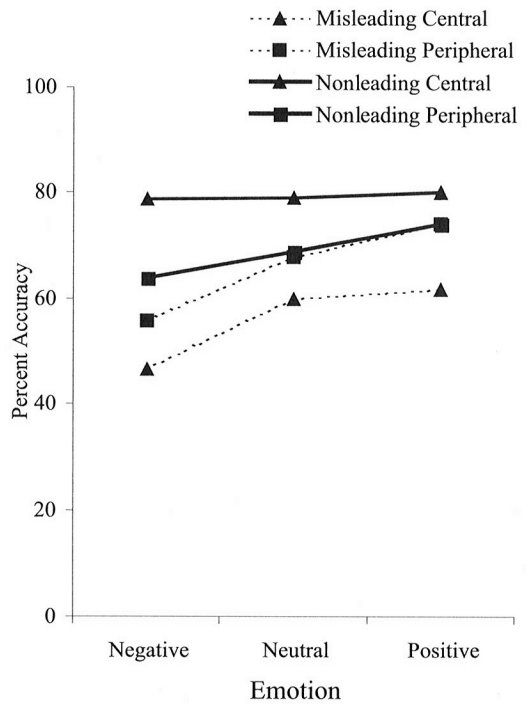

Figure 5. Accuracy for central, peripheral, nonleading and misleading details as a function of Emotion Condition.

details, the negative group ($M = 55.83\%$) had a lower accuracy rate than did either the neutral ($M = 67.78\%$) or the positive ($M = 74.17\%$) groups, although this was a marginal effect ($p = .06$). This trend was not found for the peripheral nonleading questions ($p > .05$). There also was a trend for the negative group to have a lower accuracy rate for central misleading details ($M = 46.67\%$) than either the neutral ($M = 60.0\%$) or positive ($M = 61.67\%$) groups, although this effect was not statistically significant. There was no significant effect of Emotion Condition for nonleading central questions ($p > .05$).

False Memories of the Major Misinformation

A chi-square analysis was conducted to investigate the effects of Emotion Condition and Question Condition on the incorporation of a major detail into memory, which was not present in the scene but was presented to the misled group during initial questioning. *None* of the participants (0%) in the nonmisled group recalled the major misinformation, whereas 53.3% of participants in the misled group mistakenly recalled it. This difference between the groups was significant, $\chi^2 (1, 89) = 32.13, p < .01$.

Because no participants in the Nonmisled group mistakenly recalled the major false detail, a second analysis was performed on the misled participants ($N = 45$) to examine the effect of emotionality on the incorporation of misleading information. There was a significant effect of emotion on memory distortion, $\chi^2 (1, 89) = 6.43, p < .05$. Overall, 80% of participants in the negative emotion condition mistakenly remembered the major detail, compared to 40% in both the neutral and positive Misled groups (see Figure 6).

Relation Between Encoded and Recalled Information

To examine the correspondence between information reported by participants at encoding and information remembered during free recall, a mixed MANOVA was conducted with Emotion Condition and Question Condition as between-subjects variables and "Time of Report" (Time 1 = encoding and Time 2 = free recall) as a within-subjects factor. The MANOVA yielded significant main effects for Emotion Condition, $F(14, 156) = 5.70, p < .001$, and for Question Condition, $F(7, 78) = 2.66, p < .05$ but no interaction.

Overall, Emotion was related to the number of reported central details, peripheral details, and emotion-oriented details. Specifically, participants in the negative emotion condition recalled fewer ($M = 5.93, SD = 3.45$) central details than those in the positive condition ($M = 9.40, SD = 4.89$). Participants in the negative and neutral emotion conditions recalled
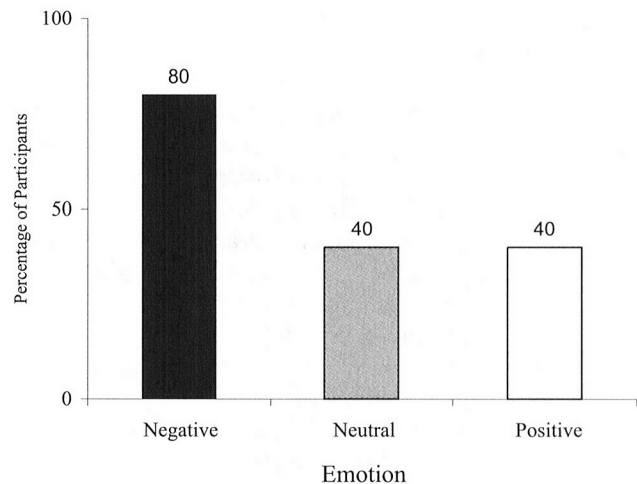

Figure 6. Incorporation of major misleading information displayed as a function of Emotion Condition for the Misled group only.

more ($M = 7.20, SD = 4.56$ and $M = 7.47, SD = 3.66$, respectively) peripheral details than those in the positive condition ($M = 4.70, SD = 3.13$). As mentioned, participants in the negative emotion condition recalled more emotion-oriented details than those in the neutral and positive conditions. As expected, overall the information provided by participants in the misled Condition contained more incorrect details than provided by those in the Nonmisled condition.

With regard to Time of Report, the MANOVA indicated several significant effects, $Fs(1, 84)$ ranged from 12.96 to 102.95, $ps < .001$. Participants provided more words ($M = 149.37, SD = 76.98$), details ($M = 22.83, SD = 10.30$), central details ($M = 11.58, SD = 6.29$), peripheral details ($M = 10.91, SD = 6.39$), and incorrect details ($M = 0.91, SD = 1.33$) in the free recall task than during the encoding report ($M = 86.61, SD = 38.45$; $M = 14.40, SD = 6.65$; $M = 7.97, SD = 4.67$; $M = 6.46, SD = 3.99$; and $M = 0.67, SD = 0.25$, respectively). However, they gave more emotional details during the encoding report ($M = 1.26, SD = 1.36$ vs. $M = 0.79, SD = 1.39$). There were also interactions between Time of Report and Emotion Condition in terms of number of words, details, and peripheral details reported, $Fs(1, 84)$ ranged from 3.50 to 4.77, $ps < .05$. Participants in the negative emotion condition generally reported less information during encoding but more during the free-recall test. There also was an interaction between time of recall and misleading question condition in terms of number of words, details, peripheral details, and incorrect details. Misled participants generally recalled more information ($M = 24.67, SD = 11.60$) than nonmisled participants ($M = 21.00, SD = 8.56$), including more erroneous information in the free-recall test.

Mood and Emotional Contagion

As expected, there were no differences, $F(4, 174) = .53$, $p > .05$, in the initial PANAS current mood ratings for participants in the Negative ($M = 2.80$, SD $= 0.52$), Positive ($M = 2.81$, SD $= 0.67$), or Neutral ($M = 2.88$, *SD* $= 0.66$) conditions. In terms of the relation between mood (as measured by the PANAS) and the dependent measures relating to memory accuracy, only one significant correlation was found: There was a positive correlation between mean current positive mood and accuracy for nonleading details, r (89) $= .21$, $p < .05$. ECQ scores were unrelated to measures of memory accuracy with the exception of a modest negative correlation between central misleading detail accuracy and Mean Negative Emotional Contagion, r (89) $= -.23$, $p < 05$.

Discussion

In light of the large body of research indicating that human memory is susceptible to a host of distorting factors such as misleading questions, the reliability of eyewitness evidence has been brought into question (e.g., Poole & Lindsay, 2001; Wells & Olsen, 2001). The present study re-examined the issue of whether misleading questions would impair accuracy of memory for a witnessed scene and, more importantly, investigated whether the emotional characteristics of the witnessed scene influence susceptibility to mistaken memories. First, as in previous studies, the inclusion of misinformation in the context of leading questions had a substantial impairing effect on recall accuracy after the passage of about an hour in an unanticipated recall test. Participants exposed to misleading questions reported numerous minor and major details that were not present in the scenes they had witnessed. These details ranged from a piece of jewelry to an entire car or animal mistakenly recalled as present in the original scene, giving further evidence that there is a wide variety of remembered details that can be easily influenced by the presence of postevent misinformation (also see Porter et al., 1999). The second major issue investigated was the influence of emotionality on susceptibility to memory distortion. In forensic settings, the heterogeneity of the emotionality of various events witnessed is considerable, ranging from benign, unemotional events such as a store clerk trying to recollect who had passed him/her a bad cheque to highly emotional, disturbing incidents such as witnessing a bank robbery or a violent crime. However, for the most part, researchers have examined misinformation effects on memory without carefully considering the emotionality of the witnessed scene.

Across participants who had or had not been mis-

led, there were no overall differences in the accuracy of the memories of those who had witnessed the negative, neutral or positive scenes. All three groups responded to the final set of questions equally well (or perhaps, equally poorly), meaning that, in general, emotion had no major facilitating or impairing effect on accuracy. However, one of the key issues in this study was whether participants could be led to recall a major piece of misinformation, something salient about which a false suggestion might seem obviously wrong. Were false memories possible for such prominent stimuli? Whereas *none* of the participants who did not receive the original misleading questions remembered seeing the major false detail, more than half of all misled participants mistakenly recalled it. Perhaps more importantly, emotion had a clear impact on susceptibility to such misinformation. Participants who had witnessed the highly negative emotional scene were twice as likely to recall seeing the major misinformation than those in both the neutral or positive groups. In fact, the majority (80%) of those in the negative condition had mistaken memories for the major detail. It appears that interviewers should be particularly careful when questioning witnesses of crimes, as they could be vulnerable to the effects of misleading information.

Our findings appear to dispute the contention of previous researchers (e.g., Bradley et al., 1992) that emotional intensity rather than emotional valence is related to memory accuracy. Why here did participants who witnessed a highly emotional and disturbing scene incorporate this major false detail more often than the other two groups? It is possible that when presented with a highly emotional negative stimulus, participants tended to focus on the aspects of the scene that were the most emotionally distressing. The photographs depicted graphic scenes such as a fatal accident, people screaming in horror, and a traumatized little girl involved in a car accident. Participants in the positive condition, however, also may have focused initially on the positive aspects of the scene but then to other aspects of the scene as points of interest. They would, thus, be more likely to deny the presence of a major piece of misinformation (generally "peripheral" to the central event) when suggested by the experimenter. One finding that is difficult to reconcile with this hypothesis is that the negative emotion group reported fewer central details at encoding than the neutral group. However, in examining their reports, we think that even though they reported fewer central details, these limited details were the "most central" or important within the central area (e.g., details about the fatally injured body). They seemed less likely to notice a lot of

details but mainly those that were the most distinctive, and this attentional focus was maintained over time. Another possible contributing factor to the heightened susceptibility to distortion for negative scenes was that the participants' decision-making itself was influenced by the negative distress (over and above the attentional focus). Viewing such disturbing images could influence the participants' suggestibility not only due to focused attention but also because of their own emotional state. As mentioned, emotion had its primary effect on susceptibility to major, dramatic misinformation. The social aspect of increased passivity and pressure to conform to the situational demands could be expected more for implausible major misinformation. Considering it another way, people in the other (nonnegative) emotional conditions would be more likely to disagree with such blatant misinformation suggestions. For example, in our previous research (Porter et al., 1999) we have found that participants are highly susceptible to false suggestions concerning negative emotional autobiographical experiences, even implausible ones, perhaps because of heightened suggestibility due to the presentation of the negative material. Future research should examine carefully the impact of negative emotional arousal (induced prior to the stimulus of interest) on suggestibility.

One possible limitation of this study concerns the generalizability of the findings. Clearly, witnessing a photograph of a traumatizing scene is different from witnessing an actual traumatizing event. One future strategy to address the generalizability issue would be to vary the emotionality of live, witnessed events. Nonetheless, the present research provides important evidence that people can indeed be "blinded by emotion." In line with reconstructive theories of memory, these findings indicate that memory can be easily manipulated and altered in a major way in the face of misleading information provided by an external source. Further, most people who view a highly disturbing scene can be *expected* to incorporate prominent, major misinformation into their memory reconstructions in the face of improper questioning techniques.

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Appendix

List of Major Misinformation Questions

Negative Slides:
1. Was the dog behind the bicycle darker or lighter coloured than the dog sniffing the blood?
2. Was the German Shepherd dog to the left of the vehicle lying down or standing?
3. Was the woman on the left looking towards her companion or off into the distance?

Neutral Slides:
1. Was the German Shepherd dog in the background lying down or standing?
2. Was the German Shepherd dog in the background on the right lying down or standing?

Positive Slides:
1. Were the three large pigeons visible on the ground white or brown?
2. What type of bird was clearly visible in the upper left-hand corner?
3. Was the bird lurking in the left hand corner a crow or a chicken?