

Title	Does reducing fear with a verbal explanation improve memory of a fearful event?
Sub Title	
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Publisher	Centre for Advanced Research on Logic and Sensibility The Global Centers of Excellence Program, Keio University
Publication year	2011
Jtitle	CARLS series of advanced study of logic and sensibility Vol.4, (2010.) ,p.197- 205
JaLC DOI	
Abstract	
Notes	Part 3 : Cognition and Language
Genre	Research Paper
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO12002001-20110331-0197

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Does Reducing Fear With a Verbal Explanation Improve Memory of a Fearful Event?

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I. Introduction

Eyewitnesses to a crime or accident often experience strong negative emotions such as fear, anger, and sadness. These emotions can trigger stress and interfere with the memory process. Loftus and Burns (1982) demonstrated that shocking, violent scenes interfered with memories of the event. Participants in their study watched one of two versions of a film depicting a bank robbery. In one version, the bank robber fired his gun while fleeing across the parking lot and the bullet struck a child (violence condition) while in the other version, the robber did not fire a gun (control condition). Memory performance was better for the control condition than for the violence condition.

Zaitso (2007) pointed out that removing or reducing negative emotions induced by observing a traumatic event would make it possible for the eyewitness to remember details that had previously been repressed. He demonstrated this effect as described below.

The study participants watched one of two versions of slide sequences in which a woman was sitting at the side of the road. In one version (ambiguous condition), a red substance could be seen on her hair and dripping from her head onto the road. Some participants interpreted the red substance as blood and others interpreted it as paint. In the other version (neutral condi-

tion), there was no red substance in the slides. Participants then took the first memory test.

Next, the participants who had viewed the ambiguous-condition slides watched one of two sets of slides that were intended to alter their interpretation of the red substance. In one set, the woman in the slide was being attacked by a man. This set was expected to bring the interpretation that the red substance in the previous slides was blood. In the other set, a paint can was lying on its side with a red substance flowing out onto the road, which was expected to bring the interpretation that the red substance was paint. Half the participants whose previous interpretation of the substance was blood (ambiguous (blood-blood) condition) and half those whose previous interpretation was paint (ambiguous (paint-blood) condition) watched the two new slides that implied blood. Half the participants whose previous interpretation of the substance was blood (ambiguous (blood-paint) condition) and half those whose previous interpretation was paint (ambiguous (paint-paint) condition) watched the new slides that implied paint. Participants in the neutral condition watched two additional slides that had no implications.

After watching the new slides, the participants took the second memory test. The results showed that the memory performance in the first test was lower for participants who had interpreted the substance as blood (ambiguous (blood-blood) and ambiguous (blood-paint) conditions) compared to the neutral participants. Memory performance in the second test was higher than that in the first test only for the ambiguous (blood-paint) condition. Zaitsu (2007) argued that these results indicated that removing or reducing negative emotions enabled retrieval of memories previously repressed by negative emotions.

However, there might be another explanation for these results. Rather than repressing memory retrieval, negative emotions might instead interfere with memory consolidation. Removing or reducing negative emotions might eliminate such interference and improve the consolidation process. If this were the case, reducing negative emotions would not improve memory retrieval after the memories have been consolidated. To test our theory, we set conditions in which emotion reduction manipulation would be applied one week after the learning session. If negative emotions interfere with the memory consolidation process, emotion reduction will not improve memory

performance. On the other hand, if negative emotions repress memory retrieval and if the negative emotions last for a week or are revived after a week, emotion reduction will improve memory performance.

From an application-oriented perspective, if negative emotions repress retrieval and negative emotion reduction improves memory recall after a delay of several days or more, it would be possible to obtain more details from eyewitnesses by providing them with information that would reduce their negative emotions. For this purpose, it would be difficult to prepare images that would alter the interpretation of the original event as in the study by Zaitso (2007). Therefore, we used verbal information to alter the participants' interpretation of the original learning material.

II. Method

1. Participants

In total, 34 males and 48 females ranging in age from 19 to 40 years (average: 22.01) volunteered to participate in the study. Two females did not complete the experiment and therefore were not included in the data analysis.

2. Materials

2.1. Memory material

A video clip was prepared from a short horror movie. At the end of the clip, two young sisters were about to be attacked by something lurking outside their apartment door. Although the original movie implied the involvement of ghosts or supernatural beings, the edited version was ambiguous as to the involvement of such entities. The duration of the clip was 4 minutes, 16 seconds.

2.2. Mood adjective checklist

The emotional stress experienced by the participants was measured according to the Japanese UWIST Mood Adjective Checklist (JUMACL; Shirasawa et al., 1999), translated from the English version by Matthews et al. (1990).

The list consisted of 20 items pertaining to the participant's mood or emotion at the time of response. Ten of the items measured tense arousal and the other 10 measured energetic arousal, on a four-point scale (1: fits present mood, 4: does not fit present mood). Shirasawa et al. (1999) showed that the tense arousal score was a good index of emotional stress. We added one more item to JUMACL, which asked if the participant felt fear directly.

2.3. Recognition test materials

We prepared 18 recognition questions pertaining to details in the video clip, such as the color of a character's cell phone, the number of photos on a shelf, and so on. For each question, four response options were provided, one of which was the correct answer. None of the questions were critical to the gist of the story.

3. Procedure

Participants took part in the session individually. Before the session, we asked if the participant was claustrophobic or nyctophobic as the learning session was conducted in a small, dark room to increase the sense of fear. None of the participants were claustrophobic or nyctophobic. After signing the informed consent sheet, each participant watched the video clip on a computer monitor in a shielded room (width: 118 cm, depth: 178 cm, height: 227 cm). The room was not lit while the clip was being shown. After watching the video, participants moved to the next room, which was lit, and were asked if they had seen the video before. Half the participants were asked to come back in a week (7 of 8 days) and then they left the lab (delayed condition). The other half of the participants took the memory test immediately after watching the video (immediate condition).

The delayed-condition participants were asked to think about the video clip for 10 seconds before starting the test. This treatment was adopted to allow the fear to resurface. Just before the memory test (after the 10-second recall for the delayed-condition participants), half of each group of participants (immediate and delayed condition) were given information that was expected to reduce their fear (fear-reduction condition). The information explained that neither ghosts nor supernatural beings were involved in the story and the sisters ended up safe and happy after the final scene of the clip.

The other participants were not provided with this information (no-reduction condition). Then, all participants were asked to recall and describe as much as possible about the video. After this, the experimenter asked the participants for any details that they could remember about the characters' clothing and appearance, etc. Participants' recall reports were tape-recorded. Then, the participants took the forced-choice recognition test consisting of 18 questions with four options each.

After the memory test, all participants were asked to complete the JUMACL questionnaire with the additional item. They were also asked to rate the fearfulness of the video clip itself, regardless of their present mood, using a 4-point scale (1: not fearful, 2: slightly fearful, 3: moderately fearful, 4: fearful).

III. Results

1. Emotional Stress and Fear

First, we analyzed each participant's emotional state just after the test phase. Table 1 shows the tense arousal score, the energetic arousal score, and the rating for the fear that the participants felt in each condition. Also shown is the rating for the fearfulness of the video clip. The average rating of the fearfulness of the video clip exceeded '3' for all conditions. This means that the participants felt that the video clip itself was moderately fearful or fearful. No one responded "not fearful" and only 8 among 80 participants responded with "slightly fearful". There were no significant effects of delay or

Table 1. JUMACL tense and energetic arousal scores, participants' fear ratings, and video fearfulness ratings for each condition (SDS in parentheses)

	Immediate		Delayed	
	Fear reduction	No reduction	Fear reduction	No reduction
Tense arousal	1.96 (0.57)	2.47 (0.86)	1.89 (0.56)	2.05 (0.53)
Energetic arousal	2.64 (0.54)	2.48 (0.54)	2.75 (0.49)	2.38 (0.54)
Participants' fear	1.65 (0.96)	2.45 (1.02)	1.10 (0.30)	1.50 (0.59)
Fearfulness of the video	3.20 (0.60)	3.20 (0.68)	3.45 (0.67)	3.35 (0.57)

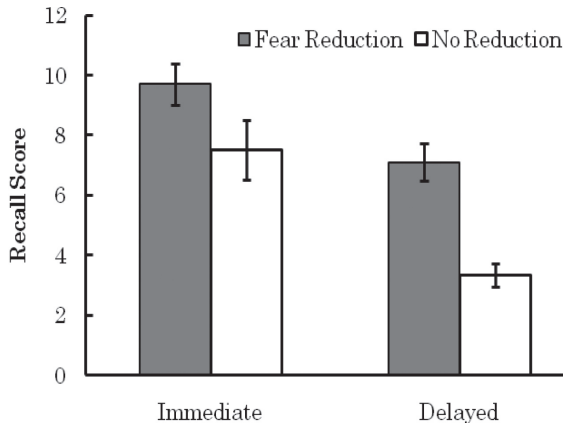


Figure 1. Mean recall score for each condition. Error bars indicate standard error.

fear reduction, and their interaction was not significant.

The tense arousal score and the participants' fear rating were higher for the immediate condition than the delayed condition, and higher for the no-reduction condition than the fear-reduction condition. Analysis of variance revealed the marginally significant effect of delay ($F(1, 76) = 2.79, P < .10$) for the tense arousal score. The effect of fear reduction was significant ($F(1, 76) = 5.04, P < .05$). For the participants' fear rating, the effects of delay ($F(1, 76) = 17.70, P < .001$) and fear reduction ($F(1, 76) = 11.33, P < .005$) were significant. No interactions were significant. From this data, we could infer that the participants felt fear and suffered emotional stress when they watched the video clip in the small, dark room, and the fear-reduction information successfully reduced the participants' fear and emotional stress. Recalling the fearful video after a week revived the fear and emotional stress to some extent, which was also reduced by the fear-reduction information.

The energetic arousal score was higher for the fear-reduction condition than for the no-reduction condition ($F(1, 76) = 4.98, P < .05$). No effect of delay and no interaction were detected.

2. Memory Performance

The participants' recall reports were transcribed and then coded based on the following coding scheme. First, a checklist of 16 items was prepared collecting the important ideas that were included in the participants' recall reports.

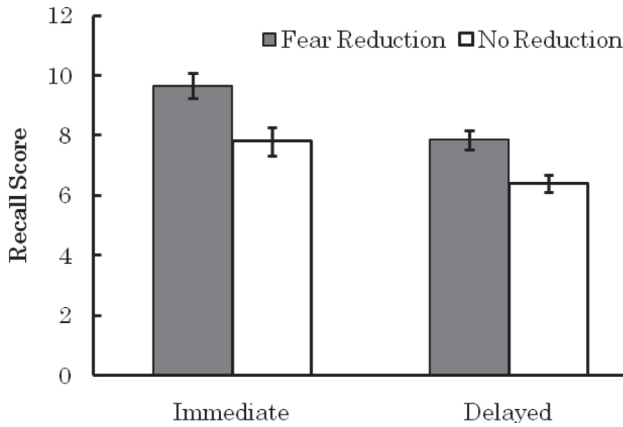


Figure 2. Mean recognition score for each condition. Error bars indicate standard error.

Two coders (one of the authors and one person who was familiar with the memory material but not with the experiment) individually checked if each checklist item was included in each recall report. If there was a disagreement, the item was regarded as not being recalled. Cohen's Kappa (.86) shows that the coders' judgments agreed very well. The number of checklist items in a recall report was used as the recall score of a participant.

Figure 1 shows the average recall score for each condition. Analysis of variance was conducted on the recall scores. The recall score was significantly higher for the immediate condition than for the delayed condition (8.60 and 5.23, respectively; $F(1, 76) = 23.16, P < .001$) and was significantly higher for the fear-reduction condition than for the no-reduction condition (8.40 and 5.43, respectively; $F(1, 76) = 18.00, P < .001$). The interaction was not significant ($P > .10$).

The number of correctly recognized items in the recognition test was used as the recognition score. Figure 2 shows the average recognition score for each condition. Again, analysis of variance was conducted on the recognition scores. The pattern of the results was quite similar to that for the recall data. The recognition score was significantly higher for the immediate condition than for the delayed condition (8.73 and 7.13, respectively; $F(1, 76) = 17.29, P < .001$) and was significantly higher for the fear-reduction condition than for the no-reduction condition (8.75 and 7.10, respectively; $F(1, 76) = 18.38, P < .001$). The interaction was not significant ($P > .10$).

IV. Discussion

Participants in all four groups equally rated the fearfulness of the video clip. However, the JUMACL tense arousal score and participants' fear rating after the test session were lower for the fear-reduction condition. This indicates that the fear-reduction manipulation worked successfully. Even in the delayed condition, the tense arousal score and participants' fear rating were higher for the no-reduction condition than for the fear-reduction condition. Perhaps, the 10 seconds spent thinking about the video revived their fear and emotional stress to some extent and then the fear-reduction manipulation might have reduced the fear and emotional stress. It could be said that the manipulation of negative emotions was successful in this experiment.

Memory performance data for the immediate condition replicated the findings of Zaitso (2007). Although the participants in the immediate/fear-reduction group rated the fearfulness of the video as high as the other groups, their rating of the fear was lower than the immediate/no-reduction group. It might be reasonable to consider that these participants thought the story in the video clip involved supernatural beings and felt fear first, and then, the fear was removed or reduced by the explanation. This reduction of fear improved their memory performance as in the ambiguous (blood-paint) group in the study by Zaitso (2007).

For the delayed condition, memory performance was better for the fear-reduction condition than for the no-reduction condition, too. Since one week's delay may be enough to complete the memory consolidation process, fear reduction did not affect memory performance in the delayed condition if fear and/or emotional stress interfered with memory consolidation. The result denied this possibility and made it more plausible that fear and/or emotional stress interfered with the memory retrieval process and fear reduction removed this interference and improved the memory performance.

In this experiment, we examined if fear-reduction manipulation using verbal information can reduce negative emotions and improve memory performance that is otherwise deteriorated by negative emotions. The results showed that fear reduction with verbal information works well both immediately after learning and one week later. From an application-oriented perspective, this implies the possibility of devising techniques to obtain more

information from eyewitnesses. If temporarily deceiving an eyewitness could be justified, interviewers may be able to tell eyewitnesses that the accident or crime was not serious and there is no need to feel fear, anger, or any other negative emotions. Alternatively, perhaps providing a positive, cheerful environment for the eyewitness would work just as well.

From a theoretical standpoint, the results of this experiment support the view that negative emotions interfere with the memory retrieval process and repress memories. However, there may be alternative explanations for the results. For example, memory performance might be improved because fear-reduction manipulation provides a new framework for retrieval, i.e., participants in the fear-reduction condition remember the event along with the ghost story schema and schemata of everyday life events whereas participants in the no-reduction condition remember the event only with the ghost story schema. Such possibilities require further study.

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