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False Memory after a Traffic Accident: The Effect of Word Types and Gender

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Abstract- When an accident happens, eyewitnesses become important so that the police get a clear description of the case. Unfortunately, eyewitness testimony is easily corrupted with false memory errors. This study examined the effects of word type and gender on the formation of false memories in the context of a traffic accident. In this study, male and female participants were each given a Deese-Roediger-McDermott list with neutral, negative, and accident-related words. The participants in this study were 60 motorcyclists who had been involved in a traffic accident previously. After seeing the Deese-Roediger-McDermott (DRM) list, participants were given a recall and recognition test to measure false memories of list items. The results showed that there was a significant false memory effect based on word type in the recall test and the recognition test. The accident-related word type produced more false memories than the neutral and negative types. There was no significant effect for gender or between word type and gender for the formation of false memories.

Keywords: false memory, gender differences, traffic accident trauma, eyewitness recall

Introduction

When an accident occurs, the police must investigate the crime scene to get a clear description of what the victim, culprit, and eyewitnesses saw, heard, and knew of the accident (Regulation of Indonesia Police Chief, 2013). In the process, the most reliable source to get the necessary information is those who were directly involved. However, a memory error called false memory often tends to happen in such cases (Wells, Memon, & Penrod, 2006). It is an error that reflects a person recalling something that never happened or that happened in a slightly different way than what is recalled (Roediger & McDermott, 1995). False memories have become important in crime and accident cases because they have been discovered to skew testimony (Otgaar, Sauerland, & Petrilla, 2013a).

False memory can be caused by multiple factors. Internal, or dispositional, factors that may affect memory include imagination (Foley, Wozniak, & Gillum, 2006), mood (Ruci, Tomes, & Zelenzki, 2009; Zhang, Gross, & Hayne, 2016), age (Brainerd, Reyna, & Ceci, 2008; Y. Lee, C. Lee, & Yang, 2012; Otgaar, Howe, Peters, Sauerland, & Raymaekers, 2013b), and gender (Areh, 2011; Wang, 2012). External, or situational factors are misleading information (Loftus & Pickrell, 1995), misinformation from a discussion with other people (Gabbert, Memon, Allan, & Wright, 2004), warnings (Neuschatz, Benoit, & Payne, 2003), conformism (Schneider & Watkins, 1996), and word valence (Brainerd, Holliday, Reyna, Yang, & Toglia, 2010; Howe, Candel, Otgaar, Malone, & Wimmer, 2010; Otgaar et al., 2013a).

Other traumatic experiences may also affect memories of an experience. Trauma memory, like memory in general, can be susceptible to distortion (Strange & Takarangi, 2015). To date,

most studies of false memory of traumatic experiences involve victims of childhood sexual abuse (CSA) (Geraerts, Smeets, Jelicic, Van Heerden, & Merckelbach, 2005; Goodman et al., 2011) and war atrocities (Brennen, Dybdahl, & Kapidzic, 2007). However, a traffic accident is also traumatic (Edelstein, Alexander, Goodman, & Newton, 2004). Since studies of false memory in a traffic accident context are not available in the literature, it would be useful to make an examination from that point of view of false memory in a traffic accident context.

One of the methods the Deese-Roediger-McDermott (DRM) list was developed by Roediger and McDermott (1995). Past studies have shown that both traumatic and non-traumatic (neutral) DRM word lists can produce false memories for traumatized individuals (Zoellner, Foa, Brigidi, & Przeworski, 2000; Geraerts et al., 2005; Brennen et al., 2007). In a study by Goodman et al. (2011), individuals with and without a history of CSA were given neutral, positive, negative, and trauma-oriented DRM lists. The result of this study showed that there was a significant effect connected with the trauma-oriented word list type. The trauma-oriented and negative word lists were more often recalled falsely than were the positive word lists. This study was in line with Brennen et al.'s (2007) research showed that individuals with Post-Traumatic Stress Disorder recalled more war-related words that had not been presented (CLs) than individuals without PTSD. Thus, we can infer that individuals with traumatic experiences often falsely remember words related to their trauma. For the current study, we hypothesized that accident-related words would produce a significantly higher false memory score from traffic accident victims than neutral or negative words.

In addition to the trauma-related word type as an external factor, there are contradictory results on the effect of one of the internal factors on false memory, which is gender. Previous studies (Butts, Mixon, Mulekar, & Bringmann, 1995; Seamon, Guerry, Marsh, & Tracy, 2002; Bauste & Ferraro, 2004) found no significant difference in false memory production by gender. However, Areh (2011) found that males remembered significantly more false details than females when giving descriptions of crime victims and culprits, these differences in accuracy of description indicating a likely difference in false memory rates based on gender differences. Wang (2012) also found that young adult males "recognized" more false words than females did when performing a verbal memory task. There were several studies that examined the effect of interaction between word type in DRM and gender on. However, he did not find a significant interaction between different word types and gender that affected false memory production. Conversely, Dewhurst, Anderson, and Knott (2012) found a significant interaction in young adult female participants. This leaves the possible link between trauma words and gender unclear and offers a direction for further study.

Current study

This current study aimed to examine the effect of word type and gender in the production of false memory. In this study, word lists related to trauma (accident-related) and word lists not related to trauma (neutral and negative) were given for participants to memorize. After the presentation of 10-word long lists, a recall test and a recognition test were given to participants to assess whether the participants came up with false memories about the words used in the DRM lists.

Materials and Methods

Participants

Sixty motorcyclists that had been through a traffic accident were included, with 30 females (M_{age} = 19.77, SD = 1.28) and 30 males (M_{age} = 20.10, SD = 1.42). All the participants were recruited by convenient sampling through an online form.

Materials

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DRM lists: At the beginning of the study, the participants were given three different DRM lists to study. Each list consisted of ten words which were associated with a critical lure (CL) word, which was used in the recall test to check for false memory. Each list featured neutral, negative, or accident-related word types. The neutral DRM list was taken from Roediger and McDermott (1995), and the CL words were “smell,” “cold,” and “cup.” The negative DRM lists were taken from Howe et al. (2010) and Shah and Knott (2018). The CL words for that list were “lie,” “thief,” and “bomb.” Accident-related DRM lists were created by the researchers, based on a survey of 120 motorcyclists. The result CLs were “crash,” “wound,” and “dangerous.”

Recall and Recognition test: In the recall test, the participants were instructed to write as many words they could remember from the DMR lists they had studied previously. When participants chose a CL as one of the words they recalled, it constituted a false memory, as the word was not actually included on any of their lists. In the recognition test, the participants had to identify words from the DMR lists they had studied previously. The recognition test consisted of 54 words. Thirty-six of the words were taken from the DMR lists (four words from each list). Nine CLs and nine words that were not related to any previous word types were also included. The participants used a checklist to indicate whether they thought a word had been on the DMR lists or not. If participants chose a CL as one of their responses, that indicated the occurrence of a false memory.

Distraction Task: To prevent the participants from rehearsing the words studied, they were given math problems as a distracter. The math distractor was made up of simple addition or subtraction problems given after the word list had been studied and before the recall test was administered.

Experimental Design and Procedure

The study experiment was a mixed design with the different word types used as the within-subject variable. Gender was used as the between-subject variable.

The experimental procedure was based on Howe et al. (2010) in which two valence types of DRM lists were used. In this study, we modified the procedure by displaying the word lists in a PowerPoint so that aspects such as intonation, tempo, and gender of the speaker would not become confounding variables. In each session, the order of the word type presentation was counterbalanced.

The duration of the experiment session was approximately 40–45 minutes, and it was conducted in a group setting. After all the participants for the session were present, they were brought to a discussion room where they sat facing a screen with the experimenter in front of them. The experimenter read the briefing and had the participants sign an informed consent document. Then, the participants were asked to pay attention to the words that would appear on the screen. Each word appeared for 3 seconds (in Calibri, font size of 72, lowercase). A blank screen appeared between each word for 1 second. After all, ten words for each word type were shown, the participants were given a distraction task with math problems for 30 seconds. Then, the participants would be asked to recall and write out the words they remember for 2 minutes. All the steps were repeated until all nine of the word lists have been shown. The participants were given a 1-minute break after both the third and the sixth recall test.

The participants were also given a recognition test where they had to choose whether the words they were shown had been on the initial lists or not. There was no time limit for this test. After all the participants had returned their response booklet to the experimenter, they could leave the room and get the reward. The participants received debriefing information later through email.

Scoring

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable. False memory was measured by scoring participants' responses regarding the CL word, a score of 1 indicating a "yes" response on the recognition test. The highest score participants could get on the test was 9 and the lowest was 0. The higher the score, the falser memories that had been created by a participant.

Results

We used a 3 (word type) x 2 (gender) mixed factorial ANOVA to analyze the experimental results. In the recall test, the results showed a significant main effect of word types, F (2, 164) = 4.83, p =.01, η^2=.077. Words on the accident-associated lists (M =.48, SD =.62) were falsely recalled significantly more than words on the neutral (M =.28, SD =.52) and negative lists (M =.22, SD =.41). There was a no significant effect associated with gender, F (1, 82) =.39, p >.05, η^2=.007, and no interaction between word type and gender, F (2, 164) = 2.59, p >.05, η^2 =.043.

Table I. Means of False Memory in Recall Test

Gender	**Word Types Percentages**			**Total Mean**	**n**
	Neutral M (SD)	***Negative*** M (SD)	***Accident-related*** M (SD)	***M (SD)***	
Male	.33 (.55)	.13 (.35)	.60 (.56)	***Male***	***.33 (.55)***
Female	.23 (.50)	.30 (.47)	.37 (.67)	***Female***	***.23 (.50)***
Total	.28 (.52)	.22 (.42)	.48 (.62)	Total	.28 (.52)

The results on the recognition test showed a significant main effect for word type [F (2, 164) = 5.13, p =.007, η^2=.081], and accident-related words were falsely recognized more than neutral and negative lists. (Table 2.) However, was analysis did not show any main effect for gender, F (1, 82) = 1.77, p >.05, η^2=.03, and no interaction effect, F (2, 164) =.24, p >.05, η^2=.004.

Table II. Means of False Memory in Recognition Test

Gender	**Word Types**			**Total**	**n**
	Neutral M (SD)	***Negative M (SD)***	***Accident-related M (SD)***	***M (SD)***	
Male	1.57 (.82)	1.57 (.89)	1.97 (.99)	5.10 (2.14)	30
Female	1.33 (.92)	1.40 (.81)	1.63 (.89)	4.37 (2.12)	30
Total	1.45 (.87)	1.48 (.85)	1.80 (.95)		60

Discussion and Conclusion

In this study, we examined the effect of word types on false memory formation in males and females. The study expanded on a previous study by Goodman et al. (2011) by including a DRM word list specifically related to accidents. We hypothesized that the accident-related words would produce higher rates of false memory formation than the neutral and negative words. The results showed that there was a significant effect of word types on false memory formation. In line with our hypothesis, accident-related words produced higher false memory rates than the neutral and negative words on both the recall and the recognition test. This result was in accordance with Goodman et al.'s study (2011), where traumatic-related words and negative words were linked with higher false memory rates in people with and without a history of CSA. This result can be best explained based on the fuzzy-trace theory of Brainerd and Reyna (2002), which posits a verbatim memory process that records surface details of an event and a gist memory process that focuses on word meaning-related features. The recall test likely activated gist processing because it involved the construction of information based on connecting with related words. Since the negative word lists relied on gist processing to a greater extent than the neutral and positive word lists did (Goodman et al., 2011). In our study, accident-related words used greater gist processing than negative words, indicating a significant difference between the two-word types.

In the recognition test, word type had a significant effect on false memory formation. This result is in line with Brennen et al.'s (2007) study, which found that individuals with war trauma produced the most falsely remembered words when working on war-related word lists. In our study, accident-related (traumatic) words were falsely recognized more often than neutral and negative words. In the recognition test, when the participants were given stimulus words that were very similar to the words on the target list, they were more susceptible to false memory (Brainerd et al., 2008). For that reason, the accident-related word lists produced the falsest memories for the participants, who had all experienced some level traffic accident trauma.

Our results showed no significant effect of gender on false memory formation for both the recall and recognition test. This result is in line with studies by Butts et al. (1999), Bauste and Ferraro (2004), and Seamon et al. (2012). The lack of gender effects on false memory may have occurred because there is not much difference in the overall memory performance of males and females (Seamon et al., 2012). Our study also did not show any interactions between word type and gender that would affect false memory formation. According to Wang (2012), males and females are not very different in terms of source memories and contexts. However, Dewhurst et al. (2012) assert that females usually process emotional words differently than males, and they produce more false memories about negative emotion-related information. Unfortunately, this statement is in contrast with our result, and the discrepancy it suggests requires further study.

There are several limitations to the current study. First, the sample used in is quite small (n = 60 participants) compared to the minimal sample required by G-Power calculations (n = 164 participants). This may serve to minimize the effects of variables on the process of false memory formation. The observed power of gender is quite small in this study (.09 for recall and .25 for recognition), which has not been the case in a number of previous studies (). Additionally, previous studies have shown that individuals with traumatic experiences are more susceptible to false memories (Zoellner et al., 2000; Brennen et al., 2007; Goodman et al., 2011). However, we did not measure the extent to which trauma associated with a past traffic accident may have affected the participants. Another factor to consider for future studies is, the measurement of Backward Associative Strength to assess ensure that every word used in the testing has the same probability of eliciting a CL, leaving less area for confounding responses. Finally, we did not calculate the degree of arousal attributable to the DMR word lists. Because arousal is associated with valence and emotions, it can strengthen information bonding in memory. This bond can increase the recollection of that information (Howe et al., 2010). In this study, we did not calculate how much the words might have aroused participants, to see if that factor had an effect the results. subject of false memories is a vast topic. The current study points to interesting areas of discussion, particularly about the influence of traffic accidents on false memory formation.

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