Running Head: CHANGES IN FALSE MEMORIES

Changes in False Memories Over Time

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Abstract

The issue of false memory has been the focus of substantial research in recent years. Numerous studies have investigated factors that influence false memories. Despite the considerable body of research in this area, few studies have looked at changes in the nature of false memory over time. The present study, using the Deese/Roediger and McDermott (DRM) paradigm to induce false memories from word lists, examined the number of false recognitions made immediately after presentation of the word lists, and after a one week delay. Contrary to the predictions of Fuzzy Trace Theory (FTT), both accurate and false recollections declined significantly over the one week retention interval. However, the results did provide evidence that the characteristics of accurate and false memories are phenomenologically similar.

Introduction

The issue of false memory has been the focus of substantial research in recent years. This is due in part to growing evidence showing that human memory may be surprisingly susceptible to distortions and errors (Loftus, 2000). Researchers have shown that memory distortions can occur in eyewitness testimony, with sometimes serious consequences (Manning & Loftus, 1996; Zaragoza & Lane, 1994). There has also been a significant amount of public attention focusing on recovered memories of childhood sexual abuse that may emerge during therapy (Hyman & Loftus, 1998).

In addition to these very practical and important applications of false memory research, studies of false memory are important because they provide further insight into the nature of human memory and contribute to general memory theory. Research conducted on false memory over the past several years has contributed greatly to several theoretical frameworks and helped us to understand the conditions in which our memory is susceptible to distortion.

Recently, a list learning paradigm originally introduced by Deese (1959) has been adapted as a useful tool for studying false memories in the laboratory. Although Deese was not specifically concerned with false memories, it was recognized that the procedure he used produced robust false memory effects (Roediger & McDermott, 1995). Roediger and McDermott (1995) revived Deese's procedure and adapted this technique for the creation and investigation of false memories. Consequently, this commonly used procedure is now referred to as the Deese/Roediger & McDermott (DRM) paradigm.

The DRM paradigm has played a major role in recent false memory research, as it provides a simple and systematic way of analyzing false memories. The procedure is

fairly straightforward and produces strong false memory effects. In this paradigm, subjects are presented with a list of related words that converge to a nonstudied critical word. For example, subjects may be presented with the following list: *hard, light, pillow, plush, loud, cotton, fur, touch, fluffy, feather, furry, downy, kitten, skin,* and *tender.* All of these words are strong semantic associates of the word *soft,* which was not presented. Following presentation of the words, subjects are asked to recall or complete a recognition test of the words on the list, and with a surprising degree of consistency, they report a memory of the critical related word that was not on the list. Additionally, when asked to state whether they distinctly remember being presented with the critical word, or just "know" that it was presented, many subjects report remembering the word.

Much of the research making use of this paradigm has focused predominantly on encoding, and on the influences that various events occurring at encoding have on the nature of false memories. For example, Goodwin, Meissner, & Ericsson (2001) provided evidence that critical words consciously come to mind during the original encoding of list words. Additional studies have shown that false remembering can be greatly influenced by presentation format (Gallo, McDermott, Percer, & Roediger, 2001). Gallo et al. (2001) found that subjects experienced substantially fewer false memories for visual presentation of items compared to auditory presentation. Interestingly, research has also shown that warning subjects about the nature and purpose of the DRM procedure prior to the experiment attenuates, but does not eliminate, the false memory effect (Gallo, Roediger, & McDermott, 2001). Other studies have examined how cues given at recall affect false memories (Reysen & Nairne, 2002). An area that has received less research attention relates to the influences of repetition on the nature of false memories (Seamon,

Luo, Schwartz, Jones, Lee, & Jones, 2002). The number and variety of research presented here indicates just how useful the DRM paradigm has become for memory research. However, despite the volume of research that has been conducted within the context of the DRM paradigm, very little attention has been paid to the ways in which false memories change over any extended time interval.

The growing body of research in this area has contributed most significantly to two major theories of memory, these being Source Monitoring Theory and Fuzzy Trace Theory. According to Source Monitoring Theory, memory traces are seen as a record of the cognitive processes that have been performed when an event has been experienced (Toglia, Neuschatz, & Goodwin, 1999). This trace will have different qualities, depending on whether it results from an internally generated inference or an externally perceived event. These differences in the qualitative aspects of the memory trace are what allow individuals to determine whether a memory is genuine, or if it is the result of an "imagined" event. Although internally generated events will have perceptual and semantic details similar to those of actually experienced events, research has indicated that internally generated traces contain fewer details (Toglia, et al. 1999). Relative to the DRM paradigm, Source Monitoring Theory suggests that since memory traces of presented words overlap so significantly with the memory trace of the internally generated critical lure, it becomes extremely difficult to accurately identify the source of these memories. This often results in a judgement that the critical word was seen, when in fact it was not. Despite its fairly sound empirical basis, some have argued that the source monitoring framework does little to help us understand the false memory phenomenon in all of its complexity (Toglia et al., 1999). In addition, researchers have

found it difficult to generate clear and useful predictions using this theory (Roediger, McDermott, & Goff, 1997).

Fuzzy Trace Theory offers another explanation of the nature of accurate and false memories. From this perspective, when exposed to an event, individuals encode verbatim and gist memory traces in parallel (Brainerd & Reyna, 2002; Toglia, et al., 1999). Verbatim traces are basically copies of the surface features of the event, while gist traces represent deeper levels of understanding which include relationships, meanings, and patterns. The relative strength of these two types of traces then determines the nature of a memory. Thus, correct recollection results when both verbatim and gist traces are strong, and remembering declines as these two traces weaken. Evidence suggests that gist traces, since they result from deeper levels of encoding, are more resistant to decay than verbatim traces (Reyna & Brainerd, 1995). Since gist representations are oriented to overall patterns of experience, situations that allow individuals to extract gist information should facilitate memory errors that are related to the theme of the trace. Consequently, in the DRM paradigm, false memory can be viewed as resulting from semantic (gist) associations between the study words and the critical word.

Fuzzy Trace Theory is especially intriguing because it offers some fairly counterintuitive predictions. One such prediction is that over extended retention intervals, false memories should not decay as quickly as true memories. This results from the reliance of false memory on gist traces. In the DRM paradigm, recollection of presented words relies heavily on verbatim traces, while memories of the critical word result from gist traces. Since gist traces are generally retained better than verbatim traces,

it would be expected that, over time, false memories would be less susceptible to forgetting. A study conducted by Toglia, et al. (1999) found evidence in support of this prediction. Over retention intervals of one and three weeks, they found that memories of presented words dropped significantly over each time interval, but false memories of critical words remained stable over this entire period.

An understanding of the changes that occur in false memories as time elapses would be beneficial from both an applied and theoretical perspective. This issue has implications for courtroom testimony, as well as other situations where recovered memories may be called into question. In the case of courtroom testimony, there is often a substantial interval between the time an event is initially recalled and the time that event is related to the court. As we begin to understand the mechanisms that may affect these memories over time, we will be better able to interpret courtroom recollections. Additionally, by examining false memories over time, we will be able to refine current memory theory and provide further insight into the fragile power of memory.

<div align="center">Method</div>

Subjects

29 subjects from the Introductory Psychology course as well as other lower division courses at Bemidji State University participated in the present study. Subjects were given extra credit for their participation.

Procedures

Subjects participated in groups of eight and were asked to be present for two trials. The order in which study words were presented was counterbalanced, so two of the groups were exposed to the standard list, and the other two viewed the same list, only

in reverse order. Among the eight subjects per group, four were given the standard recognition test, while the other four were given the same recognition test with the words in reverse order. Prior to beginning the first trial, subjects were presented with the informed consent agreement. After consenting to the study, subjects were read the following instructions:

> You will be asked to try to remember the words that are presented on the screen at the front of the classroom. Each word will appear on the screen for a short time, and then will be replaced by another word. As the words are presented, pay close attention and try to remember the words that have been shown. Once the words are done being presented, you will be given a short test to see if you can recognize the words that were shown on the screen.

Subjects were then presented with the ten word lists that elicited the highest levels of false recognition in Stadler, Roediger, and McDermott's 1999 study. These lists were presented on a computer screen, with each word in the list appearing for 2 seconds. Between presentation of each list, there was a five second interval during which a "next list" prompt appeared.

Following presentation of all of the lists, subjects were given fifteen minutes to complete a recognition test for items that were presented. This test consisted of 80 words, with the letters R and K printed next to each word. Consistent with the format of previous research (e.g., Seamon et al., 2001), the test consisted of three items from each studied list (item numbers 1,8, and 10), the nonstudied critical word associated with each studied list, three items from nonstudied lists (items 1,8, and 10), as well as the critical

word from the nonstudied lists. These words were arranged in random order. Prior to receiving this test, subjects were given the following instructions:

> You will now receive a list of words. Your task is to circle the words that you think were presented on the screen. Next to each word is an "R" and a "K." For every word that you circled, please circle "R" if you actually remember seeing the word on the screen, or circle "K" if you just know that it was presented.

These directions were also displayed on the screen at the front of the room so they could be referenced by subjects at any time during the test. Following completion of the test, subjects were asked to print their name at the top of the test so that they could be identified during the second testing. All subjects were informed that this identifying information would be kept confidential and destroyed after completion of the study.

Upon completing the initial trial, subjects were reminded that they needed to return in one week for the follow-up portion of the study. All subjects were informed that in order to receive their extra credit points, they needed to be present for the follow up trial. At this time, questions or concerns were addressed.

One week after the initial presentation of the word lists, subjects returned to the lab for a follow up test of their memory. At this time they were given the same recognition test that they were given during the first trial. The exact directions were read again, and subjects were asked to make remember/know judgments on the test. Upon completion of the task, subjects were debriefed and questions were answered. Finally, subjects were awarded their extra credit.

Results

The proportion of the various items selected on the recognition test was calculated for each subject. This resulted in recognition percentages for studied words, critical words, and nonstudied words, as well as the percent of each that were classified as being "remembered" or "known." The percentage of words recalled was analyzed using a 2 (retention interval: immediate, one-week) x 3 (item type: list, critical, nonstudied) x 2 (judgment: remember, know) within subjects ANOVA. This analysis revealed a significant Retention Interval x Item Type x Judgement interaction, $F(2, 56) = 7.79$, $MSE = .02$, $p < .05$ This interaction is represented in Figure 1. For both studied and critical words, the proportion of remember judgements dropped off substantially over the retention interval, while the proportion of know judgements increased slightly. Very few nonstudied words were selected on the recognition test, and the differences between remember and know judgements for these words remained stable over the retention interval.

Proportion of words judged as "remember" and "know" immediately and after one week for studied words, critical words, and nonstudied words.
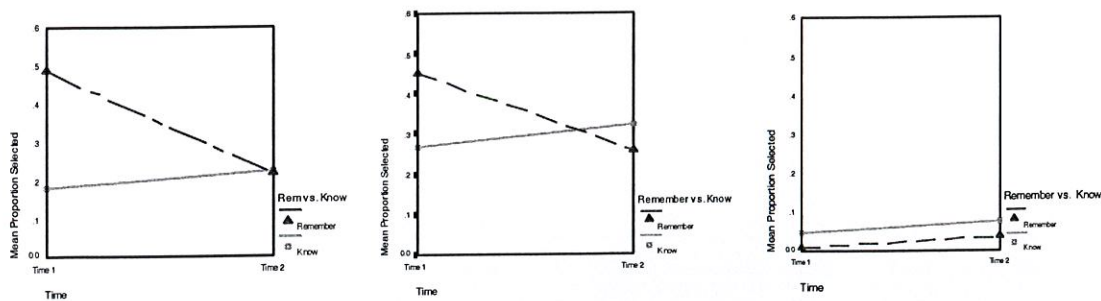

Figure 1.

An additional 2 (retention interval: immediate, one-week) x 2 (item type: studied, critical) x 2 (judgement: remember, know) within subjects ANOVA was used to determine if the two graphs on the left of Figure 1 differed. This analysis was not significant, $F(1, 28) = .54$, $MSE = .03$, $p > .45$. This indicates that the phenomenological characteristics of accurate compared to false memories are similar, since both show statistically indistinguishable patterns over the one week time period.

According to FTT, memories for studied words would be expected to deteriorate significantly over an extended time interval, while memories for critical words would be expected to remain fairly stable. As seen in Table 1, there is some evidence of this trend. In an effort to directly test the hypothesis presented within the context of FTT, several planned comparisons were conducted. Two separate paired sample t-tests were used to address this issue. A comparison of the percentage of studied words recalled immediately ($M = .67$) with the percentage of studied words recalled after one week ($M = .45$) was significant, $t(28) = 7.45$, $p < .01$. Similarly, a comparison of the percentage of critical words recalled immediately ($M = .72$) with the percentage of critical words recalled after one week ($M = .59$) was significant as well, $t(28) = 2.93$, $p < .01$. Thus, the hypothesized relationship was not found.

Table 1
Recognition Proportions for Studied and Nonstudied Words.

Word type	Immediate (R/K)	One Week (R/K)
Studied	.67 (.49/.18)	.45 (.22/.23)
Critical	.72 (.45/.27)	.59 (.26/.32)
Nonstudied	.06 (.01/.05)	.12 (.04/.08)

Discussion

The present investigation replicated the robust false memory effects that have been produced in many previous studies. However, this investigation did not find the hypothesized relationship between the recollection of true and false memories over a retention interval. Although subjects' recollection of false memories did not deteriorate as much as accurate recollections, both types of memory showed a significant decline over the one week retention interval. This may be due to several factors. First, since the present study used a recognition test rather than a free recall test, it is possible that viewing the words on the recognition test acted as an additional study trial (Toglia et al., 1999). This would help to strengthen verbatim traces, which would in turn prevent subjects from relying so heavily on the gist representations that spur false memories. Another factor that may help to explain the observed relationships concerns the time interval between the presented list words. While the numerous studies that have used the DRM paradigm have manipulated many aspects of this procedure, most have used a two second delay between presented words. Accordingly, the present investigation used a two second delay between list words. However, Toglia et al. (1999) utilized a 4 second delay between words. It is possible that the shortened interval between list words prevented subjects from identifying the relationships among the words. Consequently, resulting gist traces would be weakened.

Although the results of this study did not confirm the original hypothesis, the observed data did indicate several interesting relationships. Remember and know judgments for presented and critical words were shown to behave similarly over the retention interval. This provides an indication that subjects' true and false memories

were phenomenologically similar. The phenomenological characteristics of true and false memories are important for a number of reasons. First, if researchers can identify differences between these two types of memory, it may be possible for individuals to utilize a strategy for differentiating the two (Neuschatz, Payne, Lampinen, & Toglia, 2001). Thus, it is conceivable that people could develop a strategy that would allow them to identify false memories and avoid reporting them as accurate memories. Secondly, an understanding of the phenomenological characteristics of true and false memories would contribute significantly to theory, especially the Source Monitoring framework and Fuzzy Trace Theory already discussed. However, if it was found that these memories are indeed indistinct, the task becomes extremely difficult. Previous research focusing on the characteristics of accurate and false memories has achieved mixed results (Neuschatz et al., 2001). The present investigation has provided some indication that these memories are phenomenologically similar, although additional research is needed to further elucidate this relationship.

The findings of the present study conflict with evidence from previous research (e.g. Toglia et al., 1999) regarding the nature of false memories over time. Since this specific issue has not been widely addressed in the literature, few conclusions can be drawn from this discrepancy. Further research is needed to determine if false memories are indeed more resistant to decay, or if they are susceptible to the same rates of forgetting as accurate memories. Such research would certainly be justified, since real-world instances of false memories almost universally involve the development and maintenance of these memories over various time intervals. As we become more aware of how these memories are affected by the passage of time, we will be better prepared to

identify false memories and hopefully reduce the likelihood that they will produce

negative consequences.

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