



# Influence of suggestion in the DRM paradigm: What state of consciousness is associated with false memory?

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## ABSTRACT

We assessed the effect of suggestion on the Deese–Roediger–McDermott paradigm and associated it with the Remember–Know–Guess paradigm. Undergraduate students were given either lists of semantically related words or texts containing these words. After the recall task, if participants did not produce the critical lure, the experimenter suggested that the word had been present, using either a question (moderate suggestion) or an assertion (strong suggestion); these conditions were compared to a condition without suggestion. Afterwards, participants took a recognition test. The results showed that strong suggestions lead to more false recognitions than other conditions and the state of consciousness associated with false recognitions tends to be a feeling of knowing rather than remembering, regardless of the verbal version (list or text). Therefore moderate suggestions did not lead to more false recognitions compare to no suggestion. We discuss the impact of suggestion on consciousness associated with false memories.

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## 1. Introduction

Several decades ago, when Bartlett (1932) observed that people often created false memories after reading a text, he concluded that memory is a reconstruction of events rather than a reproduction. More recently, Schacter and Curran (2000) defined false memory as the conscious recall of an event which never happened. For example, assume that a person remembers he went swimming to a lake with his brother few years ago (which is a real event), but his brother remembers with certitude their mother was there too, the brother has created a false memory.

To understand false memories, a paradigm has been developed that allows frequent intrusions by false memories while limiting the confounding variables in healthy subjects. The first empirical study demonstrating false recall in a list-learning paradigm was conducted by Deese (1959). This paradigm was subsequently modified by Roediger and McDermott (1995). In the Deese–Roediger–McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995), participants see lists of words and are asked afterwards to remember as many words as they can. All lists of items are semantically related to a single item that is not presented (referred to as the critical lure). For instance, *hill*, *valley*, *climb*, *summit*, *top*, *molehill*, *peak*, *plain*, *glacier*, *goat*, *bike*, *climber*, *range*, *steep* and *ski* are all strongly semantically associated with the critical lure *mountain*. When participants freely recall lists or recognize items on the lists from among distractor items, they generally exhibit dramatically high levels of false memories of the critical lure, which are often accompanied by a high level of confidence, as participants claim to recollect that word. The appearance of false memories has been explained as the result of an implicit associative response (Underwood, 1965). Indeed, learning the stimuli activates semantically associated words in one's memory. False

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memories occur when a subject mistakes the associated activation for actual presentation, which can be conceptualized as a reality monitoring error (Johnson, Hashtroudi, & Lindsay, 1993). Fuzzy trace theory goes one step further and proposes that memories include two types of independent information: gist and verbatim information (Reyna & Brainerd, 1995). Gist information is the general meaning or idea conveyed by an assortment of items. Verbatim information concerns the identity, details and characteristics of the material presented. The encoding of words in the DRM paradigm leads to the extraction of a semantic representation and a perceptual episodic representation. Subjects favor gist information at the expense of verbatim information. False memories are the consequence of the confidence that the subject attributes to the gist information, rather than verbatim information. Thus, presenting information that is semantically related to the items presented at test will reinforce the gist representation of these items.

One way to create a false memory is to suggest false information. If we take our preceding example, we can assume that the brother created a false memory because someone suggested him, by a question or a statement, that his mother was there. According to Schacter (1999), suggestion causes information provided by others to be incorporated into one's own recall of events. The influence of suggestion on memory is studied for more than a century (Binet, 1900), and interest in this topic is renewed about 30 years ago (Loftus, 1975, 1979, 2003; Loftus, Miller, & Burns, 1978; McCloskey & Zaragoza, 1985). Various authors show that how a question concerning the past is formulated can influence what a person claims to remember. In the misleading postevent information (MPI) paradigm (e.g., Loftus, 1975, 1979, 2003; Loftus et al., 1978; McCloskey & Zaragoza, 1985), participants are exposed to a complex event; they are later misinformed about some details of that event, and finally are given a forced recognition test requiring them to choose between the original and the suggested details. For example, participants first watch a series of slides depicting a traffic accident that happened after a car failed to stop at a stop sign. The experimenter then asked one group of subjects what the car did after "passing the yield sign" (instead of "stop sign"). The control group was asked what the car did after passing the stop sign. When they were later asked about the information seen in the slides, the subjects who heard the misleading question were much more likely to report having seen a yield sign than the subjects who had been asked questions containing correct or neutral information.

Yet no study has tested false memories and the state of consciousness that results when people are exposed to misleading suggestions using simpler material, such as that presented in the DRM paradigm. Because subjects favor gist information in the DRM paradigm, the act of suggesting false information that is semantically related to words could lead to a higher rate of false memory. Moreover, the mechanism for the creation of false memories resulting from misleading postevent information is still unclear. Is a false memory created merely because we are exposed to false information? Or is a false memory created because, in addition to being exposed to false information, the procedure presupposes that the false information had been presented at encoding, which is not true. In other words, is the presence of feedback (i.e., feedback such as "this was presented at encoding") important in creating false memories after exposure to false information? It is known that exposure to incorrect information erodes subsequent memory performance (Baddeley & Wilson, 1994). And knowing that information is incorrect does not erase the negative effect of the suggestion on memory (e.g., Brown, 1988; Brown, Brown, Mosbacher, & Dryden, 2006; Perruchet, Rey, Hivert, & Pacton, 2006). The works cited above used material without any semantic links. But in the DRM paradigm, participants see semantically related words. So we can suppose that, in the DRM paradigm, the act of suggesting false information, namely the semantically related critical lure, should lead to more false memories than when nothing is presented after the recall. Besides, in cases where false information is suggested, we suppose that false memories would be more common when the experimenter adds feedback to suggestion by saying "this information was presented at encoding" than when there is no feedback. The first aim of the present study was to measure the rate of false memories in the DRM paradigm after a suggestion versus after no suggestion, as well as after different kinds of suggestions: one where we simply presented the false information and one where we presented the false information and added that it had been presented at encoding.

Another way of understanding false memories is to examine the state of consciousness associated with memories. The phenomenal conscious experience associated with a memory can be assessed with the Remember (R)/Know (K) paradigm (Gardiner, 1988, 2001; Tulving, 1983, 1985). Tulving proposed that there are two mind-brain declarative systems, *episodic* and *semantic* memory, and that one of their distinguishing characteristics is that they give rise to two different kinds of consciousness: *autonoetic* and *noetic*. These two kinds of consciousness are, in turn, expressed in two kinds of subjective experiences: *remembering* and *knowing*. An R judgment means that the subject recollected a specific event as a re-experiencing of the source of acquisition with details. A K judgment corresponds to a feeling of familiarity in the absence of any such recollection. A Guess (G) judgment, introduced by Mäntylä (1993), indicates that a subject was not sure of the response. This category was added so that K responses would not depend on the degree of uncertainty.

In recent years, the phenomenology of false memories has received increased attention (Frost, 2000). In the DRM paradigm, most false memories are associated with R judgments; subjects claim to relive the event of seeing a word and are able to recollect some details of that event (Roediger & McDermott, 1995). But what is the state of consciousness associated with suggested false memories? Frost (2000) assessed the conscious quality of eyewitness memory for misinformation. After a short interval, false recognitions of misinformation were more generally associated with a K judgment than with an R judgment, confirming earlier results (Roediger, Jacoby, & McDermott, 1996). According to Frost (2000), misinformation contains different perceptual details than does memory for the actual event. Subjects detect the mismatch between perceptual details of the test presentation and perceptual details of suggested information and thus this mismatch cannot lead to a recollection (R) of detailed information. Thus, when subjects recognize suggested false information, they simply feel a sense of familiarity. Given that discriminating between presentation during a test and presentation in a suggestion would be harder if

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