

## The false memory and the mirror effects: The role of familiarity and backward association in creating false recollections<sup>☆</sup>

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### Abstract

The mirror effect refers to a phenomenon where the hit rate is higher for low frequency words while the false alarm rate is higher for high frequency distractors. Using a false memory paradigm (Roediger & McDermott, 1995), we examined whether false memory for non-presented lures would be influenced by the lure's familiarity. The results revealed that false memory levels for low familiarity lures were higher than that for high familiarity lures, but only when the backward association strength between the presented list's words and the lure was high. The veridical memory for the presented words also revealed greater accuracy for low familiarity words. In contrast, higher false alarms were observed for high frequency unrelated distractors. These results are discussed in light of current theories of the false memory effect, and it is suggested that they support an activation/monitoring account of the effect, according to which non-presented lures are activated during encoding.

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Memory illusions, such as remembering events that never occurred, or remembering them differently from how they happened, are well known phenomena in the history of memory research (Roediger, 1996; Schacter, 1995). One variant of these illusions is false memory for a non-presented word, which was first described by Deese (1959). Deese developed a paradigm in which participants were presented with lists of words, each list containing 12 primary associates of a critical not-presented word (lure). After the presentation of each list, participants were asked to recall the words from the previously exhibited list. Surprisingly, although the lure

word was not presented in the list, it was falsely recalled at very high levels, reaching intrusion rates of 44% for some lures.

In spite of the robust false recall elicited by the Deese (1959) paradigm, subsequent memory research generally ignored his findings (see Bruce & Winograd, 1998, for an analysis of the topic from philosophical and sociological perspectives). The paradigm was revived by Roediger & McDermott (1995), who replicated the original study with a new set of stimuli. In addition, they modified the paradigm by introducing a recognition test following the lists' presentation. Their results also showed a high occurrence of false memory. Specifically, the non-presented associates were recalled 40–55% of the time, a rate similar to presented words appearing in the middle of the list. In the recognition test, the results were more dramatic: The false alarm rate for the critical lures was almost equivalent to the hit rate for the words appearing in the lists.

### Theoretical interpretations of false memory

Two basic accounts of false memory have emerged in the literature: The first, which we refer to as *memory-based* approach (following Hirshman & Arndt, 1997), emphasizes encoding and representational factors as major determinants of the emergence of false memories. The second account, which we refer to as a *decision-based* account, claims that decision processes could influence the production of memories that did not occur. In the following section, we will elaborate on the former approach, while postponing the discussion on the latter until the General discussion.

Within the broad category of memory-based theories, diverging accounts of false memory effects can be pinpointed. One line of theories emphasizes the role of associative processes in creating false memories (e.g., Roediger, Balota, & Watson, 2001; Robinson & Roediger, 1998; Roediger, Watson, McDermott, & Gallo, 2001). According to this approach, the presentation of a word during the encoding phase activates its associates, including the critical lure, in the semantic memory network. The cumulative activation of the lure by the multiple words in the list causes participants, in a subsequent memory test, to experience source confusion and to misidentify the lure as a presented item (Johnson, Hashtroudi, & Lindsay, 1993). The activation of the lure during the encoding stages could be either conscious or unconscious. Underwood (1965), for example, argued that participants consciously generate the associated lure during the study phase. Others, however, have demonstrated that false memories can arise even when the list is presented at a rapid pace, preventing the conscious processing of both the words and the lure (Seamon, Luo, & Gallo, 1998; see also Thapar & McDermott,

2001 who showed false recall and recognition for lures from lists that were processed at a shallow level).

A second line of theories focuses on faulty encoding of the presented words as a major determinant in the production of false memory (Dodson & Schacter, 2001; Koutstaal & Schacter, 1997). According to fuzzy trace theory (Brainerd, Reyna, & Kneer, 1995; Reyna & Brainerd, 1995) memory is based on either a “gist” trace, which preserves the meaning and interpretations of the experience, or a “verbatim” trace, which preserves the specific features of the experience. False memories are attributed to remembering the gist but not the verbatim representation of the presented words, while veridical memories are driven by an item-specific verbatim trace. This reliance on gist traces may result from a pattern separation failure (McClelland, McNaughton, & O'Reilly, 1995), which is the inability to form non-overlapping unique representations of the items in the list. As a result, participants have good memory for the common aspects of the words, but poor memory for the items themselves. Thus, the lures will be identified as part of the presented list because of its common attributes (see also Hunt & McDaniel, 1993 for a similar account).

The two approaches differ on the question of whether false memory for the non-presented lure is actually a genuine recollection of events occurring during study, or an illusory experience constructed during retrieval. According to the associative process account, the critical lure is activated (consciously or unconsciously) during the encoding stage and becomes an entity that is experienced during encoding and related to other events taking place at that time. In contrast, according to fuzzy trace theory and similar accounts, the failure to identify the critical lure as a non-presented item is not related to the activation status of the lure but to the encoding of the presented items. Thus, the activation of the lure is not a necessary condition for false memory.

Support for the claim positing that activation processes underlie the creation of false memories is provided by participants' phenomenological experiences of these non-studied lures. Using the remember-know judgement paradigm (Tulving, 1985) numerous studies have found that participants can report re-experiencing the lures' presentation during study at levels equal to those of items that were actually studied (e.g., Gallo, McDermott, Percer, & Roediger, 2001; Israel & Schacter, 1997; Roediger & McDermott, 1995). The fact that participants claim conscious recollection of the lure suggests that it was indeed activated during study, thus sharing similar features with the list's items (but see Brainerd, Wright, Reyna, & Mojardin, 2001 for an alternative account from a fuzzy-trace theory perspective). However, one drawback of this line of reasoning is that conclusions are based on subjective evaluation of previous memory judgements and not on more objective data

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