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Evidence that nonconscious processes are sufficient to produce false memories

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Abstract

Are nonconscious processes sufficient to cause false memories of a nonstudied event? To investigate this issue, we controlled and measured conscious processing in the DRM task, in which studying associates (e.g., *bed*, *rest*, *awake*...) causes false memories of nonstudied associates (e.g., *sleep*). During the study phase, subjects studied visually masked associates at extremely rapid rates, followed by immediate recall. After this initial phase, nonstudied test words were rapidly presented for perceptual identification, followed by recognition memory judgments. On the perceptual identification task, we found significant priming of nonstudied associates, relative to control words. We also found significant false recognition of these nonstudied associates, even when subjects did not recall this word at study or identify it at test, indicating that nonconscious processes can cause false recognition. These recognition effects were found immediately after studying each list of associates, but not on a delayed test that occurred after the presentation of several intervening lists. Nonconscious processes are sufficient to cause this memory illusion on immediate tests, but may be insufficient for more vivid and lasting false memories.

Keywords: Nonconscious activation; False recognition without identification

1. Introduction

Memory can influence our thoughts and behaviors even when we are not consciously aware of this influence. For instance, the ability to perceive a perceptually degraded picture can be facilitated by an earlier encounter with this picture, even if one cannot explicitly remember this prior occurrence (Mitchell, 2006). Numerous other studies have demonstrated that memory can nonconsciously prime performance, using a variety of implicit memory tasks that are relatively insensitive to more conscious forms of memory (e.g., Roediger & McDermott, 1993; Schacter, 1987). There is no unquestionable evidence, though, that nonconscious processes are sufficient to cause false memories for nonstudied events. In perhaps the strongest evidence for such nonconscious effects,

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Jacoby and Whitehouse (1989) found that the false recognition of nonstudied words could be increased by briefly flashing a prime word just prior to the recognition decision. However, although the prime was initially thought to exert a nonconscious influence on the memory decision, subsequent research indicates that some minimal conscious processing of the primes may be necessary (see Bernstein & Welch, 1991; Higham & Vokey, 2000). These and other findings raise questions about whether nonconscious processes can cause false recognition. More generally, it is often difficult to distinguish between memory processes that occur completely nonconsciously and those that occur with minimal conscious awareness, making the role of nonconscious processes on false memories difficult to determine.

More recent research has tried to isolate the influence of nonconscious processes on false memory creation using the Deese, Roediger, and McDermott (DRM) procedure (Deese, 1959; Roediger & McDermott, 1995). In this task, subjects study lists of words (e.g., *bed*, *rest*, *awake*, etc.) that are semantically associated to critical nonpresented word (e.g., *sleep*). On subsequent tests, subjects are more likely to falsely remember the nonstudied critical words, relative to unrelated control words (see Gallo (2006), for a review of the research on this illusion). In the first study to explore nonconscious processes using this illusion, Seamon, Luo, and Gallo (1998) presented DRM lists at extremely rapid presentation rates (approximately 20 ms per word). Even though recognition of studied items was at chance levels, they found significant false recognition of critical words (relative to unrelated words). Seamon et al. (1998) argued that the lists were presented too rapidly for conscious generation of the critical words at study, and because memory for studied items was at chance, nonconscious processes created this memory illusion. As one explanation, they argued that studied associates nonconsciously activated the critical word, via spreading activation in semantic memory, and this activation was later confused with actual presentation in the study list.

The conclusions of Seamon et al. (1998) have been questioned for at least two reasons. First, from the semantic priming literature, it is clear that activation of one word from the brief presentation of another word tends to be short-lived, lasting only several hundred milliseconds (for relevant discussion, see Roediger, Balota, & Watson, 2001). Thus, unless the critical word is consciously generated, rehearsed, and encoded into episodic memory during the study phase, nonconscious activation at study is unlikely to cause DRM false recollections over longer retention intervals lasting up to several weeks (e.g., Seamon et al., 2002; Toglia, Neuschatz, & Goodwin, 1999). Second, as pointed out by Zeelenberg, Plomp, and Raaijmakers (2003), chance recognition of some of the studied words is relatively weak evidence for nonconscious processess. It may have been that subjects consciously processed some of the list items, but these items were not tested in the subsequent recognition phase. If so, then conscious processes occurring at test may have caused false recognition. Gallo and Seamon (2004) proposed one such mechanism, in the form of test-based associative activation. The presentation of the critical word at test might have cued the recollection of those studied associates that were actually perceived, and these recollections might, in turn, have activated the critical word.[1] Such resonant activation could occur automatically and nonconsciously, as predicted by spreading activation models, leaving the subject with a feeling of familiarity toward the critical word. Alternatively, the recollection of related words may have simply caused subjects to guess that the critical word was studied, in the absence of any nonconscious activation of the critical word. Although such associatively-based guessing strategies cannot explain the typical DRM false memory illusion (see Gallo, 2006), these strategies may play a larger role in situations where encoding is extremely impoverished, as in the rapid presentation procedures used by Seamon et al. (1998).

Motivated by these concerns, Gallo and Seamon (2004) developed a stronger test of the nonconscious activation hypothesis. As in Seamon et al. (1998), they rapidly presented DRM lists to subjects, using masked visual presentation. Rather than assuming that these procedures eliminated the conscious generation of critical words at study, Gallo and Seamon (2004) attempted to measure such activation. Immediately after the rapid presentation of each list (presenting all 15 associates in less than 2 s), subjects were asked to write down every word that they perceived in the list. (This test can be considered a perceptual identification test, but because it occurred after the presentation of all 15 associates, we will refer to it as a recall test.) Consistent with the assumptions of Seamon et al. (1998), subjects rarely falsely recalled the critical word, suggesting that the rapid

[1] This test-based activation hypothesis differs from the idea that the related lure can be activated at test by other associates presented on the test. There is mixed evidence for this latter process (e.g., Marsh, McDermott, & Roediger, 2004), and some have argued that processing studied associates at test can actually suppress false recognition (see Brainerd, Reyna, & Kneer, 1995).