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ScienceDirect

Journal of Memory and Language 56 (2007) 305–320

Journal of Memory and Language

www.elsevier.com/locate/jml

The roles of spreading activation and retrieval mode in producing false recognition in the DRM paradigm ☆

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Received 23 February 2006; revision received 25 July 2006
Available online 26 September 2006

Abstract

The nature of persisting spreading activation from list presentation in eliciting false recognition in the Deese–Roediger–McDermott (DRM) paradigm was examined in two experiments. We compared the time course of semantic priming in the lexical decision task (LDT) and false alarms in speeded recognition under identical study and test conditions. The results revealed priming on the LDT only when a test item occurred immediately (1 s) after the last list item. In contrast, robust false recognition occurred across all delays in both experiments. We interpret the data as indicating that the automatic activation processes evidenced in lexical decision do not persist sufficiently long to produce the false recognition obtained in the DRM paradigm. False recognition occurs because episodic retrieval instructions and a related probe item create reactivation of a list's associative structure, but such reactivation does not occur in LDT under conditions in which subjects are discouraged from retrospective checking of the list.

Keywords: False memory; Lexical decision; Spreading activation; DRM

The Deese–Roediger–McDermott (DRM) paradigm involves presenting subjects with a list of semantically related words (e.g., *bed, rest, wake, tired, dream,* etc.) that converge on a single, non-presented critical item such as *sleep* (Deese, 1959; Roediger & McDermott, 1995). Subjects have been shown to misremember the critical item at remarkably high rates as having been presented in the study list across a variety of experimental situations (see Gallo, 2006; Roediger & Gallo, 2005 for reviews). The purpose of the current paper is to examine the ways in which persistent spreading activation may operate to create the DRM memory illusion. Spreading activation serves as a fundamental retrieval mechanism across a wide variety of cognitive tasks (e.g., Anderson, 1983). The notion is that related concepts are linked in

☆ This research was supported by NIA Grants PO1 AG-03991, AGO2049, and NIA Training Grant AG00030. We thank Jerry Markman for help with the computer program used for testing subjects, personnel at Lackland Air Force Base for help in testing subjects in Experiment 1, Jen Coane and David McCabe for comments on an earlier version of the manuscript, and Darius Tse and James Neely for helpful discussions regarding these studies.
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doi:10.1016/j.jml.2006.07.007

memory, and that when one item or concept in memory is activated (via encoding or retrieval), the activation spreads to other related concepts (Collins & Loftus, 1975). The concept of spreading activation has been supported in a wide variety of semantic priming experiments (see Neely, 1991 for a review). The present experiments explore the role of spreading activation in producing the high levels of false memory effects with DRM materials by directly comparing the time course of semantic priming effects in a lexical decision task and false memories in a recognition test under identical study-test procedures. The aim is to see whether the same (or similar) sorts of activation operate in the two paradigms or whether their forms are different.

Of course, several theories have been proposed to account for the DRM illusion, and we consider alternative frameworks in the General Discussion. However, the implicit associate response (IAR) theory originally proposed by Underwood (1965) and the more recent Activation Monitoring theory (AMT) advanced by Roediger, Balota, and Watson (2001) (see too Balota et al., 1999; McDermott & Watson, 2001; Roediger, Watson, McDermott, & Gallo, 2001) are most relevant to the current project. The IAR theory relies on the concept of spreading activation: when a word is studied, the meaning of that studied item is activated and the words associated to the studied item are also implicitly activated. To account for associative memory illusions, IAR theory suggests that subjects may falsely recognize that a non-presented associate occurred in the list because activation of the list items has spread and has heightened activation levels of the associate. IAR theory has received support from past research showing that false recognition increases in relation to associative proximity (e.g., Vogt & Kimble, 1973). More recently, Robinson and Roediger (1997) presented subjects with study lists ranging in length from 3 to 15 semantic associates per list and found that false recall and recognition increased with greater numbers of associates studied. An activation account of this finding suggests that increasing the number of associates also increases the convergence of activation on the critical non-presented item. Further evidence for an activation account of false memory comes from a regression analysis conducted on predictors of false memory in the DRM paradigm. Across 55 associative word lists, Roediger, Watson et al. (2001) found the highest levels of false recall and false recognition for the lists with the greatest average associative strength from list items to the non-presented item. The greater the associative strength of the list, the more likely list items activate the non-presented critical item and the more probable is its false recall or false recognition on a later test.

The activation monitoring theory (AMT) is based on the idea that spreading activation works in conjunction with a more controlled, monitoring process that allows subjects to make attributions about the source of the activation (Johnson, Hastroudi, & Lindsay, 1993). That is, when making a memory judgment, subjects may use information from heightened activation, but must also rely on a monitoring process to discriminate those activated items that were studied from those that were not studied. Strongly activated items may be misattributed to having occurred in the list if there is no information to distinguish list items from critical items. Several lines of evidence support the idea that monitoring processes are critical. First, numerous experiments have now shown that when list items are made distinctive in some way (e.g., by presenting them with pictures, or presenting them visually rather than auditorily), false recall and false recognition is lessened (e.g., Israel & Schacter, 1997; Smith & Hunt, 1998). Such evidence supports the distinctiveness heuristic as a means of a person rejecting a candidate memory and reducing levels of false recall or false recognition (see Schacter, Cendan, Dodson, & Clifford, 2001). Second, warning subjects before the lists are presented about the presence of critical non-presented items decreases false recall in the DRM paradigm, presumably due to monitoring processes invoked during encoding which then are carried forward during retrieval (e.g., Gallo, Roberts, & Seamon, 1997; Gallo, Roediger, & McDermott, 2001; McDermott & Roediger, 1998). Third, Roediger, Watson et al. (2001) found a negative correlation between veridical and false memory so that the better remembered the list items were (presumably due in part to greater source monitoring), the less likely subjects were to falsely remember the critical item. Fourth, evidence in support of the AMT comes from investigations of age-related changes in false memories in the DRM paradigm. Because evidence indicates that activation patterns in younger and older adults are equivalent, but that monitoring processes suffer age related decline (see Balota, Dolan, & Duchek, 2000), one might expect declines in veridical recall for older adults relative to young adults, but similar or even heightened false recall in older adults. Indeed, this is the pattern observed by Balota et al. (1999) and Norman and Schacter (1997), among others. Finally, repetition of the study list has been shown to increase false recognition for older adults, but to decrease false recognition for younger adults, presumably because older adults are impaired in their ability to monitor the source of the increased activation from repetition and so have higher false alarms (Benjamin, 2001; Kensinger & Schacter, 1999; Watson, McDermott, & Balota, 2004). These studies and others (e.g., McDermott & Watson, 2001) have been viewed as providing converging evidence that, in addition to activation processes, monitoring processes are an important part of memory decisions on the DRM task.

Although there has been considerable literature viewed as supporting the IAR and AMT, the evidence