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# The corrective effects of warning on false memories in the DRM paradigm are limited to full attention conditions

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ABSTRACT

Effects of attention control and forewarning on the activation and monitoring of experimentally induced false memories in the Deese/Roediger–McDermott paradigm were investigated in a young adult sample ($N = 77$). We found that reducing the degree of attention during encoding led to a decrease in veridical recall and an increase in non-presented critical lure intrusions. This effect could not be counteracted by a forewarning instruction. However, these findings did not emerge in a (retrieval supportive) recognition task. It seems that divided attention increases false recall when attention control and forewarning have to compete for limited cognitive resources in a generative free recall as opposed to a retrieval supportive recognition task. Forewarning instructions do not always protect young adults against experimentally induced false memories.



## 1. Introduction

### 1.1. False memories

Many studies have attempted to identify antecedents and consequences of experimentally induced false memories (e.g. McDermott & Watson, 2001; Neuschatz, Benoit, & Payne, 2003; Neuschatz, Payne, Lampinen, & Toglia, 2001; Watson, Bunting, Poole, & Conway, 2005). One of the most frequently used paradigms to elicit such false memories in the absence of suggestion is the Deese/Roediger–McDermott paradigm (DRM paradigm; Deese, 1959; Roediger & McDermott, 1995). In this paradigm, participants are presented with lists of words (e.g. *bed*, *rest*, *pillow*, *night*, etc.) that are semantically related to a non-presented critical lure word (e.g. *sleep*). The typical outcome during a subsequent memory test (free recall or recognition) is that participants often falsely recall and/or recognize the non-presented critical lure word.

### 1.2. Theoretical accounts

#### 1.2.1. Theories on false memories

Because of the robustness of the DRM illusion, this method is often used to test theories about false memory (for a theoretical overview, see Brainerd & Reyna, 2005). Several general theoretical accounts have been put forward to explain false memories in the DRM paradigm. For example, the fuzzy trace theory (e.g. Brainerd & Reyna, 2005) assumes that participants encode information by a two-track process, namely, gist (general theme of event) and verbatim (event specific details). According to this account, DRM false recall and/or recognition are a byproduct of over reliance on this gist-based processing.

Another general false memory theory is the discrepancy-attribution hypothesis (Whittlesea & Williams, 2001). According to this theory, the feeling of familiarity is the driving force behind false recall and recognition. At retrieval, participants may easily attribute the new, non-presented semantically related critical lure word to a prior experience. This perception of discrepancy can then give rise to a (false) feeling of familiarity.

According to the source monitoring framework (Johnson, Hashtroudi, & Lindsay, 1993), memory traces include, in varying degrees, information about the qualitative characteristics (e.g.

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perceptual and contextual details of an experience). Thus, memories from different sources (e.g. imagined vs. externally presented) differ in their average qualitative characteristics. In the DRM paradigm, false recall or recognition can occur when participants confuse internally generated items (critical lures) with externally presented items (studied words).

*1.2.2. Activation-monitoring account*

The theories described above are general false memory theories in that they have been used to explain the occurrence of false memories in a variety of paradigms. Recently, the dual-process activation-monitoring framework was developed to specifically explain semantic-related false memories which occur during the DRM paradigm (McDermott & Watson, 2001). According to this theory, spreading activation works in conjunction with a more controlled, monitoring process in which participants have to make attributions about the source of activation (Johnson et al., 1993). False recall and recognition may result (at least in part) from spreading activation. More specifically, when list items are viewed during the study phase (encoding) or memory testing (retrieval), the critical non-presented associate (critical lure) can be activated and made more easily accessible through spreading activation in the semantic network. Recent research by Meade, Watson, Balota, and Roediger (2007) has demonstrated that reactivation of semantic associates is the driving force during episodic retrieval [related to Tulving's (1983) concept of episodic retrieval mode]. Activation (during encoding) and reactivation (during retrieval) of the critical lure increase its familiarity, leading to an increased susceptibility to DRM-induced false memories at the time of testing. This activation of the non-presented critical lure can either be established through conscious processing such as elaboration (e.g. Brédart, 2000; Gallo, Roberts, & Seamon, 1997; McDermott & Watson, 2001), or automatically as a result of spreading activation in a semantic network (McDermott & Watson, 2001).

The second process, memory monitoring, works in the opposite direction of activation, suppressing both true and false recall/recognition. During memory monitoring, participants have to make specific attributions about the source of activations. Misattributions of this feeling of familiarity (due to spreading activation) may lead to mistakenly assuming that it must have been on the studied list. This tendency varies directly with the level of activation during list presentation.

For activation and monitoring, one essential prerequisite to discern correct from false memory traces is the amount of perceptual detail during encoding and subsequent retrieval, with correct memory traces containing more distinctive perceptual and contextual information (e.g. Johnson et al., 1993; Schacter, Israel, & Racine, 1999). When making monitoring judgments at retrieval, these distinctive details may serve as landmarks in memory evaluation. A monitoring error may arise when such distinctive information is poorly encoded, leading to familiarity-based decisions (e.g. Watson et al., 2005). False memories in the DRM paradigm are thought to occur due to a failure of the attention control and/or monitoring systems that evaluate and differentiate between activated critical lure words in the associative networks and the actual presentation of the words at encoding.

To underscore the merits of the activation-monitoring account, several lines of research support the idea that activation and monitoring are critical in eliciting DRM-related false memories. The monitoring account is supported by several extreme-group studies (e.g. Gerrie & Garry, 2007; Peters, Jelicic, Haas, & Merckelbach, 2006; Peters, Jelicic, Verbeek, & Merckelbach, 2007a; Watson et al., 2005) that have found that poor neurocognitive functioning (i.e. monitoring deficits) reflects participants' poor ability to actively maintain task goals during encoding and difficulty to avoid the seductive power of familiarity during monitoring, leading to an increased susceptibility to DRM-related false recall or recognition. Furthermore, actively manipulating monitoring by forewarning participants about the intentions of the DRM false memory paradigm decrease false recall and recognition in the DRM paradigm (e.g. Gallo et al., 1997; Jou & Foreman, 2007; McCabe & Smith, 2002; Watson, McDermott, & Balota, 2004; Watson et al., 2005). In addition, a vast amount of research has shown that increasing the distinctiveness of list items (e.g. through visual as opposed to auditory presentations) or repeating study lists decreases false recall and recognition, at least in young participants (e.g. Israel & Schacter, 1997; Watson et al., 2004).

To manipulate activation of the semantic network during encoding, a number of studies have used a dual task (i.e. divided attention) procedure (e.g. Dodd & MacLeod, 2004; Pérez-Mata, Read, & Diges, 2002; Seamon et al., 2003). A typical finding in these studies is that dividing attention during the encoding phase of a DRM paradigm increases DRM-related false recall and recognition at retrieval. Dividing attention disrupts distinctive perceptual and contextual encoding (e.g. Troyer & Craik, 2000), making it difficult for participants to rely on detailed forms of "recollection", and so they will be more susceptible to familiarity-based critical lure intrusions (e.g. Dodd & MacLeod, 2004; Pérez-Mata et al., 2002; Seamon et al., 2003).

### *1.3. Combined effects of activation and monitoring on recall and recognition*

The activation-monitoring account is supported by extensive empirical evidence (but see Brainerd & Reyna, 2005 and McDermott & Watson, 2001 for some unresolved issues concerning the activation-monitoring account). However, most research has manipulated either activation or monitoring processes, studied across population differences (Koutstaal, Schacter, & Brenner, 2001), or used indirect manipulations by extreme group analyses (e.g. Gerrie & Garry, 2007; Peters et al., 2006, 2007a; Watson et al., 2005). Since this framework is based upon a dual-process account by which these two opposed processes compete, from a theoretical perspective, it would be of great interest to manipulate activation and monitoring concurrently to disentangle the combined effects and dynamics between both processes on susceptibility to experimentally induced false memories.

Based on the activation-monitoring theory, one could hypothesize that because a recognition task is more retrieval supportive, this extra perceptual and contextual support together with a warning would counteract the familiarity-based activation effect of divided attention. However, the studies mentioned above have used either recall or recognition (but see Peters et al., 2007a). Thus, the questions whether activation and monitoring manipulations would exert comparable effects on the immediate, generative free recall compared to delayed retrieval supportive recognition task remains unanswered. Moreover, the role of delay and retention interval (see for example Seamon et al., 2002) should also be mentioned here, as a warning could have an immediate impact on eliminating DRM-related false memories in the recall test. However, it remains to be seen if this manipulation also affects delayed recognition.

### *1.4. The current study*

The purpose of this experiment was to explore the combined effects and dynamics between divided attention (using an auditory oddball task) and forewarning during encoding and retrieval on DRM-induced false recall and recognition (Deese, 1959; Roediger & McDermott, 1995) in a young adult sample. We hypothesized that although forewarnings (better monitoring) could (partly) counteract DRM-related false memories, dividing attention would