



## Veridical and false memory for scenic material in posttraumatic stress disorder

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### ABSTRACT

The question whether memory aberrations in posttraumatic stress disorder (PTSD) also manifest as an increased production of false memories is important for both theoretical and practical reasons, but is yet unsolved. Therefore, for the present study we investigated veridical and false recognition in PTSD with a new scenic variant of the Deese–Roediger–McDermott (DRM) paradigm, which was administered to traumatized individuals with PTSD ( $n = 32$ ), traumatized individuals without PTSD ( $n = 30$ ), and non-traumatized controls ( $n = 30$ ). The PTSD group neither produced higher rates of false memories nor expressed more confidence in errors, but did show inferior memory sensitivity. Whereas depressive symptoms did not correlate with veridical nor false recognition, state dissociation was positively associated with false memories.

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### 1. Introduction

Memory aberrations, like intrusive vivid recollections of a traumatic event, represent core symptoms of posttraumatic stress disorder (PTSD, American Psychiatric Association, 1994). Current cognitive (e.g., Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000; Foa, Steketee, & Rothbaum, 1989) and neurobiological (e.g., Elzinga & Bremner, 2002; van der Kolk, 1994) models of PTSD emphasize the key role of mnemonic dysfunctions in the development and maintenance of the disorder (for reviews see Brewin & Holmes, 2003; Dalgleish, 2004). Furthermore, numerous studies have shown that impaired memory functioning is demonstrated not only for autobiographical content, but also for non-autobiographical material (for reviews see Brewin, Kleiner, Vasterling, & Field, 2007; Vasterling & Brailey, 2005).

There are several pieces of evidence to assume that mnemonic aberrations in PTSD also manifest as an increased production of false memories. For example, neuropsychological studies demonstrated impairments in initial learning (Bremner et al., 1993; Vasterling et al., 2002), a heightened sensitivity to retroactive interference (Vasterling, Constans, Brailey, & Sutker, 1998; Yehuda et al., 1995), as well as a greater difficulty to inhibit inaccurate responses (i.e., high rates of commission errors and false positive responses) in PTSD (Vasterling et al., 1998). The latter authors also found an association between false positive responses and PTSD re-experiencing symptoms. Generally, impairments of working memory (i.e., the active maintenance and manipulation of information) have been associated with poor monitoring abilities and shown to correlate with false memory production in healthy subjects (e.g., Peters, Jelicic, Haas, & Merckelbach, 2006; Peters, Jelicic, Verbeek, & Merckelbach, 2007). In addition, the impaired retrieval of specific versus overgeneral autobiographical memories, which

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has been observed in PTSD (for a review see Moore & Zoellner, 2007), points to deficient source monitoring (for reviews on cognitive abnormalities in PTSD see, e.g., Isaac, Cushway, & Jones, 2006; McNally, 2006).

Notably, another body of research has suggested an increased production of false memories in PTSD due to dissociation, (e.g., Bremner et al., 1992; Dancu, Riggs, Hearst-Ikeda, Shoyer, & Foa, 1996). The umbrella term “dissociation” includes alterations in memory, identity, and consciousness (Lynn & Rhue, 1994; van der Hart & Horst, 1989), which would all be expected to naturally interfere with monitoring processes (Johnson, 2006; Zoellner, Foa, Brigidi, & Przeworski, 2000) making dissociation one of the most discussed correlates of memory suggestibility (Wright & Livingston-Raper, 2002). In fact, dissociation has been associated with false memory production in both healthy and patient samples (e.g., Clancy, Schacter, McNally, & Pitman, 2000; Dehon, Bastin, & Laroi, 2008; Winograd, Peluso, & Glover, 1998; but see also Geraerts, Smeets, Jelicic, van Heerden, & Merckelbach, 2005; Wright, Startup, & Mathews, 2005).

Finally, there is an ongoing debate in the literature concerning the relationship of trauma and false autobiographical memories, which was first sparked by a considerable controversy particularly concerning the validity of recovered memories of childhood sexual abuse (CSA) in the 1990s (see, e.g., Geraerts & McNally, 2008; Loftus & Davis, 2006). In fact, the question of false memory propensity in PTSD is important for both the understanding of the disorder and from a practical (i.e., juridical) perspective. Traumatic incidences are often witnessed only by the alleged perpetrator and the victim, making the validity of the victim’s memory crucial in finding the truth. As memory lapses for the traumatic experience are common in PTSD, the credibility of the victim is often undermined in the eye of juries, judges, or lawyers. Knowing more about the memory signature of PTSD therefore has very practical implications and may remove common misconceptions.

### 1.1. Deese–Roediger–McDermott paradigm, false memories and PTSD

An experimental paradigm allowing the concurrent investigation of veridical and false memory production is the Deese–Roediger–McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995). Numerous DRM studies have consistently demonstrated that after learning word lists (e.g., *hill, climb, valley, summit, top*), previously not presented but highly semantically associated items (“critical lures”, in the example: *mountain*) were falsely recalled or recognized in a subsequent memory test (for an extensive review see Gallo, 2006).

Five previous studies have used variants of the DRM paradigm to investigate whether PTSD is associated with an increased production of false memories. These studies yielded mixed results: Bremner, Shobe, and Kihlstrom (2000) found higher false and lower correct recognition of neutral DRM word lists in a sample of women with PTSD following CSA compared to women with CSA and without PTSD, as well as non-traumatized controls. In a study by Brennen, Dybdahl, and Kapidzic (2007), a higher production of false memories for trauma-related but not for neutral DRM word lists was demonstrated in a PTSD sample relative to traumatized controls. Zoellner et al. (2000) found that both a PTSD and a trauma-exposed non-PTSD group produced higher rates of false recognition for neutral DRM word lists than non-traumatized controls. A recent study (Goodman et al., 2011) investigated false memory for trauma-related, negative, neutral, and positive DRM word lists in adults and adolescents with and without PTSD following CSA. Regression analyses showed a relation of PTSD severity with less proficient memory monitoring for trauma-lists. Only one study (Jelinek, Hottenrott, Randjbar, Peters, & Moritz, 2009) used a visual variant of the DRM paradigm to compare a PTSD sample with traumatized and non-traumatized controls. In this visual variant, false memories were assessed for critical lures from complex pictures (lures were related to but not shown in the picture). Here, groups did not differ with regard to false memory. At trend level, the PTSD group showed lower corrected recognition than non-traumatized controls.

In summary, although there is some evidence for an association of PTSD and false memories from verbal DRM tasks, results do not yet allow a definite conclusion. Besides inconsistent findings, the extent to which the results of studies using (verbal) variants of the DRM paradigm may be generalized to the production of real-life autobiographical memories is being controversially discussed in literature (e.g., Pezdek & Lam, 2007; but see also Wade et al., 2007; for a review see Gallo, 2010). This question, however, is of utter importance in the context of PTSD, as the validity of trauma memories is repeatedly challenged (e.g., in court). Though classical DRM studies have greatly contributed to our basic understanding of false memories, in order to advance our comprehension of memory functioning in PTSD, this line of research should be extended to more ecologically valid settings.

### 1.2. Moderating factors of veridical and false memory production

Veridical and false memory is affected by various factors which may have led to inconsistent results in the literature. As outlined above, dissociation is being discussed as one of these factors. Surprisingly, none of the aforementioned DRM studies with PTSD samples reported a significant relationship between dissociation and false memory production. Whereas four of five studies (Bremner et al., 2000; Goodman et al., 2011; Jelinek et al., 2009; Zoellner et al., 2000) included a trait measure for dissociation, a state measure has not yet been employed, even though, as a state characteristic, dissociation is particularly likely to influence encoding processes.

Further possible moderators for false memory production are valence of the stimulus material as well as arousal during encoding. However, findings vary with regard to whether more or less false memories occur for negative, positive, or neutral stimuli. While in some DRM studies with healthy participants affective (i.e., negative, positive) word lists produced more

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