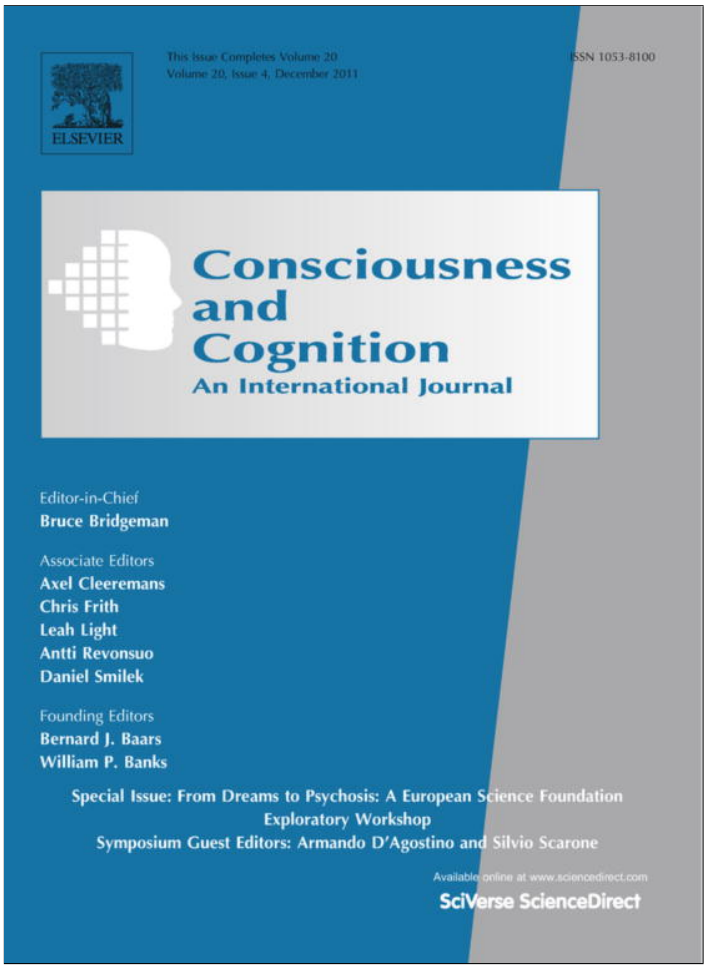

Consciousness and Cognition 20 (2011) 1144–1153

Contents lists available at ScienceDirect

Consciousness and Cognition

journal homepage: www.elsevier.com/locate/concog

Underestimation of prior remembering and susceptibility to false memories: Two sides of the same coin?

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ARTICLE INFO

Article history:
Received 23 September 2010
Available online 11 January 2011

Keywords:
Underestimation of prior remembering
False memories
Fantasy proneness
Dissociation
Cognitive efficiency
Trauma history

ABSTRACT

In two studies, we explored whether susceptibility to false memories and the underestimation of prior memories (i.e., forgot-it-all-along effect) tap overlapping memory phenomena. Study 1 investigated this issue by administering the Deese/Roediger–McDermott task (DRM) and the forgot-it-all-along (FIA) task to an undergraduate sample ($N = 110$). It was furthermore explored how performances on these tasks correlate with clinically relevant traits such as fantasy proneness, dissociative experiences, and cognitive efficiency. Results show that FIA and DRM performances are relatively independent from each other, suggesting that these measures empirically apparently refer to separate dimensions. However, they do not seem to define different profiles in terms of dissociation, fantasy proneness, and cognitive efficiency. Study 2 replicated the finding of relative independence between false memory propensity (as measured with the DRM task) and the underestimation of prior memories (as measured with an autobiographical memory dating task) in people with a history of childhood sexual abuse ($N = 35$).

1. Introduction

Significant life experiences tend to be well remembered. Some people, however, report that they have had the experience of forgetting and subsequently recovering memories of aversive life events. Since the 1980s, many studies have focused on mechanisms that may underlie such recovery of autobiographical memories. Recovered memories refer to autobiographical recollections that are perceived as having been unavailable or inaccessible for some period of time (Sivers, Schooler, & Freyd, 2002). According to Schooler (1999, p. 205), "An individual who reports recovering a memory for trauma is really indicating two sentiments: (a) that abuse occurred and (b) that there was a period of time in which the memory was not available."

Schooler and colleagues were among the first to publish systematic case studies of individuals reporting to have experienced the discovery of long-forgotten memories of abuse (Schooler, 2001; Schooler, Ambadar, & Bendiksen, 1997; Shobe & Schooler, 2001). They observed that some people reporting recovered trauma memories had mentioned these experiences to their partner, family or friends before the "recovery" of the abuse episodes (Schooler et al., 1997). It appeared that these individuals forgot having remembered the traumatic event, producing an "illusion of amnesia". Schooler (1999) hypothesized that this underestimation of prior remembering could explain how people may come to believe that they previously forgot an important episode, a phenomenon that he termed the "forgot-it-all-along" (FIA) effect.

With this in mind, Merckelbach et al. (2006) examined the existence of this effect for autobiographical details in different samples (see also a recent study by Abenavoli & Henkel, 2009 for a similar procedure). Merckelbach and colleagues

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1053-8100/$ - see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.concog.2010.12.010

instructed undergraduate participants and women with childhood sexual abuse (CSA) experiences to recall vivid memories of certain childhood events. After a delay of 1 h or 2 days, participants were asked whether they had recently thought about any of these events and several others. Despite recalling the events either an hour or 2 days before, many participants claimed not to have thought about these events for years. Relative to individuals reporting continuous CSA memories, those who reported having recovered CSA memories were more likely to forget remembering the recent events during the laboratory tasks. This finding provides indirect support for Schooler's (1999) idea that the forgot-it-all-along bias is typical for at least some individuals reporting recovered memories of CSA.

Another line of research examining memory performance of people reporting recovered CSA memories demonstrates that this group exhibits a heightened vulnerability to develop false memories. A case in point is a study of Clancy, Schacter, McNally, and Pitman (2000) that relied on the Deese–Roediger–McDermott (DRM) task (Roediger & McDermott, 1995). Basically, this task has been shown to be effective in eliciting laboratory induced false memories for semantically related words by requiring participants to study a list of words, all of which are strong associates of a non-presented critical lure. For example, participants are instructed to study words such as *injection, sharp*, *pain*, *thread*, words that are all associated with the non-presented critical item *needle*. Typically, many participants falsely recall and recognize the non-presented lures on later tests (Roediger, Watson, McDermott, & Gallo, 2001). Clancy et al. (2000) found that individuals reporting recovered CSA memories more often falsely recognize the non-presented critical lures relative to individuals with continuous CSA memories and control participants with no history of sexual abuse.

The pronounced false memory effects on the DRM and the enhanced forgetting of prior remembering in people reporting recovered memories seem to indicate different accounts of recovered memory reports. Clinical vignettes are also suggestive of differing recovered memory experiences (Schooler et al., 1997; see also McNally & Geraerts, 2009). Thus, on the one hand, there are persons who gradually came to believe that they are abuse survivors. They typically attribute current problems to their repressed memories of abuse. The abuse events were mostly recovered step by step, often promoted by suggestive therapeutic techniques such as hypnosis, dream interpretation or guided imagery. It is tempting to assume that these people exhibit a heightened susceptibility to false memories. Another pathway seems evident in people who are suddenly reminded of events and mistakenly believe they have not thought about the events for many years. They experience their recollection as shocking and often describe it as an "Aha-Erlebnis". Here, it is plausible that individuals have a tendency to overlook prior remembering, i.e., are susceptible to the forgot-it-all-along (FIA) effect rather than to false memories (see for example McNally & Geraerts, 2009).

Geraerts et al. (2009) suggest that the FIA account offers a mechanism to explain recovered memory experiences involving events that actually did occur, whereas the DRM account offers a mechanism to explain false recovered memories. However, whether susceptibility to false memories and the FIA effect reflect two different and unrelated pathways has not yet been firmly established. Furthermore, the question arises whether susceptibility to false memories and FIA effect go along with different personality characteristics. If it could be shown that susceptibility to false memories and FIA are unrelated phenomena that have their own distinct personality correlates, this would underpin the clinical impression that there are two different pathways to "recovering" memories.

A number of studies have looked at whether certain personality traits contribute to susceptibility to false memories. Many of them examined the links between fantasy proneness (i.e., an extensive involvement in fantasy, vivid imagery, and daydreaming), dissociative symptoms, (e.g., derealisation, depersonalization, identity confusion), and false memories in undergraduate samples. For example, Jelicic and co-workers (2006) found a link between the creation of memories of a non-existent film and fantasy proneness as measured by the Creative Experiences Questionnaire (CEQ; Merckelbach, Horselenberg, & Muris, 2001). That is, participants who reported false details (i.e., memories of the non-existent film) scored significantly higher on the CEQ relative to those who did not report such details. Furthermore, positive associations between false memories and traits closely related to fantasy proneness (e.g., absorption and creative imagination) have been found with other paradigms (Drivdahl & Zaragoza, 2001; Hyman & Billings, 1998).

In addition to studies focussing on the link between false memories and fantasy proneness, researchers have attempted to relate false memories to dissociative symptoms. For example, Clancy and co-workers (2000) found a significant correlation between performance on the Dissociative Experiences Scale (DES questionnaire; Bernstein & Putnam, 1986) and DRM false recognition in people reporting continuous and recovered memories of CSA (Clancy et al., 2000). Also, Dehon, Bastin, and Larøi (2008) found that scores on the DES were positively associated with increased DRM false recall rates. In another study using a misinformation paradigm in undergraduate students, Hyman and Billings (1998) reported a positive association between false memories and dissociative experiences, and suggested that habitual dissociation may facilitate the acceptance of external information as self-defining, thereby increasing the likelihood to accept falsely suggested events as autobiographical memories. Using a variety of stimulus materials (e.g., video footage, slides), work of Giesbrecht and colleagues (Candel, Merckelbach, & Kuijpers, 2003; Giesbrecht, Geraerts, & Merckelbach, 2007; Merckelbach, Zeles, van Bergen, & Giesbrecht, 2007) also showed that there is a robust connection between dissociative symptoms and false memories (i.e., memory commission errors) in undergraduates. A link between false memory development and certain individual differences has also been documented in clinical samples. For example, Peters, Horselenberg, Jelicic, and Merckelbach (2007) showed that people with previous-life memories (i.e., memories of highly unlikely events) report elevated levels of dissociation.

Like dissociation, poor cognitive efficiency (i.e., reporting many cognitive failures) has been associated with memory dysfunctions (Merckelbach, Muris, Nijman, & de Jong, 1996). Though research on individual differences and the FIA effect is rather scarce, one could speculate that people showing a large FIA effect will also score high on measures of cognitive failures

(i.e., everyday lapses in attention, memory and perception, e.g., Broadbent, Cooper, Fitzgerald, & Parkes, 1982). One widely used measure of cognitive efficiency is the Cognitive Failures Questionnaire (CFQ; Broadbent et al., 1982) in which cognitive efficiency is approached in terms of susceptibility to cognitive failures. Wilhelm, Witthöft, and Schipolowski (2010) identified three factors underlying CFQ scores which were labeled retrieval (e.g., 'Are you unable to remember something that you had been told some time ago?'), intention forgotten (e.g., 'Do you find you forget what you came to the shops to buy?'), and clumsiness (e.g., 'Do you bump into objects?'). Given that the overall content of the CFQ seems to have much in common with the type of failure that occurs in the FIA effect, one would predict they both covary.

We investigated: (i) whether the FIA effect (i.e., the underestimation of prior remembering) and susceptibility to false memories are relatively independent from each other. We investigated this issue in an undergraduate sample (Study 1) and in a sample consisting of people with a history of childhood sexual abuse (Study 2). Moreover, we examined (ii) whether these memory illusions are related to different individual difference measures (Study 1). We hypothesized that the DRM and FIA effects would be unrelated to each other in the student as well as in the trauma sample. We also expected that these measures would be related to different individual difference measures. Specifically, we tested whether the susceptibility to false memories is particularly related to heightened levels of self-reported dissociation and fantasy proneness. On the other hand, susceptibility to underestimate prior memories was predicted to be particularly related to cognitive failures (Study 2).

To avoid potentially confounding factors (e.g., depression, motivational variables), we started out with a non-clinical undergraduate sample to examine the relation between false memory propensity and the susceptibility to underestimate prior memories. One might argue, though, that results found in an undergraduate sample cannot be generalized to results in people with a trauma history. Particularly, differences in mean education level, mean age, and potential psychopathology between student samples and trauma samples could lower the generalizability of the findings. In Study 2, we therefore examined the relation between false memory propensity and susceptibility to the FIA effect in people with a history of childhood sexual abuse. To increase ecological validity, we used an autobiographical memory dating task which can be viewed as an autobiographical version of the FIA task described above (Parks, 1999).

2. Study 1

2.1. Method

2.1.1. Participants

One hundred and ten psychology undergraduates (92 women) with a mean age of 19.75 years (SD = 2.76) participated in exchange for course credit. All participants were first year students at Maastricht University. The study was approved by the Standing Ethical Committee of the Faculty of Psychology and Neuroscience, Maastricht University.

2.1.2. Materials

2.1.2.1. DRM paradigm. In this paradigm, participants are required to study lists of words, all of which are strong associates of a non-presented item termed 'the critical lure'. For example, participants are instructed to study words like *injection*, *sharp*, *pain*, *thread*, and so forth, which all converge on the non-presented critical lure *needle*. Individual differences in false recall and/or recognition of the critical lures on later memory tests are thought to reflect variability in proneness to false memories (Roediger & McDermott, 1995). In the current study, 10 neutral word lists derived from a larger set of lists previously employed in our lab (Peters, Jelicic, Haas, & Merckelbach, 2006) were used. Participants were instructed to study each orally presented word list after which they were given two minutes to recall as many words as possible from the study phase. Finally, a recognition task was administered that included 30 studied words (i.e., these words were obtained by selecting the 1st, 8th, and 10th word of each studied list) and the 10 critical lures.

2.1.2.2. FIA task. During an initial study phase, participants studied a list of 100 homographic target words, each accompanied by a context word that "biased" the interpretation of the target (e.g., hand-*palm*; see Arnold & Lindsay, 2002, 2005). Both context and target word appeared on a computer screen for 2 s and participants were instructed to repeat the word pairs out loud in order to prepare themselves for an upcoming memory test. Immediately after the presentation of each word pair, a study sentence appeared on the screen to ensure that people fully understood the context of each target item. The study sentence contained the context word and a row of asterisks representing the target word (e.g., "She was holding the pen in the ∗∗∗∗ of her hand"). The study sentences appeared on the screen for three and a half seconds during which participants were required to read them aloud.

In Test 1 (immediately following the study phase), participants were tested for a subset (approximately two thirds) of the words presented during the study phase, with some of the target items being cued with the same context word as initially studied (i.e., "studied-context" words; e.g., hand-p∗∗m), while the remaining items were cued with a new context word that was different from the one studied during the study phase and selected to bias the interpretation of the target item towards its other meaning (i.e., "other context" words; e.g., tree-p∗∗m). Context words were always presented together with the first and the last letter of the target words, and participants were instructed to fill in the missing letters and verbalize the words so that the experimenter could write down their responses. Participants were instructed that on half of the trials they would

receive the same context word as originally studied during the study phase, while on the other half of the trials they would receive a context word different from the one initially studied but one that was nevertheless related to the targets. Participants were told they should only respond with targets that they remembered studying during the study phase. The purpose of introducing other context items is to imitate a situation in which a person recollects a past experience in a qualitatively different context from that in which it was originally encoded (for a detailed description, see Arnold & Lindsay, 2002, 2005).

During Test 2 (immediately following Test 1), participants were subjected to a final memory test in which they were tested for all items studied during the initial study phase. Importantly, participants' memory for the original target words was always tested with the original studied-context cues, directing their recall efforts back to the original encoding experience at study, and not to the intervening test phase (Test 1). In order to measure people's susceptibility to forgetting prior instances of remembering, participants had to make a judgment immediately after recalling each of the target items on the final test (Test 2). Specifically, they were asked the crucial question: "Did you or did you not correctly recall this particular target item during Test 1, irrespective of being primed with a studied or another context word?" The basic finding with this paradigm is that people more often forget/underestimate their prior recollection of the words on Test 1 when cued with an "other-context" word than when cued with a "studied-context" word. Thus, when people remember the experience in a different context on the previous test, they are more likely to believe that the recall on the final test is completely new and that they had not previously recalled it.

2.1.3. Questionnaires

2.1.3.1. The Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986). The DES (Cronbach's alpha = 0.81) is a 28-item self-report measure that asks respondents how often they experience dissociative symptoms like derealization or depersonalization. Items are scored on 100 mm Visual Analog Scales (VASs) representing the degree to which they apply to them (anchors: 0 = *not at all*; 100 = *very much*). A total DES score (range: 0–100) is obtained by averaging across individual items, with higher scores indicating higher dissociative tendencies.

2.1.3.2. The Creative Experiences Questionnaire (CEQ; Merckelbach et al., 2001). The CEQ (Cronbach's alpha = 0.69) is a measure based on the Wilson and Barber (1983) listing of fantasy proneness characteristics. It includes 25 dichotomous (yes/no) items that cover experiences related to daydreaming, imagination, and fantasy. The number of yes-answers is summed to obtain a total CEQ score (range: 0–25), with higher total CEQ scores indicating higher levels of fantasy proneness.

2.1.3.3. The Cognitive Failures Questionnaire (CFQ; Broadbent et al., 1982). The CFQ (Cronbach's alpha = 0.84) is a 25-item self-report instrument measuring the frequency of everyday cognitive failures and minor lapses (e.g., "Do you sometimes forget what you just read?"). Participants indicate on a 5-point scale (anchors: 0 = *never*; 4 = *very often*) how often they have experienced each cognitive failure in the past couple of months. Scores are summed to obtain a total CFQ score (range: 0–100) with higher scores indicating poorer cognitive efficiency.

2.1.4. Procedure

After having provided informed consent, participants were given instructions and stimulus materials. Presentation order of the DRM and FIA task were counterbalanced such that half of the participants performed the DRM task, completed the three questionnaires, and then carried out the FIA task, while the other half started with the FIA task, then completed the questionnaires, and ended with the DRM task.

2.2. Results

2.2.1. DRM recall and recognition performance

Table 1 shows the means for correct recall and recognition (i.e., proportion recalled/recognized studied words), and false recall and recognition of critical lures (i.e., proportion recalled/recognized critical lures). On average, participants correctly recalled 0.66 ($SD = 0.09$) of the studied words and falsely recalled 0.38 ($SD = 0.22$) of the non-studied critical lures. In the DRM task, we also measured recognition memory. On average, participants correctly recognised 0.81 ($SD = 0.13$) of the studied words and falsely recognised 0.77 ($SD = 0.22$) of the non-studied critical lures. These results are in line with the robust false recall and recognition effects typically found with the DRM paradigm (Roediger & McDermott, 1995).

2.2.2. FIA performance

2.2.2.1. Recall performance. Proportion correctly recalled words on Test 1 was significantly higher for items cued with studied-context words ($M = 0.69$) than for items cued with other-context words ($M = 0.52$), $t(109) = 37.77$, $p < 0.001$. An ANOVA was performed on the proportion correctly recalled items on Test 2, with context during Test 1 (studied context, other context and non-studied context) as repeated measure. There was a significant difference in proportion of items recalled for the studied-context ($M = .88$), other-context ($M = 0.82$), and non-tested ($M = 0.84$) conditions, $F(2, 218) = 38.94$, $p < 0.001$, $\eta_p^2 = 0.26$. The recall rate was relatively high regardless of whether participants had previously recalled the target from a studied- or an other-context cue on Test 1.

Table 1
Mean proportion of words recalled/recognized and standard deviations ($M \pm SD$) on the Deese/Roediger McDermott (DRM) task, the forgot-it-all-along (FIA) task and mean scores on self-report measures in an undergraduate sample (Study 1). Pearson product–moment correlations between DRM recall and recognition performance, FIA performance, and self-report measures are also shown.

	$M \pm SD$	FIA	Correct recall studied words	Recall of critical lures	Correct recognition studied words	Recognition critical lures	DES	CEQ	CFQ
FIA	0.27 (0.19)	1							
Correct recall of studied words	0.66 (0.09)	−0.03	1						
Recall of critical lures	0.38 (0.22)	0.14	−0.04	1					
Correct recognition of studied words	0.81 (0.13)	−0.10	0.22*	0.00	1				
Recognition of critical lures	0.77 (0.22)	0.02	−0.27**	0.49**	0.31**	1			
DES	19.57 (11.01)	−0.10	0.07	0.08	0.12	−0.13	1		
CEQ	6.27 (3.40)	0.05	0.05	0.04	0.16	−0.09	0.55**	1	
CFQ	42.32 (10.85)	−0.22*	0.04	−0.22*	−0.01	−0.22*	0.44**	0.11	1

Notes. FIA performance was defined as the differential score between proportion judged as "recalled" on Test 1 for studied context recalled/recalled and the proportion judged as "recalled" on Test 1 for other context recalled/recalled; DES, Dissociative Experiences Scale; CEQ, Creative Experiences Questionnaire; CFQ, Cognitive Failures Questionnaire.
* $p < .05$ (2-tailed).
** $p < .01$ (2-tailed).

Table 2
Forgot-it-all-along (FIA) task. Mean number of items and mean proportion of items judged as "recalled" as a function of recall status on Test 1 and Test 2 in an undergraduate sample (Study 1). Standard deviations are given between parentheses.

Test1/Test 2 recall status	No. of items	Proportion judged as "recalled" on Test 1
Studied-context		
Not recalled/not recalled	3.69 (3.16)	0.05 (0.19)
Not recalled/recalled	6.78 (2.53)	0.09 (0.20)
Recalled/recalled	**23.11 (4.39)**	**0.87 (0.12)**
Recalled/not recalled	0.41 (0.63)	0.10 (0.29)
Other-context		
Not recalled/not recalled	4.55 (2.89)	0.06 (0.15)
Not recalled/recalled	11.82 (2.82)	0.13 (0.16)
Recalled/recalled	**16.07 (3.54)**	**0.60 (0.19)**
Recalled/not recalled	1.55 (1.20)	0.33 (0.41)
Not-tested		
NA/not recalled	5.22 (2.56)	0.03 (0.08)
NA/recalled	26.78 (2.56)	0.14 (0.13)

2.2.2.2. Judgment of previous recollection. The proportion of items judged on Test 2 as recalled on Test 1 is shown in Table 2. An ANOVA was performed on the proportion correct judgments, with context as the repeated measure. Overall, participants were significantly more likely to forget that they had recalled an item on Test 1 when they had been cued with the other-context word on Test 1 than when it had been cued with the studied-context word, $F(1, 109) = 208.26$, $p < 0.001$, $\eta_p^2 = 0.66$. Thus, context did affect whether or not participants correctly reported that they had recalled the item on Test 1. More specifically, participants were significantly less likely to correctly judge that they had recalled the item before in the other-context condition than in the studied-context condition. Replicating prior work (e.g., Arnold & Lindsay, 2002, 2005), our findings demonstrate an increased tendency to forget prior incidents of remembering when retrieval contexts change between retrieval attempts, producing a FIA effect.

2.2.3. Correlational analyses

Table 1 shows mean scores and standard deviations on the DES, the CEQ, and the CFQ. As can be here, mean scores of participants on self-report measures were similar to those found in previous studies (e.g., Merckelbach, Muris, & Rassin, 1999; Merckelbach et al., 1996). Table 1 shows Pearson product–moment correlations between DRM recall and recognition performance, the FIA effect, dissociative experiences, fantasy proneness, and cognitive efficiency. FIA performance was defined as the differential score between correct recall during Test 2 when previously being cued with a studied-context word (T1) versus when previously being cued with an other-context word (T1; see Arnold & Lindsay, 2002, 2005). DRM false recall performance was defined as the proportion non-studied critical lures recalled on the free recall task, while DRM false recognition performance was defined as the proportion of non-studied critical lures recognized on the recognition task. We found no

significant correlation between FIA effect and DRM false recall ($r = 0.14$; $p = 0.16$). Nor did the correlation between FIA and DRM false recognition attain significance ($r = 0.02$; $p = 0.86$). Though unrelated to one another, both DRM false recall as well as FIA correlated significantly with CFQ scores. More specifically, significant correlations between CFQ scores and both false recall and false recognition ($r = -0.21$, $p < 0.05$ and $r = -0.22$, $p < 0.05$, respectively) and between CFQ scores and FIA effect ($r = -0.22$, $p < 0.05$) were found. Thus, in contrast to what we predicted, high levels of cognitive failures were associated with reduced susceptibility to false memories and weaker FIA effects, although the correlations were by all modest.

Not surprisingly, DRM false recall was significantly associated with false recognition performance ($r = 0.49$; $p < 0.001$). DES scores were found to be significantly correlated with CFQ ($r = 0.44$; $p < 0.001$) and CEQ ($r = 0.55$; $p < 0.001$) scores. All other correlations failed to reach conventional levels of significance.

We furthermore looked at the correlations between DRM correct recall, DRM correct recognition, the FIA effect, CFQ, DES and CEQ scores (Table 1). As is to be expected, correct recall on the DRM task correlated significantly with correct recognition on the DRM task $r = 0.22$; $p < 0.05$. Moreover, DRM correct recall was negatively correlated with false recognition of the critical lures ($r = -0.27$; $p < 0.01$), while, correct recognition on the DRM task was significantly correlated with false recognition of the critical lures ($r = 0.31$, $p < 0.01$). All other correlations failed to reach conventional levels of significance (see Table 1).

3. Study 2

Study 1 showed that the FIA effect was unrelated to DRM false recall and false recognition performance in an undergraduate sample. In Study 2, we sought to replicate the relative independence between the forgot-it-all-along effect and false memory propensity for words by administering an autobiographical dating task (Parks, 1999) and DRM task to a sample consisting of people with a history of childhood sexual abuse. We chose to use an autobiographical memory dating task (see also Merckelbach et al., 2006) instead of the standard FIA task (Arnold & Lindsay, 2002) to increase ecological validity.

3.1. Method

3.1.1. Participants

Thirty-five (30 women) individuals with a mean age of 44.14 years ($SD = 9.15$) participated in exchange for a small financial reimbursement. As part of an ongoing research project, participants were recruited by means of advertisements in local newspapers. The advertisements invited people to participate in our research when they had a history of childhood sexual abuse (CSA) that was never forgotten (i.e., people with *continuous* memories of CSA). Childhood sexual abuse was defined as presence of "hand/mouth to genital" and "genital to genital" contact. To check whether participants had experienced their CSA history as traumatic, we asked them to rate the traumatic impact of their CSA on an 8-point Likert scale with 1 referring to a very low traumatic impact and 8 referring to a very high traumatic impact. On average, participants rated the traumatic impact of their CSA history as 7.21 ($SD = 1.41$). Eighteen (51%) participants reported no other history of abuse, 6 (17%) participants reported a history of CSA in addition to emotional abuse, 1 (3%) reported a history of CSA in addition to physical abuse/violence, 4 (11%) participants reported a history of CSA in addition to emotional and physical abuse/violence, 3 (9%) participants reported a history of CSA in addition to emotional abuse and neglect, and 3 (9%) reported a history of CSA in addition to emotional and physical abuse/violence and neglect. The study was approved by the Standing Ethical Committee of the Faculty of Psychology and Neuroscience, Maastricht University.

3.1.2. Materials

3.1.2.1. DRM paradigm. As in Study 1, the DRM paradigm was used to measure susceptibility to false memories for words. Participants were instructed to study five orally presented word lists. After presentation of each list, they were given one minute to recall as many words as possible. Participants were presented with five neutral word lists derived from a larger set of lists previously employed in our lab (Peters et al., 2006). Finally, a recognition task was administered that included 15 studied words (i.e., these words were obtained by selecting the 1st, 8th, and 10th word of each studied list) and the five critical lures.

3.1.2.2. Autobiographical memory dating task. To examine participants' ability to recall prior remembering we used an autobiographical memory dating task originally developed by Parks (1999). In this task, participants first completed a 23-item 'yes–no' questionnaire about specific childhood events or facts (questionnaire 1). The items were either drawn from the Parks task (1999) or formulated along the lines of his items (e.g., 'Do you have vivid memories of the first time you went to a funeral?'; see Merckelbach et al., 2006). Participants were instructed to think for 3 s about each item, before indicating whether they had or had not vivid memories about these events. Hereafter, they filled out some unrelated questionnaires that served as a filler task. After an interval of 1 h, participants completed a second autobiographical questionnaire (questionnaire 2). This questionnaire consisted of 18 items of which nine were drawn from the first questionnaire (i.e., target items) and nine items pertained to not previously mentioned items (i.e., control items). The target items were described in exactly the same way as in the first questionnaire though listed in a different order. For target as well as control items, participants were instructed to indicate 'to their best estimate' the time they recalled 'even it was only briefly' the events or facts described by the items. The following response scale was presented to the participants: 0 = *one hour or less ago*;

1 = *several days ago*; 2 = several *weeks ago*; 3 = *several months ago*; 4 = *about a year ago*; 5 = *several years ago*. They were instructed to give an estimate even when they felt an item did not apply to them (but see below).

3.1.3. Procedure

After having provided informed consent, participants were given instructions and stimulus materials. Presentation order of the DRM and autobiographical FIA task was counterbalanced.

3.1.4. Design and analyses

Analyses were restricted to those target items for which the participants claimed to have vivid memories (i.e., yes-responses on questionnaire 1). In other words, items referring to events that did not happen to participants or for which participants did not have vivid memories were excluded from the analyses.

One way to evaluate memory dating performance is to calculate mean dating estimates that participants gave to their vivid memories. Another way to look at the data is to focus on participants who gave at least one correct estimate (i.e., response = 0), but also made dating errors for other vivid memories (see for a similar approach, Parks, 1999 and Merckelbach et al., 2006).

3.2. Results

3.2.1. DRM recall and recognition performance

Table 3 shows the means for correct recall and recognition (i.e., proportion recalled/recognized studied words), false recall and recognition of critical lures (i.e., proportion recalled/recognized critical lures). On average, participants correctly recalled 0.55 ($SD = 0.14$) of the studied words and falsely recalled 0.86 ($SD = 0.15$) of the non-studied critical lures. With regard to DRM recognition performance, participants on average correctly recognised 0.83 ($SD = 0.14$) of the studied words and falsely recognised 0.90 ($SD = 0.15$) of the non-studied critical lures.

3.2.2. Autobiographical memory dating performance

We analyzed the number of vivid memories, the proportion correct recall in time for vivid target items, the mean time estimate of the vivid target items and how often participants gave at least one correct recall and had one or more dating errors (this latter variable indicates that participants followed the instructions but nevertheless made errors).

Overall, participants said to have vivid memories for 5.17 ($SD = 1.64$) of the nine target items. The proportion of vivid memories that were correctly dated (i.e., items that were given a rating of 0) was 0.36 ($SD = 0.39$). Mean dating estimate[1] was 2.14 ($SD = 1.73$). Note that correct dating performance corresponds to a 0 on the 0–5 scale (see materials). A mean dating estimate of 2.14 reflects a mean response of 'around several weeks ago', illustrating that participants underestimated their prior memories. Seven participants (20%) had a mean estimate of 'about a year ago' or longer. Twenty-one (60%) participants had at least one accurate estimate in combination with one or more dating errors.

3.2.3. Correlational analyses

Table 3 shows Pearson product–moment correlations between DRM recall and recognition performance and the autobiographical FIA effect. With regard to the autobiographical FIA effect, we examined performance on the autobiographical memory dating task focussing on the mean dating estimates. DRM parameters were defined in the same way as in Study 1. We found no significant correlation between mean dating estimate (FIA) and DRM false recall ($r = 0.21$; $p = 0.25$), nor did the correlation between mean dating estimate (FIA) and DRM false recognition attain significance ($r = 0.06$; $p = 0.73$).

We furthermore calculated the correlations between DRM correct recall, DRM correct recognition, and the autobiographical FIA effect (see also Table 3). As is to be expected, correct recall on the DRM task correlated significantly with correct recognition on the DRM task ($r = 0.55$, $p < 0.01$). Moreover, DRM correct recall was negatively correlated with false recognition of the critical lures ($r = -0.50$; $p < 0.01$). All other correlations were non-significant.

4. General discussion

The aim of the current studies was to examine to what extent susceptibility to false memory effects is related to the tendency to underestimate prior remembering in an undergraduate sample (Study 1) and a sample of people with a history of childhood sexual abuse (Study 2). We also wanted to explore whether these memory illusions are differentially associated with dissociative experiences, fantasy proneness, and cognitive efficiency (Study 1).

The main findings of the current studies can be summarized as follows. Firstly, in Studies 1 and 2, the standard DRM false recall and recognition effects and the FIA effect were found. That is, participants showed a tendency to falsely recall and rec-

[1] We also looked at performance on the autobiographical memory dating task (Parks, 1999) in a small number ($n = 12$) of people reporting *recovered* memories of CSA (*ms. in preparation*). Mean dating estimate of this group corresponded to 0.92 ($SD = 0.90$) which was not significantly different from the mean dating estimate of 2.14 ($SD = 1.73$) reported by people with continuous memories of CSA. These results are at variance with earlier findings reported by Merckelbach et al. (2006) who showed that women with recovered CSA memories exhibit a specific failure to take recent recall into account when they had to give estimates of the last time they thought about vivid target memories compared to people with continuous CSA memories and controls.

Table 3
Mean proportion of words recalled/recognized and standard deviations ($M \pm SD$) on the Deese/Roediger McDermott (DRM) task and an autobiographical forgot-it-all-along (FIA) task (Parks, 1999 in a sample of people with a history of childhood sexual abuse (Study 2). Pearson product–moment correlations between DRM recall performance, DRM recognition performance, and autobiographical FIA performance are also shown.

	$M \pm SD$	FIA mean dating estimate	Correct recall studied words	Recall critical lures	Correct recognition studied words	Recognition critical lures
FIA mean dating estimate	2.14 (1.73)	1				
Correct recall of studied words	0.53 (0.12)	−0.11	1			
Recall of critical lures	0.88 (0.15)	0.21	0.33	1		
Correct recognition of studied words	0.81 (0.16)	−0.17	0.55**	0.15	1	
Recognition of critical lures	0.94 (0.11)	0.06	−0.50**	−0.01	−0.25	1

Notes. FIA performance was defined as the differential score between proportion judged as "recalled" on Test 1 for studied context recalled/recalled and the proportion judged as "recalled" on Test 1 for other context recalled/recalled; DES, Dissociative Experiences Scale; CEQ, Creative Experiences Questionnaire; CFQ, Cognitive Failures Questionnaire.

* $p < .05$ (2-tailed).

** $p < .01$ (2-tailed).

ognize the non-presented critical lure words. They also were less likely to correctly judge that they had recalled an item in the other-context condition than in the studied-context condition (as measured with the FIA task, see Arnold & Lindsay, 2002, 2005; Study 1) or came up with inaccurate estimates when they were asked to date recent recalls of vivid childhood memories (as measured with an autobiographical memory dating task, see Parks, 1999; Study 2). Secondly, these FIA effects were unrelated to DRM false recall and false recognition performance (Studies 1 and 2). Thus, FIA and DRM measures seem to index relatively independent memory illusions. Thirdly, Study 1 showed that both FIA and DRM measures correlated significantly with cognitive efficiency: the less cognitive failures participants reported, the stronger they exhibited FIA and DRM effects, although the associations were by all modest. Fourthly, no correlations between FIA and DRM on the one hand, and dissociative symptoms (i.e., DES) and fantasy proneness (i.e., CEQ) on the other, were found. With respect to the interrelations between the personality traits, DES was found to correlate significantly with CEQ and CFQ scores, a pattern that has also been found in previous studies (see for example Merckelbach et al., 1999).

Clinical case vignettes suggest that qualitatively different memory illusions may underlie recovered memory reports. Thus, in the literature, recovered memory cases have been interpreted in terms of a heightened susceptibility to false memories but also in terms of a tendency to underestimate prior recall (e.g., Clancy et al., 2000; Loftus & Davis, 2006; Merckelbach et al., 2006; Schooler, 1999). We found that, whether a participant shows a strong or subtle false memory effect is largely independent of the size of the FIA effect in that participant. Thus, our data indicate that we are, indeed, dealing with two different constructs. Meanwhile, they also imply that the two memory illusions are not orthogonal. There is no reason to assume that those who are susceptible to false memories as indexed by DRM parameters are less susceptible to underestimation of prior recall (as indexed by the FIA effect). The implication of this would seem to be that there must be cases in which people exhibit both: a tendency to develop false memories and a tendency to underestimate prior remembering. A thorough examination of how these memory illusions covary in clinical groups, among which people with recovered memories, seems warranted.

Unlike previous studies that often relied on special samples (e.g., people with recovered memories; Clancy et al., 2000; see also Drivdahl & Zaragoza, 2001; Jelicic et al., 2006), we did not find fantasy proneness and dissociative experiences to be related to the size of the false memory effect in our sample consisting of non-clinical undergraduates (Study 1). Our failure to find correlations between these traits and false memory susceptibility may have to do with our reliance on intelligent, young adults (i.e., undergraduates). On the other hand, finding a correlation between false memory susceptibility and dissociation or fantasy proneness in a clinical sample introduces the interpretational problem of the possibility of a third underlying (mediating) variable (e.g., post traumatic stress symptoms). Therefore, we believe that the non-significant zero-order correlations that we found are informative: they strongly suggest that the idea that susceptibility to false memories and underestimation of prior recall have distinct profiles in terms of symptoms and traits has little empirical basis. Unexpectedly, we found that cognitive efficiency (as indexed by self-reported cognitive failures) was linked to both the FIA phenomenon and the DRM effect. The direction of the correlations suggests that a relative lack of cognitive efficiency to some degree immunizes against false memories and a tendency to overlook previous instances of remembering although, of course, the correlational nature of our findings precludes a causal interpretation of this relationship. Nevertheless, one possible explanation of the negative association between self-reported cognitive efficiency, false memories, and the FIA effect is that self-reported cognitive efficiency reflects optimism and reliance on liberal criteria for evaluating the accuracy of self-reported memory reports. By this view, heightened levels of cognitive failures would imply that people are critical and use strict standards (see for a similar line of argumentation Hekkanen & McEvoy, 2002). In more general terms, the significant correlations between self-reported cognitive efficiency and memory illusions illustrate that this might be a fruitful area for further research. So far, studies in this domain have traditionally focused on characteristics that superficially seem to be more interesting (e.g., dissociative symptoms; fantasy proneness) than lack of cognitive efficiency (e.g., Hyman & Billings, 1998; Jelicic et al., 2006; Winograd, Peluso, & Glover, 1998). A more systematic analysis of how cognitive efficiency

relates to memory illusions would be interesting because this cognitive efficiency can be related to other phenomena, for example, mind wandering (e.g., Smallwood, Fishman, & Schooler, 2007; on the link between attention lapses and cognitive failures, see Carriere, Cheyne, & Smilek, 2007; Cheyne, Carriere, & Smilek, 2006).

With respect to the interrelations between the various self-report measures (Study 1), we found positive and significant correlations between dissociative experiences, on the one hand, and everyday cognitive failures and fantasy proneness, on the other. Though cognitive failures and fantasy proneness appear to be predictors of dissociative experiences in the current student sample, these measures were found to be unrelated to each other. This pattern of fantasy proneness and cognitive failures as independent correlates of dissociation replicates previous work (e.g., Horselenberg, Merckelbach, & Josephs, 2003; Merckelbach et al., 1999).

As to the limitations of the current study, it should be mentioned that no corroboration for the current trauma reports was sought, making it impossible to report on the authenticity of these experiences. Another limitation of the current studies is the way in which pertinent memory illusions were measured. Using lab tasks, both underestimation of prior recall and susceptibility to false memories have been documented in clinical samples, e.g., women who reported recovered memories of CSA (Clancy et al., 2000; Merckelbach et al., 2006). However, it might well be the case that we would have found a different pattern of correlations had we used lab tasks that involved episodic rather than semantic memories. Clearly, this possibility needs to be addressed in future studies. In order to increase ecological validity, we, in Study 2, investigated the relation between false memory propensity (as measured with the DRM task) and susceptibility to the FIA effect as measured with an autobiographical memory dating task (see Parks, 1999) in a sample of people reporting a history of childhood sexual abuse (CSA). As said above, we replicated the finding of relative independence between DRM performance and the FIA effect.

In sum, the current studies showed the FIA effect to be unrelated to DRM false recall and false recognition performance. This indicates that FIA and DRM tap different memory illusions that are independent of one another. However, at the level of personality characteristics, both aberrations did not have distinct profiles. However, at the level of personality characteristics, both aberrations did not have distinct profiles. Thus, from a clinical perspective, the existence of two different types of memory illusions seems to have limited relevance. Both types are related to cognitive efficiency, a link that merits further research.

Acknowledgments

Linsey Raymaekers was supported by a Grant from The Netherlands Organization for Scientific Research (NWO 400 06 024).

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