Confabulation versus experimentally induced false memories in Korsakoff patients

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The present study focuses on both the clinical symptom of confabulation and experimentally induced false memories in patients suffering from Korsakoff’s syndrome. Despite the vast amount of case studies of confabulating patients and studies investigating false memories in the Deese–Roediger–McDermott (DRM) paradigm, the nature of Korsakoff patients’ confabulatory behaviour and its association with DRM false memories have been rarely examined. Hence, the first aim of the present study was to evaluate confabulatory responses in a large sample of chronic Korsakoff patients and matched controls by means of the Dalla Barba Confabulation Battery. Second, the association between (provoked) confabulation and the patients’ DRM false recognition performance was investigated. Korsakoff patients mainly confabulated in response to questions about episodic memory and questions to which the answer was unknown. A positive association was obtained between confabulation and the tendency to accept unstudied distractor words as being old in the DRM paradigm. On the other hand, there was a negative association between confabulation and false recognition of critical lures. The latter could be attributed to the importance of strategic retrieval at delayed memory testing.

Korsakoff’s syndrome typically develops following years of chronic alcohol abuse and nutritional thiamine deficiency (e.g., Homewood & Bond, 1999). The most cardinal feature of the syndrome is undoubtedly the disproportionate impairment of memory relative to other aspects of cognitive functioning (Butters & Cermak, 1980; Parkin & Leng, 1993). Another salient symptom, however, is the patients’ tendency to confabulate (e.g., Dalla Barba, Cipolotti, & Denes, 1990; Kessels, Kortrijk, Wester, & Nys, 2008; Kopelman, 1995; Talland, 1965). As stated by Dalla Barba (1993a, p. 2), confabulation is ‘that particular symptom, frequently observed in amnesic patients unaware of their memory deficit, which consists of both actions and verbal statements that are unintentionally incongruous to the patients’ history, background, and present situation’. More specifically, confabulations can be defined as erroneous memories, either false in themselves or resulting from the inappropriate retrieval or

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misinterpretation of ‘true’ memories (Kopelman, Guinan, & Lewis, 1995; for more definitions, see Schnider, 2008).

A distinction often made is the one between ‘spontaneous’ confabulation and ‘provoked’ or ‘momentary’ confabulation (Kopelman, 1987; see also Berlyne, 1972; Schnider, 2008). Whereas the former refers to the unprovoked production of erroneous, incoherent, and often implausible memories, the latter refers to intrusions or distortions of memory in response to a challenge, such as questions or a memory test. As this second type of confabulation is considered coherent and internally consistent, and mainly comprises true memories being displaced in time and context, it closely resembles the type of memory distortion we all sometimes produce. Both involve reconstructive processes and the modification or combination of elements in memory. In that sense, memory distortion is no more a characteristic of the memory deficit of Korsakoff patients than it is of the memory failure of healthy individuals (Moscovitch, 1995). Hence, it should be no surprise that the same processes that are supposed to elicit the clinical symptom of confabulation are also believed to play a role in the creation of false memories in the ‘Deese–Roediger–McDermott (DRM)’ paradigm.

In the DRM paradigm, participants study lists of words (e.g., bed, rest, wake, tired, dream, etc.), which are all semantically related to a critical, but non-presented ‘lure word’ (e.g., sleep; Deese, 1959; Roediger & McDermott, 1995). Afterwards, memory is tested by means of free recall and/or recognition. By now, it has repeatedly been shown that healthy individuals falsely recall and/or recognize the lure words with about the same probability as they correctly recall/recognize studied list words (see Gallo, 2006, for a review). Theoretical explanations are provided by the activation–monitoring account (Roediger & McDermott, 1995, 2000) and fuzzy-trace theory (e.g., Brainerd & Reyna, 1998, 2002). According to the former, false memories are due to the activation of critical lures during study (cf. Underwood, 1965), followed by source-monitoring problems at test (see Johnson, Hashtroudi, & Lindsay, 1993). According to the latter, false memories result from the fact that critical lures are consistent with ‘gist’ information retrieved at test. ‘Verbatim’ memory for specific list words, however, could inhibit the occurrence of false memories. In a similar way, both deficient source monitoring and defective recollection of specific information are considered to be at the basis of confabulations: due to impaired executive functions (resulting from frontal lobe damage), both the active process of strategic retrieval and the evaluation of its output are being disrupted (e.g., Baddeley & Wilson, 1986; Kopelman, 1999; Moscovitch & Melo, 1997; however, see also Dalla Barba, Nedjam, & Dubois, 1999). So, confabulations occur when the faulty output of a deficient retrieval process is emitted without proper monitoring or evaluation (Moscovitch, 1995; see also Ciaramelli & Ghetto, 2007).

A second similarity between the two types of memory distortion is their lack of intentionality: confabulations are typically not intentionally produced, and patients are in fact not aware that their memories are false. Accordingly, confabulation has sometimes been referred to as ‘honest lying’ (Moscovitch, 1989). Similarly, the DRM illusion has been shown to be difficult to place under conscious control: false memories are hard to avoid, even when participants are explicitly warned about the way in which they are created (McDermott & Roediger, 1998).

When Korsakoff patients are tested with the DRM paradigm, they typically demonstrate diminished levels of both false and veridical memory (e.g., Schacter, Verfaellie, & Anes, 1997; Schacter, Verfaellie, & Pradere, 1996). In a recent study of Van Damme and d’Ydewalle (2009), however, evidence was obtained that time of testing is an important factor contributing to the patients’ performance. At both free
recall and old/new recognition, Korsakoff patients’ false memory scores were only significantly lower than controls' when tests were administered at the end of the experiment (i.e., after studying eight word lists). When memory was tested immediately after each study list, the group difference in false memory was not significant. In addition and more importantly, in an immediate recognition test, Korsakoff patients even showed significantly more ‘remember’ judgments of critical lures than control participants did (see Tulving, 1985; Yonelinas, 2002). The authors explained the latter finding by fluency-based retrieval, unopposed by explicit recollection: due to the combination of impaired strategic retrieval and deficient source monitoring, the patients could not use item-specific memory to counteract the (false) feeling of familiarity for critical lures in this condition. Healthy controls, on the other hand, could (see also Cermak, Butters, & Gerrein, 1973).

So, despite the fact that confabulation and DRM false memories seem to have similar underlying mechanisms, Korsakoff patients are not consistently more susceptible to the latter than healthy individuals are. This is only the case when memory is tested immediately after study, but not when testing is postponed until the end of the experiment. The difference can be explained by the fact that, at delayed testing, strong explicit recollection is required in order to retrieve any (item-specific or thematic) information. As stated by Moscovitch (1995), recovering some information is a prerequisite to confabulation. The same is true for false memories in the DRM paradigm. Since Korsakoff patients are characterized by deficient recollection (e.g., Beauregard et al., 1997; d’Ydewalle & Van Damme, 2007), they will only occasionally succeed in retrieving the necessary information required to obtain false memories in a delayed explicit memory test.

Surprisingly, the issue of how confabulation is related to experimentally induced false memory has not received much attention in the literature yet. On the one hand, based on a comprehensive literature review, Schneider (2008) recently concluded that both phenomena are most likely to be dissociated. In line with this argument, Kessels et al. (2008) showed that confabulation in Korsakoff patients was not related to the number of intrusions on a verbal memory task. On the other hand, Ciaramelli, Ghetti, Frattarelli, and Ládavas (2006) provided preliminary evidence that confabulation and DRM false memory might be related: first, in line with the arguments just made, confabulating patients falsely recognized critical lures to a greater extent than non-confabulating participants did, when memory was tested immediately after each study list. Second, with immediate testing, they also showed increased false recognition of unrelated distractor words as compared with non-confabulating participants. Finally, confabulators showed a positive correlation between the tendency to make (delayed) false alarms and the proportion of confabulatory responses obtained in (one section of) a confabulation questionnaire.

The first aim of the present study was to evaluate (provoked) confabulation in a large group of patients suffering from Korsakoff’s syndrome by means of (a Dutch version of) the Confabulation Battery of Dalla Barba (1993a). The question of interest was whether Korsakoff patients would consistently show confabulatory responses, and whether or not these would be restricted to specific types of information. In contrast to older claims that confabulation is only a prominent symptom in the early (Wernicke) stage of the disease and rarely occurs in the ‘chronic’ stage (e.g., Benson et al., 1996; Köpelman, 1995; Victor, Adams, & Collins, 1989), two recent studies provided evidence that Korsakoff patients demonstrate (provoked) confabulations even after years of disease onset (Borsutzky, Fujiwara, Brand, & Markowitsch, 2008; Kessels et al., 2008).
The present results were expected to replicate these findings. In addition, based on previous studies and theories about confabulation (e.g., Borsutzky et al., 2008; Dalla Barba, 1993a; Moscovitch, 1995; however, see also Moscovitch & Melo, 1997), it was predicted that confabulatory responses would be mainly obtained on questions about episodic memory, and less so on questions evaluating semantic memory.

The second aim of the study was to explore the association between the clinical symptom of confabulation and the DRM false memory phenomenon. Building further on Ciaramelli et al. (2006), the degree of false recognition was linked to confabulatory responses on the Confabulation Questionnaire. Since Ciaramelli et al. obtained a clear association between confabulation and immediate false recognition, but less clear results for delayed recognition, the present study focused on the latter. DRM data were taken from Van Damme and d’Ydewalle (2010, Exp. 1). In this experiment, both Korsakoff patients and memory-intact controls were shown 12 Dutch DRM lists, each consisting of 15 words which were semantically related to a critical lure word. Half of the lists were presented under incidental encoding instructions, half of the lists were presented under intentional encoding instructions. Participants were randomly assigned to two conditions, in which study words were presented for either 2 or 5 s. An implicit stem completion test was provided immediately after each word list, whereas an old/new recognition test was administered following each block of six lists. The latter test consisted of studied words, non-studied unrelated distractor words, and non-studied related critical lures. Results revealed equivalent priming for critical lures in the implicit stem completion test, whereas Korsakoff patients showed significantly reduced (delayed) false recognition of critical lures. There were no group differences in the proportion of false alarms to unrelated distractor words.

Expectations concerning the relationship between the patients’ recognition performance and confabulation were different for the unrelated distractor words and related critical lures. As in Ciaramelli et al., the tendency to confabulate was predicted to be positively associated with the tendency to say ‘old’ to unrelated distractors. False recognition of related critical lures, however, was not necessarily expected to be positively linked to confabulation. As stated before, a relatively high degree of strategic retrieval is required to obtain false memory for critical lures in a delayed recognition test. Moreover, confabulating patients are characterized by deficient strategic retrieval and defective monitoring. In Van Damme and d’Ydewalle (2010), ‘meaning retrieval instructions’ were used, asking participants to endorse any item that shared the meaning of the studied lists, irrespective of whether or not they had actually seen it before. This was done to allow for a direct comparison of Korsakoff patients’ and controls’ explicit memory for the gist of the lists, without having to take into account possible inhibition of false memories by controls (cf. Verfaellie, Schacter, & Cook, 2002). This implied, however, that source monitoring was not required for items related to the theme of the lists, and inter-individual differences in monitoring abilities were therefore not relevant for this type of items. Hence, merely based on confabulating patients’ difficulties with strategic retrieval, confabulation could be expected to have no or even a negative association with false recognition of critical lures.

To corroborate the latter reasoning, we also examined the association between confabulation and priming for critical lures in Van Damme and d’Ydewalle (2010, Exp. 1; stem completion test). As implicit retrieval instructions require participants to give whatever word that first comes to mind, both strategic retrieval and source monitoring are unnecessary for this type of task. Hence, performance should not show any association with confabulation.
Method

Participants
A total of 35 chronic Korsakoff patients (30 men and 5 women) participated in the study. They were residents from two psychiatric institutions in Belgium. Their mean age was 53 years (range 43–69, SD = 5.6) and they had an average of 12 years of formal education (range 6–16, SD = 2.3). All patients met the criteria for the DSM-IV alcohol-induced persisting amnesic disorder (American Psychiatric Association, 1994) and the criteria for the Korsakoff syndrome as described by Kopelman (2002). They all had histories of chronic alcoholism, and showed severe anterograde and retrograde amnesia. More detailed information and neuropsychological test scores for a subset of the patients are presented in Appendix. All patients tested showed impaired memory performance on the Auditory Verbal Learning Test. In addition, they produced an increased number of perseverative responses on the Wisconsin Card Sorting Test (WCST), and most patients exhibited impaired performance on the Trail Making Test and the Controlled Oral Word Association Test. Attention, as measured by the Bourdon–Wiersma Dot Cancellation Test, was disturbed in approximately half of the patients. For all of the tests, except for the WCST, Flemish normative data of Miatton, Wolters, Lannoo, and Vingerhoets (2004) were used.

A group of 30 healthy and volunteering controls (22 men and 8 women) was recruited for comparison. They were matched to the patients as closely as possible in terms of age (M = 52 years, range 44–69, SD = 6.0), education (M = 10 years, range 6–15, SD = 2.7), and (former) vocational levels. They had no neurological or psychiatric history, and showed no signs of any memory problems.

Materials
A Dutch version of the Confabulation Battery (Dalla Barba, 1993a) was used to study confabulations in a standardized manner. First, the original questionnaire was adapted and translated into Dutch by Merckelbach and colleagues from the University of Maastricht. Next, some of the questions evaluating semantic memory (i.e., those referring to specific, national events) were replaced so they would fit within a Belgian context.

The Confabulation Battery is a semi-structured interview consisting of 65 questions, aimed at evaluating different memory domains. Questions can be divided into the following six categories:

1. Twenty questions testing personal semantic memory (i.e., general personal facts, such as age, place of birth, current address, etc.).
2. Fourteen questions testing episodic memory (i.e., previously experienced autobiographical events).
3. Nine questions testing orientation in time and place.
4. Ten questions testing general semantic memory (i.e., knowledge of famous facts and people, in both past and present).
5. Six ‘I don’t know – semantic’ questions (i.e., questions about famous facts and people, but constructed as such that the appropriate response given by healthy participants would be ‘I don’t know’; e.g., ‘What did Marilyn Monroe’s father do?’).
6. Six ‘I don’t know – episodic’ questions (i.e., questions about personal activities and events, but constructed as such that the appropriate response given by healthy participants would be ‘I don’t know’; e.g., ‘What did you do on April 30 in 1995?’).
In both of the final two categories, there is one question that is ‘implausible’ and refers to an event that could never have happened. The Dutch questionnaire is presented in full in Appendix.

**Design and procedure**

All, except the first four, questions were randomized and were administered in a different random order to each participant. The first four questions (i.e., ‘What’s your name, age, date and place of birth?’) were always asked first, as a way to open the conversation and to introduce the procedure.

Questions were asked one by one in a random order, with the experimenter writing down all responses. Occasionally, a question was left out, in case it was not applicable to the situation of a particular participant. For instance, questions about being admitted to the hospital or psychiatric institution were left out for healthy controls. Likewise, questions about personal experiences with one’s own children were not appropriate for all participants. Hence, if a participant responded negatively to the question ‘do you have children?’, no further questions about having children were asked to that person. Participants were tested individually, and gave informed consent before starting the procedure. The study was approved by the local ethics committee.

Responses were scored as either ‘correct’, ‘wrong’, ‘I don’t know’, or ‘confabulation’. For the first two categories (personal semantic and episodic memory), responses were scored as ‘correct’ when they matched information obtained from the nursing staff and/or from the participant’s relatives. Small mistakes were scored as a ‘wrong’ response, whereas large discrepancies were considered confabulations. If verification was not possible, the question was omitted from data analysis. For Categories 3 and 4 (orientation in time and place and general semantic memory), correct responses were self-evident. Following Dalla Barba (1993a), the criterion used to distinguish between a wrong response and a confabulation for questions about orientation in time was the following: answers to questions regarding the current year, season, month, day of the month, day of the week, and hour of the day were judged to be confabulatory only if deviating from the correct response by more than 10 years, 1 season, 3 months, 15 days, 3 days, or 6 h, respectively. For all other types of questions, the distinction between a wrong or confabulatory response was always clear, although possibly made on a subjective basis (cf. Dalla Barba, 1993a, 1995). Since questions in Categories 5 and 6 were designed as such that participants should not know the answer, any response other than ‘I don’t know’ was scored as a confabulation (cf. Borsutzky et al., 2008).

**Results**

First, results of the Confabulation Questionnaire will be discussed. Next, Korsakoff patients’ tendency to confabulate will be linked to their false memory performance in the DRM paradigm. An alpha level of .05 was used for all statistical tests.

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1 There was one exception to this rule: for the ‘implausible’ questions, the appropriate response was not ‘I don’t know’, but rather ‘Never’. Therefore, for these two questions, the latter response was scored as if it was an ‘I don’t know’ statement. If the participant really thought about the matter and responded that he/she did not know, this was considered to be a confabulatory response.
**Confabulation Questionnaire**

Table 1 presents Korsakoff patients’ and healthy controls’ performance in all six categories of the Confabulation Questionnaire. Mean proportions were calculated by dividing the number of correct, wrong, ‘I don’t know’, and confabulatory responses by the number of questions in a category. Compared to controls, Korsakoff patients showed impaired performance in all memory categories tested. Confabulations mainly occurred in response to questions about episodic memory and in both ‘I don’t know’ sections.

Table 1. Mean proportions of correct, wrong, ‘I don’t know’, and confabulatory responses produced by Korsakoff patients and control participants in all six categories of the Confabulation Questionnaire (with standard errors of the mean in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>PS</th>
<th>E</th>
<th>O</th>
<th>GS</th>
<th>DKS</th>
<th>DKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korsakoff patients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct</td>
<td>.78 (.02)</td>
<td>.41 (.04)</td>
<td>.71 (.04)</td>
<td>.68 (.04)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Wrong</td>
<td>.10 (.01)</td>
<td>.11 (.02)</td>
<td>.18 (.02)</td>
<td>.12 (.02)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>I Don’t Know</td>
<td>.08 (.01)</td>
<td>.33 (.04)</td>
<td>.07 (.02)</td>
<td>.19 (.03)</td>
<td>.87 (.02)</td>
<td>.86 (.02)</td>
</tr>
<tr>
<td>Confabulation</td>
<td>.04 (.01)</td>
<td>.15 (.03)</td>
<td>.04 (.02)</td>
<td>.01 (.01)</td>
<td>.13 (.02)</td>
<td>.14 (.02)</td>
</tr>
<tr>
<td>Control participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct</td>
<td>.99 (.01)</td>
<td>.79 (.02)</td>
<td>.99 (.01)</td>
<td>.92 (.02)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Wrong</td>
<td>.01 (.00)</td>
<td>.04 (.01)</td>
<td>.01 (.01)</td>
<td>.05 (.01)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>I Don’t Know</td>
<td>.002 (.00)</td>
<td>.17 (.02)</td>
<td>.00 (.00)</td>
<td>.03 (.02)</td>
<td>.84 (.02)</td>
<td>.96 (.02)</td>
</tr>
<tr>
<td>Confabulation</td>
<td>.00 (.00)</td>
<td>.00 (.00)</td>
<td>.00 (.00)</td>
<td>.00 (.00)</td>
<td>.16 (.02)</td>
<td>.04 (.02)</td>
</tr>
</tbody>
</table>

Note. PS, personal semantic memory; E, episodic memory; O, orientation in time and place; GS, general semantic memory; DKS, ‘I don’t know – semantic’; DKE, ‘I don’t know – episodic’. Mean proportions were calculated by dividing the number of correct, wrong, ‘I don’t know’, and confabulatory responses by the number of questions in a category.

First, a 2 (Group) × 4 (Question type) mixed-factors ANOVA was carried out on the proportions of correct responses obtained for personal semantic memory, episodic memory, orientation in time and place, and general semantic memory. Significant main effects of both Group \[F(1,63) = 89.53, \text{MSE} = .054, p < .0001, \eta^2_p = .59\] and Question type \[F(3,189) = 78.38, \text{MSE} = .014, p < .0001, \eta^2_p = .55\], were qualified by a significant interaction, \[F(3,189) = 6.89, \text{MSE} = .014, p = .0002, \eta^2_p = .10\]. A posteriori pairwise Tukey tests revealed that the proportion of correct responses for Korsakoff patients was significantly lower than controls’ across all four categories (all \(p \text{'s} < .0001\)). Control participants performed at ceiling in all memory domains, except for episodic memory (see Table 1). Performance in the latter category was significantly lower than performance concerning personal semantic memory (\(p < .0001\)), orientation in time and space (\(p < .0001\)), and general semantic memory (\(p = .0007\)). Episodic memory was also the memory domain in which numerically the largest group difference was obtained (\(M = 0.38\) vs. \(M = 0.21, 0.28,\) and 0.24, respectively): Korsakoff patients performed relatively worse in this category as compared to all others. Accordingly, they also showed significant differences between episodic memory and all three other categories (all \(p \text{'s} < .0001\)).

The same 2 (Group) × 4 (Question type) mixed-factors ANOVA on the proportions of wrong responses also revealed significant main effects of Group \[F(1,63) = 64.15, \text{MSE} = .010, p < .0001, \eta^2_p = .50\] and Question type \[F(3,189) = 3.02, \text{MSE} = .007,
as well as a significant interaction, $F(3, 189) = 5.27, MSE = .007$, $p = .002, \eta^2_p = .08$. Pairwise Tukey comparisons showed that the latter could be attributed to the fact that only Korsakoff patients showed different results depending on the type of questions asked (see Table 1): relatively more wrong responses were given to questions regarding orientation in time and space than to any other type of questions ($p = .0008, .01, \text{and} .05$, respectively). Orientation in time and space was also the domain in which numerically the largest difference with control participants was found: patients made more mistakes than controls in personal semantic memory ($M = 0.09, p = .003$), episodic memory ($M = 0.07, p = .02$), orientation in time and space ($M = 0.17, p < .0001$), and general semantic memory ($M = 0.07, p = .03$), but the difference was largest in the third category.

For the ‘I don’t know’ responses, a distinction must be made between questions in the first four and the last two categories. Whereas for questions regarding personal semantic memory, episodic memory, orientation, and general semantic memory a statement of not-knowing could be considered ‘bad’ performance, it was the required response and therefore ‘good’ performance in the final two categories. The result pattern obtained in the first four categories mirrored the one for correct responses: statements of not-knowing were relatively more frequent for those questions to which fewer correct responses were given. Likewise, the result pattern obtained in the last two categories mirrored the one for confabulations (see Table 1). Therefore, analyses for ‘I don’t know’ responses will not be presented in full.

Figure 1 depicts the percentage of confabulatory responses made by patients and controls across all categories of the questionnaire. Confabulation was mainly observed in Korsakoff patients, and was most likely to occur as a reaction to questions about episodic memory and questions to which the answer was unknown. An ANOVA on Korsakoff patients’ confabulations with Question type as a within-subjects variable,
followed by pairwise Tukey comparisons, confirmed that the proportions of confabulatory responses in Categories 2, 5, and 6 significantly differed from the proportions in Category 1 ($p = .0006$, .004, and .002), Category 3 ($p = .0006$, .005, and .003), and Category 4 (all $p$'s < .0001). Control participants also occasionally confabulated in both of the ‘I don’t know’ sections. This was due to the fact that some participants tried to guess the right answer (see Kopelman, Ng, & Van Den Brouke, 1997, for similar findings). As explained before, any other response than ‘I don’t know’ was scored as a confabulation here. A $2 \times 2$ (Group) $\times$ (Question type) mixed-factors ANOVA on the confabulations obtained in both of the ‘I don’t know’ sections revealed a significant main effect of Question type [$F(1,63) = 6.01, \text{MSE} = .015, p = .02, \eta_p^2 = .09$], qualified by a significant interaction with Group, $F(1,63) = 7.13, \text{MSE} = .015, p = .01, \eta_p^2 = .10$. Whereas the difference between Korsakoff patients and controls was significant for ‘I don’t know’ questions in the episodic memory domain ($M = 0.14$ vs. 0.04; Tukey, $p = .02$), it was not for questions in the semantic memory domain ($M = 0.13$ vs. 0.16).

**Confabulation versus DRM false memory**

In order to investigate the association between confabulation and DRM false memory, a linear regression analysis was carried out on Korsakoff patients’ performance in the DRM paradigm using confabulation as a quantitative predictor. To control for the fact that two different encoding durations were used in the DRM experiment (Van Damme & d’Ydewalle, 2010, Exp. 1), the encoding condition was also included in the analysis as a qualitative predictor. Data were available for 17 of the Korsakoff patients. False alarms to unrelated distractor words, false recognition of critical lures, and corrected false recognition scores were successively used as dependent variables.

Surprisingly, only confabulation in the first category of the questionnaire (i.e., personal semantic memory) was significantly related to DRM performance. The result pattern obtained was as expected: first of all, evidence was found for a positive association between confabulation and false alarms to unrelated distractor words, $\beta = 3.09$, $t(14) = 2.12$, $p = .05$, $r_p^2 = .24$. Secondly, a non-significant negative association was obtained between confabulation and false recognition of critical lures ($\beta = -1.27, p = .22$). Finally, and as a result, there was a significant negative association between confabulation and corrected false recognition scores (calculated by subtracting the proportion of false alarms to distractors from the proportion of hits to critical lures), $\beta = -4.36$, $t(14) = -2.73$, $p = .02$, $r_p^2 = .33$. Linear regression results for Categories 2, 5, and 6 of the questionnaire roughly followed the same pattern, but showed no significant regression coefficient for confabulation. Also, as expected, regression analyses on stem completion data revealed no significant association between confabulation and implicit false memory.

**Discussion**

In the present study, both (provoked) confabulation and its association to false recognition in the DRM paradigm were investigated in a large group of chronic Korsakoff patients. First of all, evidence was obtained that Korsakoff patients do confabulate, even in the chronic stage of the disease. Second, this tendency to confabulate (at least with respect to personal semantic memory) was shown to be
positively associated with false recognition of unrelated distractor words, negatively associated with false recognition of critical lures, and not associated with implicit false memory in the DRM paradigm.

Korsakoff patients showed impaired performance in all categories of the Confabulation Questionnaire. However, both episodic memory and orientation in time and space were relatively more impaired than (personal and general) semantic memory: as compared to healthy controls, the patients gave relatively the least correct responses to questions evaluating episodic memory, and relatively the most wrong responses to questions evaluating orientation in time and space. Both findings are in agreement with what is currently known about the syndrome: Korsakoff patients’ episodic memory is considered to be more severely impaired than semantic memory (e.g., Dalla Barba et al., 1990; Verstichel, 2000; see also Van der Linden, Brédart, Depoorter, & Coyette, 1996), and the patients typically show impaired recall of temporal and spatial information (e.g., Lezak, 1995; Postma, Van Asselen, Keuper, Wester, & Kessels, 2006).

Consistent with recent findings of Borsutzky et al. (2008) and Kessels et al. (2008), the present Korsakoff patients demonstrated (provoked) confabulations, although all of them could be considered to be in the chronic stage of the syndrome. Only 1 out of 35 patients did not show any confabulatory responses. With respect to the content of the confabulations, it was predicted that confabulatory responses would be mainly observed in reaction to questions about episodic memory, and less so in reaction to questions about semantic memory. This prediction was confirmed: Korsakoff patients exhibited significantly more confabulations in Category 2 than in Categories 1 and 4 of the Confabulation Questionnaire. According to Moscovitch (1995), there are two possible underlying factors for this difference. First, patients may confabulate more about episodic than semantic memory because the former is relatively more impaired than the latter. Consistent with this argument, Borsutzky et al. (2008) recently concluded that, although Korsakoff patients show a general disposition to produce confabulations, ‘this dysfunction may culminate in the most vulnerable memory domain – that is, episodic memory’ (p. 3140). Second, however, it might also be that questions about episodic memory make greater demands on strategic retrieval than questions about semantic memory do, and that the difference is therefore no more than a methodological artifact. Nevertheless, as domain-specific confabulations have been reported in many studies using various techniques (e.g., Borsutzky et al., 2008; Dalla Barba, 1993a; Dalla Barba et al., 1999), and recent evidence exists that domain-specific confabulations even have different neural correlates (Turner, Cipolotti, Yousry, & Shallice, 2008), the latter explanation seems less likely.

Next to confabulations concerning episodic memory, Korsakoff patients in the present study also showed robust confabulation levels in response to questions to which the appropriate response would actually be ‘I don’t know’. In addition, even healthy control participants showed some confabulations in the final two categories of the questionnaire. This could be attributed to the fact that some participants were just trying to guess the right answer on questions to which they could not know the answer. As explained before, any response other than ‘I don’t know’ was scored as a confabulation here. Similar findings have been reported by both Borsutzky et al. (2008) and Kopelman et al. (1997). However, whereas Korsakoff patients’ performance was similar to controls’ in response to ‘I don’t know’ questions in the semantic memory domain, their tendency to confabulate significantly exceeded controls’ in response to ‘I don’t know’ questions in the episodic memory domain.
The fact that confabulations were most likely in episodic memory - that is, the domain in which relatively the least correct responses were obtained - as well as in response to episodic ‘I don’t know’ questions, could be considered consistent with the ‘gap-filling’ hypothesis (see Dalla Barba, 1993b). This early account of confabulation states that confabulations are fabricated by amnesic patients in order to protect themselves from the embarrassment of not being able to remember (for a review, see Schnider, 2008). In other words, confabulation reflects a tendency to fill memory gaps with fictitious information. However, as Korsakoff patients are typically unaware of their memory deficit, and are therefore unlikely to consciously compensate for their memory loss, this explanation is necessarily incomplete. Moreover, in the present study, patients did not just confabulate whenever a memory gap was present: the most frequent response given to questions in the final two categories was still ‘I don’t know’, and also in response to questions about episodic memory, ‘I don’t know’ was a frequently given answer (see Table 1).

With respect to the relationship between DRM false recognition and the tendency to confabulate, expectations were only confirmed for confabulations concerning personal semantic memory. The more Korsakoff patients tended to confabulate in this particular memory domain, the more they were inclined to accept unrelated distractor words as being old in a delayed recognition test. There was a negative association, however, between confabulation and false recognition of critical lures. Although the latter finding strongly differs from the one obtained by Ciaramelli et al. (2006) for immediate false recognition, it was in fact predicted on the basis of confabulating patients’ impaired strategic retrieval abilities and the importance of such retrieval to recollect any information at delayed testing: patients showing higher levels of (delayed) false recognition could be considered to be better at strategic retrieval of earlier encountered information, and should therefore be less inclined to confabulate. Patients showing higher levels of false alarms to unrelated distractor words, on the other hand, could be considered to be worse at strategic retrieval, and should therefore be more inclined to confabulate. Also in line with the predictions, there was no association whatsoever between confabulation and implicit false memory: the ability to strategically retrieve information and to monitor the source of one’s own memories [i.e., the factors (mainly) responsible for patients’ tendency to confabulate], are both unnecessary and irrelevant in an implicit stem completion test.

The fact that expectations were only confirmed for confabulations concerning personal semantic memory might be surprising. Although results for other memory domains roughly followed the same pattern, none of the regression analyses revealed significant effects of confabulation. Future studies will need to determine whether this was due to the fact that DRM data were only available for 17 patients, and whether the use of a larger group could clarify the present findings. Nevertheless, we believe that there might also be an alternative explanation: possibly, a link between confabulation and DRM false recognition only exists for patients showing personally important, and hence quite severe, confabulations in daily life. Obviously, confabulating in response to questions like ‘how old are you?’ or ‘what are your children’s first names?’ can be considered to be more disturbing than confabulating in response to questions like ‘do you remember the last time you went to the cinema?’. Patients who frequently confabulate in the personal semantic memory domain might actually be those patients for which strategic retrieval is most strongly impaired.

To summarize, in line with Borsutzky et al. (2008), the present findings point to the conclusion that confabulation does occur in Korsakoff patients, even in the chronic
stage of the syndrome. The tendency to confabulate was shown to be domain-specific, as it occurred more frequently in response to questions about episodic memory than in response to questions about semantic memory. Although the present study only examined 'provoked' confabulations, results are in agreement with verbal reports of nursing staff and psychologists stating that (some of) the patients frequently confabulate spontaneously in daily life. Based on both Ciaramelli et al. (2006) and the present data, it can be concluded that confabulation and DRM false recognition are positively related when memory is tested immediately after study, but negatively related when memory is tested only at the end of the experiment (using meaning retrieval instructions). Further research is needed to determine whether the latter finding will be confirmed when ‘normal’ recognition instructions are used. Based on the important role of strategic recollection at delayed memory testing, one could expect this to be the case. False recognition of unrelated distractor words was shown to be positively related to confabulation in both studies, and can therefore be considered to be ‘confabulatory-like’ behaviour (see also Dalla Barba, 1993b).

**Acknowledgements**

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**References**


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## Appendix

### A1. Demographic and neuropsychological characteristics of a subset of the Korsakoff patients: Vocabulary, attention, and memory

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Note. Patients 1–17 also participated in the DRM experiment (Van Damme & d’Ydewalle, 2010, Exp. I). BW, Bourdon–Wiersma Dot Cancellation Test; AVLT, Auditory Verbal Learning Test; Educ., years of formal education; ART, average row time; AD, average row deviation time; Omis., omissions; Err., errors; A8+, recognition hit rate; A8−, recognition false positives; M, male; F, female.
### A2. Demographic and neuropsychological characteristics of a subset of the Korsakoff patients: Executive functions

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**Note.** Patients 1–17 also participated in the DRM experiment (Van Damme & d’Ydewalle, 2010, Exp. 1). TMT, Trail Making Test; COWAT, Controlled Oral Word Association Test; WCST, Wisconsin Card Sorting Test; Educ., years of formal education; Anim., animals; # Categ., number of categories completed; # Trials, number of trials needed to complete the first category; Perc.Err., percentage of errors; Perc.P.Res., percentage of perseverative responses; Perc.P.Err., percentage of perseverative errors; Perc.NP.Err., percentage of non-perseverative errors; FMS, failure to maintain set; M, male/F, female.
A3. Dutch confabulation questionnaire

Naam: ................ Geslacht: M/V
Geb. Dat.: .................
1 = juist
2 = fout
3 = Ik weet het niet
4 = confabulatie

(1) Persoonlijk semantische herinneringen

- Wat is uw naam?
  1  2  3  4
- Hoe oud bent u?
  1  2  3  4
- Wat is uw geboortedatum?
  1  2  3  4
- Waar bent u geboren?
  1  2  3  4
- Wanneer bent u opgenomen in het ziekenhuis/verpleegtehuis?
  1  2  3  4
- Wat is uw huidige adres?
  1  2  3  4
- Leven uw beide ouders nog?
  1  2  3  4
- Waarom bent u in het ziekenhuis?
  1  2  3  4
- Bent u getrouwd?
  1  2  3  4
- Hebt u kinderen?
  1  2  3  4
- Hoeveel kinderen heeft u?
  1  2  3  4
- Hoe oud zijn uw kinderen?
  1  2  3  4
- Hoe oud was u wanneer u voor het eerst vader werd?
  1  2  3  4
- Wat zijn de voornamen van uw kinderen?
  1  2  3  4
- Wat zijn de geboortedaten van uw kinderen?
  1  2  3  4
- Welke voornamen hebben/hadden uw ouders?
  1  2  3  4
- Wat is/was de baan van uw vader?
  1  2  3  4
- Hebt u broers of zussen?
  1  2  3  4
• Wat zijn de voornamen van uw broers/ zussen?
  1 2 3 4

• Hebt u mij al eens eerder gezien?
  1 2 3 4

(2) Episodische herinneringen (bij enkel ja antwoord, doorvragen!)

• Wat hebt u gisterenavond gegeten?
  1 2 3 4

• Wat hebt u gisteren gedaan?
  1 2 3 4

• Wie hebt u vanmorgen gezien?
  1 2 3 4

• Waar hebt u afgelopen kerst doorgebracht?
  1 2 3 4

• Wat hebt u op uw laatste verjaardag gedaan?
  1 2 3 4

• Wanneer bent u voor het laatst naar een dokter geweest?
  1 2 3 4

• Wanneer bent u voor het laatst naar de bioscoop geweest?
  1 2 3 4

• Kunt u zich herinneren dat u voor het laatst naar een restaurant bent geweest?
  En zo ja, wanneer was dat?
  1 2 3 4

• Kunt u zich de dag van opname in dit ziekenhuis/verpleegtehuis nog herinneren? Wanneer was dat?
  1 2 3 4

• Weet u nog wat u aan het doen was op 11 september 2001 (flashbulb)?
  1 2 3 4

• Kunt u zich uw eerste dag op de middelbare school nog herinneren?
  1 2 3 4

• Wat kunt u zich nog herinneren van de geboorte van uw eerste kind?
  1 2 3 4

• Kunt u zich uw trouwdag nog herinneren?
  1 2 3 4

• Kunt u zich nog herinneren wanneer u voor het eerst in een ziekenhuis bent opgenomen?
  1 2 3 4

(3) Oriëntatie in tijd en plaats

• In welk jaar zijn we nu?
  1 2 3 4

• Welk seizoen is het nu?
  1 2 3 4

• In welke maand zijn we?
  1 2 3 4
• Welke datum is het vandaag?
  1 2 3 4
• Welke dag van de week zijn we?
  1 2 3 4
• Kun je schatten hoe laat het nu is?
  1 2 3 4
• Waar bevindt u zich nu?
  1 2 3 4
• In welk land bevinden we ons nu?
  1 2 3 4
• Op welke verdieping bevinden we ons nu?
  1 2 3 4

(4) Algemeen semantische herinneringen

• Wanneer begon wereldoorlog 1?
  1 2 3 4
• Wanneer begon wereldoorlog 2?
  1 2 3 4
• Wat gebeurde er met President Kennedy?
  1 2 3 4
• Wie is Brigitte Bardot?
  1 2 3 4
• Wie is koning der Belgen?
  1 2 3 4
• Wat gebeurde er op de avond van 6/3/1987 voor de Belgische kust?
  1 2 3 4
• Wat gebeurde er op 29/5/1985 in het Heizelstadion te Brussel?
  1 2 3 4
• In welke stad gingen de Olympische Zomerspelen in 1920 door?
  1 2 3 4
• Wie is Eddy Merckx?
  1 2 3 4
• Wat gebeurde er met de paus op 13 mei 1981?
  1 2 3 4

(5) ‘Ik weet het niet - semantisch’

• Welk beroep had de vader van Marilyn Monroe?
  1 2 3 4
• Wat is de naam van de hond van Bill Clinton?
  1 2 3 4
• Hoeveel kleinkinderen heeft voormalig premier Gaston Eyskens?
  1 2 3 4
• Welke club strandde in 1975 op de derde plaats in de Belgische eredivisie?
  1 2 3 4
• Welk land was in 1996 culturele hoofdstad van Europa?
  1 2 3 4
Implausibel

- In welk jaar werd Elvis tot president van Amerika verkozen?
  1  2  3  4

(6) ‘Ik weet het niet - episodisch’

- Kunt u zich nog herinneren wat u deed op 10 mei 1985?
  1  2  3  4
- Op welke dag gingen uw kinderen voor het eerst naar de markt?
  1  2  3  4
- Wanneer ging u in 1990 met vakantie?
  1  2  3  4
- Weet u nog hoeveel dagen u in 1990 gewerkt hebt?
  1  2  3  4
- Kunt u zich nog herinneren wat u deed op 30 april 1995?
  1  2  3  4

Implausibel

- Weet u nog wanneer u voor het eerst een reis maakte naar de zuidpool?
  1  2  3  4