ELSEVIER

Neuropsychologia 47 (2004) 727–744

NEUROPSYCHOLOGIA

www.elsevier.com/locate/neuropsychologia

Wishful reality distortions in confabulation: a case report☆

Aikaterini Fotopoulou[a,*], Mark Solms[b,c], Oliver Turnbull[d]

[a] *Science Laboratories, Department of Psychology, University of Durham, South Road, DH1 3LE Durham, UK*
[b] *Department of Psychology, University College London, London, UK*
[c] *University of Cape Town, Cape Town, South Africa*
[d] *Centre for Cognitive Neuroscience, School of Psychology, University of Wales, Bangor, UK*

Received 31 October 2003; accepted 19 November 2003

Abstract

Several theories have been proposed to account for the complex cognitive mechanisms underlying the various forms and manifestations of confabulation. As regards the *content* of confabulations, deficit accounts explain what is *lacking* in the confabulations, but accounts of the *positive* features of the content may also be required to explain what remains. There is reason to believe that the content of confabulations is not motivationally neutral; in particular, they appear to 'improve' the world experienced by the patient, making it more pleasant than the reality of the situation demands. The present study investigated the content of the confabulations of a neurological patient, ES: a 56-year-old man, who developed a striking confabulatory syndrome following removal of a meningioma in the pituitary and suprasellar region. ES's cognitive abilities were severely compromised, and he confabulated continuously and bizarrely. Raters presented with transcriptions of ES's confabulations found them to represent significantly more pleasant experiences than their corresponding, misrepresented realities. This finding suggests that confabulations include motivated (or 'wishful') content. The influence of this motivational feature of confabulation must be considered in parallel with the memory and executive deficits which contribute to the mechanism of confabulation.

Keywords: Amnesia; Memory; Motivation; Emotion; Executive functions

1. Introduction

Confabulations, i.e. inaccurate or false narratives about the world or the self (Berrios, 1998), were first comprehensively described by Korsakoff (1889). Confabulation affecting the recollection of autobiographical memories has since been widely studied. It is now known to occur with a variety of neuropathologies, including anterior communicative artery (ACoA) aneurysms, traumatic brain injury, tumour, and dementia (for recent reviews see Berrios, 1998; DeLuca, 2000; Johnson, Hayes, D'Esposito, & Raye, 2000; Kopelman, 1999; Schnider, 2003).

Despite the progress in identifying the prevalence and pathological anatomy of confabulation, a generally accepted theoretical account of its neuropsychological mechanism has yet to emerge. Attempts have been made to explain confabulation with reference to impairments of general executive dysfunction (Baddeley & Wilson, 1986; Benson et al., 1996; Kapur & Couchlan, 1980; Papagno & Baddeley, 1997; Stuss, Alexander, Lieberman, & Levine, 1978), temporality (Dalla Barba, 1995; Korsakoff, 1889; Schnider, von Daniken, & Gutbrog, 1996; Talland, 1961), memory control processes (Burgess & Shallice, 1996; Moscovitch, 1989; Schacter, Norman, & Koutstaal, 1998), and source monitoring (Johnson, 1991, 1997). Commonly, these interpretations explain the memory distortion in terms of categories of cognitive *deficit*.

In Jacksonian terminology (Jackson, 1932), these accounts have been informative with regard to 'negative' symptoms of confabulation, such as the semantic anomaly of its content (Dalla Barba, 1995), or the specification of the memory domains affected by confabulation (Burgess & McNeil, 1999; Dab, Claes, Morais, & Shallice, 1999; Moscovitch, 1995). However, when confronted with the 'positive' symptomatology of confabulation, most of these accounts face conceptual problems. For example, they cannot sufficiently explain why the content of confabulation should focus on particular themes, and why the content of specific confabulations should be so stable over time (for examples of content-specific confabulation see Burgess

☆ The study was carried out in the Psychology Department of University College London.

* Corresponding author. Tel.: +44-191-3343249; fax: +44-191-3343241.
E-mail address: aikaterini.fotopoulou@durham.ac.uk (A. Fotopoulou).

0028-3932/$ – see front matter © 2003 Elsevier Ltd. All rights reserved.
doi:10.1016/j.neuropsychologia.2003.11.008

& McNeil, 1999; Conway & Tacchi, 1996; Downes & Mayes, 1995; Jorn & Rybarczyk, 1995; Marshall, Halligan, & Wade, 1995; Villiers, Zent, Eastman, & Swingler, 1996). These 'fixed delusion' features of confabulation are better accounted for by models which include reference to unimpaired cognitive functions (Burgess & McNeil, 1999; Burgess & Shallice, 1996; Johnson, 1991) and motivational factors (Conway & Tacchi, 1996; Solms, 2000).

The positive aspects of confabulation are often reported in content-focused case reports. These reports suggest that confabulations involve 'some kernels of truth of genuine experience' (Talland, 1961) misattributed in time and space, and also that they are apparently influenced by factors of great affective importance (Mercer, Wapner, Gardner, & Benson, 1977), marked personal significance (Burgess & McNeil, 1999), or wish-fulfilments (Betlheim & Hartmann, 1951; Kaplan-Solms & Solms, 2000; Turnbull, Berry, & Evans, 2003; Villiers et al., 1996). Supporting the motivational nature of confabulations, confabulatory content has been claimed to frequently include personal grandiose references (Berlyne, 1972; Sabhesan & Natarajan, 1988), to allow patients to modify their self-image (Moscovitch, 1989; Weinstein & Kahn, 1955), or to allow them to avoid anxiety and adapt to challenging situations (Conway & Tacchi, 1996; Lidz, 1942; Weinstein, Kahn, & Malitz, 1956). The content also appears to be influenced by premorbid personality traits (Gainotti, 1981; Moll, 1915; Moscovitch, 1989; Talland, 1961; Weinstein, 1996; Whitlock, 1981; Williams & Rupp, 1938).

A synthesis between purely negative (deficit) and purely positive motivational accounts is offered by Conway and Tacchi (1996), who have argued that the highly specific nature of some confabulations may arise from combinations of damaged and preserved memory processes in autobiographical memory 'construction' (see also Solms, 2000). On this account, dysfunctional executive control processes are argued to compromise both the *search* of autobiographical memory and the *evaluation* of long-term memory output (see also Burgess & Shallice, 1996; Kopelman, 1999; Moscovitch & Melo, 1997; Schacter et al., 1998 for a review). Thus, patients are unable to distinguish between new memory constructions created by the 'current' self and ones grounded in (and constrained by) autobiographical knowledge. As a consequence, the degree of involvement in memory construction of the 'wished-for-self' is disproportionately larger than of the 'actual' self (Conway & Pleydell-Pearce, 2000). For example, the frontal patient OP, reported by Conway and Tacchi (1996), confabulated and persistently maintained a set of plausible, but false, memories that rewrote the disappointments in familial interactions of her past into a history of successful and supportive intimacy with certain family members.

This perspective, influenced by cognitive psychology (Bartlett, 1932) and recent studies in normal autobiographical memory (McAdams, 2001), conceptualises autobiographical memory as constructed from dynamic, fluid and situationally bound representations—influenced by the context in which they are produced (Conway & Pleydell-Pearce, 2000; Johnson, 1991; Johnson et al., 2000). It further assumes that remembering following brain damage, no matter how severely or mildly affected, will continue to have a constructive nature, and be subject to factors that have been identified as making normal subjects more prone to source misattributions and false memories. Accordingly, confabulation could be best understood as the magnification of existing normal misremembering mechanisms (Conway & Fthenaki, 2000; Johnson & Raye, 1998; Johnson et al., 2000), rather than a dysfunction of a previously flawless memory system. Thus, the specific form and content of confabulations will depend on the particular pattern of preserved and impaired memory processes. Indeed, some studies have already begun to recognise and address this complexity in the production of confabulation (Burgess & McNeil, 1999; Conway & Tacchi, 1996; Johnson, O'Connor, & Cantor, 1997; Kopelman, Ng, & Van den Brooke, 1997).

However evident the potential theoretical contribution of motivational factors in confabulation, there has been little experimental work investigating the issues raised by the anecdotal clinical descriptions upon which such accounts are based. The present study reports a patient who produced striking confabulations, and systematically measures a motivational feature of the patient's confabulation: the 'pleasantness' of its content.

2. Materials and methods

2.1. Case report

At the time of assessment, ES was a 56-year-old left-handed man. He was born in northern Italy and moved to southern Africa aged 11. He was an electronic engineer and a successful businessman. He was recently re-married, and had a young daughter. His wife described him as a highly active and knowledgeable person, one who likes "to chat to people and have control over situations". He had no psychiatric history.

In January 1997 ES was admitted to a regional hospital for the removal of an olfactory sheath meningioma in the pituitary and suprasellar region. The operation was uneventful, but the meningioma reoccurred in the same region, and in May 2000 he was readmitted to the hospital. In the second operation the meningioma was completely removed and, apart from post-surgical gliosis in the right temporal fossa and in the region of the sella turcica, the brain appeared normal in subsequent CT scans. However, the patient developed pituitary hypothyroidism and was placed on thyroxine until his thyroid hormone levels settled. MRI scans taken 1 year later were uninformative, showing only the changes caused by the craniotomy, i.e. gliotic change in the anterior aspect of the right temporal lobe, with a fairly large arachnoid cyst anteriorly in the right temporal fossa, and cortical

thinning and atrophy of the white matter in the right temporal lobe subjacent to the arachnoid cyst. It is assumed that this patient had sustained a peri-surgical lesion, not detected radiologically, in the basal forebrain or diencephalic region, the site of the meningioma, and it is this lesion that gave rise to his cognitive impairments. Confabulation following lesions in this area has been previously reported by various authors (Damasio, Graff-Radford, Eslinger, Damasio, & Kassell, 1985; Fischer, Alexander, D'Esposito, & Otto, 1995; Hashimoto, Tanaka, & Nakano, 2000; Luria, 1966; Wright, Boeve, & Malec, 1999, for a review).

On waking from surgery ES was severely disoriented and confused. One month post-operatively his mental function remained profoundly impaired, with mental clouding and disorientation. Thereafter there was a gradual improvement until he reached a stage where he was able to cope relatively independently at home. However, his memory abilities remained markedly and disproportionately impaired. He was often not aware that he was married, nor did he know the names of his relatives, and his orientation in time and place was poor. A gross reduction in motivation was also reported. His expressive output was confabulatory and incoherent, and he lacked any insight into his memory deficit.

Two months post-operationally ES was assessed clinically by a psychiatrist and diagnosed as suffering from a "Korsakoff-like" syndrome. His amnesia and confabulation were considered severe. He scored 21.5/30 (normal mean 29/30 ± 1.5) on the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975). Assessed 2 weeks later on the same test, his mental status had not improved significantly (22/30). Subsequently, ES underwent a 6-month cognitive rehabilitation programme, but according to his medical records "his amnesia and confabulation remained unaltered".

In addition to the above-described cognitive change, ES's eyesight was also poor. This was the case even before his surgery (he suffered from severe glaucoma), but it gradually deteriorated between his two neurosurgical operations—though apparently due to the recurrent meningioma rather than the glaucoma. After his second operation, ES reported some spared vision in the right eye, but this proved to be yet another confabulation; it was later confirmed that he had lost all vision in that eye.

2.2. Formal neuropsychological investigation

ES was referred to London in February 2001, where he underwent comprehensive neuropsychological assessment. His profound amnesia, disorientation and confabulation were still present, but he was cooperative during most of the testing sessions. His test performance is summarised in the Tables 1–3. ES's level of general intelligence (on the WAIS-R, Wechsler, 1945) (see Table 1) was lower than expected, based on his previous education and occupational level, with his lower Performance IQ attributable partly to his visual problems. His language abilities were only mildly compromised, apparently secondary to executive and organisational problems. He had intact comprehension and vocabulary, but impaired word finding (McKenna & Warrington, 1983) exaggerated by poor response suppression and error monitoring.

Table 1
ES's performance on the WAIS-R (Wechsler, 1981)

WMS subtest	SS
Verbal IQ	**103**
Information	10
Comprehension	11
Arithmetic	10
Digit span	8
Vocabulary	11
Similarities	9
Performance IQ	**91**
Digit symbol	6
Picture completion	6
Block design	7
Picture arrangement	5
Objects assembly	8
Full scale IQ	**96**

ES showed dramatic memory impairments in his everyday life: he was unable to retain new information for more than a few seconds, and he recalled practically nothing of his ongoing personal life with any degree of accuracy. These observations were confirmed by formal neuropsychological assessment. ES's performance on all tasks tapping recent memory (Table 2) was markedly impaired for both verbal and visual material. He scored very poorly on immediate recall tests, and frequently scored zero whenever a delay was introduced. There was clear evidence of confabulation even on these tasks. On immediate recall of the two passages from the logical memory subtest (WMS-R, Wechsler, 1945), ES distorted the stories by inserting new (but plausible) information, and on delayed recall (where he could not remember any of the correct items) he replaced them with

Table 2
ES's performance on tests of memory

Test	Performance	Normal data
Rey figure immediate recall[a]	0/36 (impaired)	
WMS visual reproduction[b]	6/14 (impaired)	8.7 ± 2.5
WMS logical memory[b]		
Immediate	2/23 (impaired)	7.3 ± 2.9
Delayed	0/23	
WMS paired associate learning[a]	3.5 (3, 0/3, 0/1, 0, impaired)	17.3 ± 33
Rey auditory verbal learning[a]	Trial I: 1 (impaired)	6 ± 1.4
	Trial II: 0 (impaired)	
	Trail III: 0 (impaired)	

[a] Standardization scores from Lezak (1995).
[b] Standardization scores from Spreen and Strauss (1991).

Table 3
ES's performance on tests of executive function

Test	Performance	Normal data
Hayling test		
Hayling overall score	SS 1/10 (impaired)	Percentile < 1
Verbal fluency	$F = 3$, $A = 2$, $S = 5$ (impaired)	Percentile < 1
Stroop test	Score: l71 s	
	Errors: 16/56 (impaired)	Percentile < 2
WCST	No. of category 2 (impaired)	4
	Personal errors 14	
	Total errors: 16 (impaired)	13
Cognitive estimates	Error score: 8 (impaired)	5th percentile
Buxton test	Errors: 13 (high average)	16 ± 5.7
Rey complex figure (copy)	35/36 (intact)	90th percentile
Weigl colour form sorting	No. of category 2 (intact)	
Luria rhythmic tapping	10/10 (intact)	

completely different elements. This pattern of performance is often observed in confabulating patients (Box, Laing, & Kopelman, 1999; Dalla Barba, 1993a; Dalla Barba, Boisse, Bartolomeo, & Bachoud-Levi, 1997a; Dalla Barba, Cappelletti, Signorini, & Denes, 1997b; Papagno & Baddeley, 1997). On the WMS-R paired associate learning test, ES produced four intrusions (all of them extra-list, not prior-list errors). However, no intrusions were observed on the Rey auditory verbal learning test.

ES's retrograde memory abilities were inferred from his answers to Dalla Barba's Battery (1993a), and from extensive interviews with the patient (see below). He exhibited a gross retrograde memory deficit, showing problems in ordering events in time, and a general confusion regarding the temporal context of events—a characteristic often seen as causative of confabulation (e.g. Dalla Barba, 2002; Schnider, 2000) but also reported as absent in other studies (Dab et al., 1999; Johnson et al., 1997). It is of some interest that ES was able to recall isolated events in some detail on certain occasions, but not others, suggesting that it was at times hard to gain access to information rather than that the information itself was degraded (Baddeley & Wilson, 1986; Conway & Pleydell-Pearce, 2000). Finally, although he frequently recalled the gist of remote events (e.g. he provided a coherent account of his wedding day), he was unable to recall specific details, or to recall the names of any of the guests. He appeared to compensate for this by initiating other (also incomplete) memory searches. In Baddeley and Wilson's (1986) terms he presented with a "clouded" autobiographical memory.

ES's performance on tasks measuring *executive functions* (Table 3) was markedly impaired on five tasks, i.e. verbal fluency, Stroop test (Trenerry, Crosson, Deboe & Leber, 1989), WCST (Heaton, 1981), cognitive estimates (Shallice & Evans, 1978) and Hayling test (Shallice & Burgess, 1997), while no impairment found on a further four tasks, i.e. Brixton test (Shallice & Burgess, 1997), Rey Complex Figure Copy, Weigl colour-form sorting and tapping test (Luria, 1966). Of the five on which he was impaired, two involve attention, response initiation and suppression abilities, and one involves reasoning and general problem-solving capacities. The rest concern cognitive flexibility and set-shifting abilities. These mixed results on tasks of executive performance are, of course, a pattern not uncommon among frontal patients (Shallice & Burgess, 1991).

2.3. Nature of ES's confabulation

Collecting systematic data on confabulating patients presents several difficulties, especially as regards quantifying and characterizing the confabulatory material (Johnson & Raye, 1998). Furthermore, dissociations have been observed between the presence of confabulation in everyday life and in neuropsychological testing (Conway & Tacchi, 1996; Papagno & Muggia, 1996). Nevertheless, the role of behavioural observations, and detailed descriptions of specific confabulations in case reports, remains an important source of information for understanding the nature of confabulation. ES's confabulations were ubiquitous, and he produced them even when there was no verbal or any other evident perceptual probe. For example, ES would greet the examiner with questions such as "Was somebody chasing us? Just now, out in the street, I saw somebody chasing us"; or, he would interrupt a session, asking his examiner: "Where is my beer?" and look for a bottle on the desk.

Furthermore, ES defended his false beliefs strenuously, and he failed to acknowledge their unreliability, to the extent that he often acted upon his confabulations (see also Schnider et al., 1996). For example, he once refused to leave the clinic with his wife because he initially insisted that he was not married to her. He then added that she was his "other wife", but he was waiting for the "first one" to come and pick him up. More often, ES would ask the examiner for permission to "phone the gate" to check the whereabouts of his car, or to "ask the guys" for details of the business affairs he was talking about, but had forgotten.

Many of ES's confabulations were moderately plausible, so that it was hard to identify them without detailed knowledge of his everyday life. However, he occasionally also produced bizarre and implausible confabulations. For example, ES: "I had gone to see Dr. S. Quite a few doctors, I think. Well in the last 3 years they replaced, basically, my eyes." Examiner: "They replaced your eyes? What did they replace? The lenses?" ES: "No, no. He started with, about 4–5 years ago, I used to come and he used to try my eyes and say, 'that eye, the lens is not working properly'. He used to take the lens off, polish it, or replace it". Examiner: "The lens in your spectacles?" ES: "No, my eyes."

ES's confabulations were typically accompanied by denial of deficit (anosognosia). Schacter and Prigatano (1991) have distinguished between unawareness of the existence of a neuropsychological deficit *itself*, and unawareness of some of the consequences of the deficit. The examples below illustrate that while ES appeared to be unaware of his memory deficit, on several occasions (when confronted) he accepted the consequences of these deficits, and tried to find alternative explanations. Some examples, (1) examiner: "Do you sometimes confuse memories?" ES: "It's a few glasses of drink . . . It's once a year". (2) Examiner: "Your memory is failing you?" ES: "It is. More than failing is that I am not interested in helping it along . . . You talk to me and say, let's say for example, 'I'll see you now at five o'clock in the afternoon and we can go for a beer and have a swim'. Examiner: "You won't remember that?" ES: "I won't bother. Do you understand the difference?" (3) Examiner: "And how about your memory? How is that doing?" ES: "Old age. Everyone would like to have a better . . . , but we get to a certain age in life which you have to accept".

Although ES's confabulations often appeared to consist of previously real events misplaced in time or place, he also often produced "memories" completely unrelated to his previous or current life. For example, on different sessions ES claimed that he had a Porsche and a Maserati, that he was a race-car driver, that he was working at a Grand Prix selling bags, that he was working with the police doing chemical analysis, that he had two grown up sons, that his older son had a motorcycle (in reality he has only one daughter). The complete inaccuracy of these 'memories' was verified by his wife and brother.

While ES's confabulations often had an ephemeral character, and their content did not share the specificity and constancy described by some authors (e.g. Burgess & McNeil, 1999; Conway & Tacchi, 1996; Dalla Barba, Cipollotti, & Denes, 1990), several distinguishable themes did emerge. For example, very frequently (i.e. several times per hour, in the sessions reported below) ES had the impression that he was in some professional situation and location, and deeply involved in demanding professional activities. Furthermore, almost every time he became short of breath (for example when walking upstairs to the testing room), or when he tired of the examination, he would 'recall' some pressing arrangement for rugby, tennis, squash or other sporting activity that required him to leave soon. He would also often talk about his past medical problems and treatments, but significantly he would almost always describe a *successful* final outcome. ES would also frequently describe current events that included his parents, although both his parents were no longer alive.

ES's severe achronogenesis denied him access to correct information on the temporal ordering of events (Schnider, 2000). However, he insisted on providing explicit temporal 'tags', usually mistaken and inconsistent with each other, for almost every memory. Perceptual details were absent or rarely present in the patient's recollections. Such features might have helped him determine the veridicality of his recollections (Johnson et al., 1997). For example, examiner: "We were talking about your memory problems, I am not sure why it made you think of that . . . " ES: "Well let's see; start at the beginning of the year. There were all these rooms we had set up and eventually something happened here and then they connected the very old . . . or whatever . . . My results were quite good. But my partner was supposed to be Frank, not Frank F, Frank . . . Anyway he started things about 3–4 years ago at the other side of [the University]. Off . . . campus, where they did safety blasting . . . and I did most of this in M [the site of a chemical and explosives factory.] . . . and, um, they finished about April last year . . . got back um . . . August, September, October, November, October. And they seemed to be very good results. But I mean, from when I started there about 4 years ago, there have been about 20 of us. Last year when we finished I think there were about two of us. But they are separate results because it was the best thing."

In summary, ES's memory recall was contaminated by an enormous amount of confabulation, produced both spontaneously and with provocation. It was not restricted to plausible information, past events misplaced in time, or specific and constant events, but included bizarre and implausible accounts of events that never took place in the past, and showed some theme specificity and constancy. The patient was unaware of his amnesia and confabulation, although he would (when challenged) demonstrate some awareness of the consequences of his memory difficulties.

3. Experimental investigations

3.1. Assessment of confabulation

In order to address the nature of ES's confabulations formally, the confabulation battery of Dalla Barba (1993b) was administered. This test consists of six subsections of questions, concerning personal semantic memory, episodic memory, orientation in time and place, general semantic memory, and "I don't know" semantic and episodic memory sections. When necessary, the questions were adjusted to the patient's cultural background (see also Box et al., 1999), e.g. "Who is Nelson Mandela?" replaced "Who is

Charles De Gaulle?" The test was administered in one session and the patient's answers were recorded on audio- and video-tape. A full transcription of the sessions was made. Kopelman et al. (1997) healthy control (aged 44 and 42) scores on the same battery were used to compare ES's performance. In order to corroborate ES's memory statements, five extensive interviews were conducted with the patient's wife, and one shorter interview was conducted with his oldest brother. Dalla Barba's criteria (1993b) for classifying answers were followed as closely as possible.

4. Motivated distortions of reality

4.1. Eliciting confabulations

4.1.1. Patient ES

Twelve 1 h long interviews were conducted with the patient on 12 successive days (excluding Sundays), at the same time every day and in the same room. The examiner's role in the interviews was restricted to setting some initial everyday conversational questions, reflecting the patient's statements, asking for clarifications when needed, and providing information or explanations when required by the patient. These minimally guided interviews allowed the patient himself to choose the topics discussed, the amount of detail given, the time dedicated to each theme, and the temporal reference of each topic (e.g. past, present or future events). The aim was to obtain a representative sample of ES's confabulations, as these spontaneously occurred in his everyday interactions. The interviews were recorded on audiotape and fully transcribed.

An unselected, consecutive listing of the first 155 confabulatory statements, as they occurred in the transcripts of the first six sessions, were presented to naïve raters (see later), along with a synopsis of the general situation in which they arose. The confabulated statements were set in bold letters, for purposes of identification. Each confabulation was accompanied by (verified) 'real' information, set in parentheses. The 'real' information distorted or replaced by the corresponding confabulation was provided by ES's wife and brother, and by the examiner. For example, (1) ES claimed that he had undergone a heart operation (example 4 in Appendix A). His relatives pointed out that this was false and this simple fact was presented to the raters but the exact and rather obscure associations, which the patient provided, were left to their judgment. (2) When the patient suddenly associated a work project with a hole in his head (which he touched and mentioned to his examiner) the true cause of this "hole", i.e. the craniotomy, was revealed to the raters, but the patients associations were again left to their judgment (example 3 in Appendix A).

Inclusion criteria were false memories or beliefs stated by the patient regarding any past, present or future object (event, fact or situation), as determined by the verified information collected from his relatives. Exclusion criteria included correct information (non-confabulatory valid memories or thoughts) or information impossible to verify, which meant that it was impossible to present to raters a comparable corresponding reality. However, repeated, incoherent or obscure confabulatory statements, were not excluded from the list, since this would require arbitrary decisions, by the experimenter. Instead, the raters themselves were given the option to characterise statements as 'unclear/impossible to judge'.

Although common methodological practice might require randomly ordering the sequence of confabulations between different groups of raters, in this case the natural unfolding of the conversation often revealed the bizarreness of a memory, or helped establish its implausibility, and therefore the sequence of the material was preserved.

4.1.2. Controls

The question of 'control' investigations of confabulation is complex: confabulation in neurologically normal subjects, unlike in confabulating neurological patients, can only be studied in experimental conditions. However, existing experimental paradigms which elicit false memories in controls (Barclay & DeCooke, 1988; Loftus, 1993; Loftus & Pickrell, 1995; Loftus, Miller, & Burns, 1978; Suengas & Johnson, 1988) do not require the controls to generate their *own* material. Typically, all (Heaps & Nash, 2001; Hyman & Billings, 1998; Hyman & Pentland, 1996; Johnson, Foley, Suengas, & Raye, 1988; Suengas & Johnson, 1988) or part of (Conway, Collins, Gathercole, & Anderson, 1996) the false and true events tested are chosen, constructed and/or manipulated by the experimenters (see also Lampinen, Neuschatz, & Payne, 1998; Pezdek, Finger, & Hodge, 1997). To address this problem, the present study proposes a method of eliciting false memories in control subjects which allows them to spontaneously choose the theme, temporal reference, importance, amount of detail and emotional valence of each memory produced.

Six male adults (mean age 55 years, range 53–58 years) were asked to generate 20 self-referential but false statements each, and provide corresponding 'real' information about each statement. False statements were defined as: events or facts related to one's self which were in fact completely incongruent with the subject's past, or which distorted the subject's past experience in some way. Participants were told that such facts could potentially include any topic of their preference, could be recent or remote, short or long, important or trivial, emotional or neutral. It was also stressed to the participants that their self-generated false statements could involve great or no relation at all with their previous lives—but it was essential that such statements had at least one element of fabrication or distortion that involved their personal past or present.

To increase the ability of the control group to 'simulate' confabulations, six examples of ES's confabulations, balanced for valence (i.e. two positive, two negative and two neutral confabulations) were read out to them. These examples included a variety of topics and were either false

statements (e.g. “My brother is dead”) or false events narrated in detail (I bought a Ferrari 2 years ago when my mother had . . .). They also included recent and remote events’ distortions, as well as extreme fabrications. This range was pointed out to the subjects, with the goal of providing them with a comprehensive and balanced set of possible confabulation types, as these are exemplified in the literature. It was then explained to them that they should use these examples merely as illustrations, and should construct their own false memory statements in a spontaneous and self-related way.

The corresponding reality of each of ES’s confabulations was also read out to them and they were informed that following each false statement they constructed, they would also have to describe the most relevant corresponding true situation or fact. For example one of the control subjects stated: “Yesterday evening leaving the pub I saw two very big fat lads trying to attack a young pretty-looking girl”. When asked for the corresponding reality of the above false memory he said: “The two fat lads were drunk but they were just having fun, not doing anything violent, you know”. Another control participant said: “I feel great today because the reviews I’ve got from my painting exhibition were beyond my expectation. It was my third exhibition and particularly the international reviews were wonderful”. When asked for a true statement in relation to the above he said: “I am not a painter, I am a chemical engineer. I did follow a painting summer school in the past though”.

Their statements were recorded and fully transcribed. For each of the six control participants, a list of 20 false statements, each followed by corresponding reality information, was presented to the raters (see below). The overall questionnaire format was identical to that of ES’s confabulation questionnaire.

4.2. Rating procedure

In order to investigate the possible ‘positive’ distortions in the content of ES’s confabulations, 15 raters were asked to rate the pleasantness or unpleasantness of the confabulated events and facts described by the patient in comparison with the corresponding reality (i.e., the events and facts distorted or replaced by the confabulation). The raters were 15 adults, eight males and seven females, of higher educational level (the mean number of years of education was 11) and mean age 38 years (range: 26–59 years). All were blind to the hypotheses of the study.

In order to investigate similar or different tendencies in the content of the false memories produced by the control participants, two of the naïve raters mentioned above (males of ages 55 and 52) were asked to rate the 120 false memories produced.

Raters were given the listings of ‘confabulations’ (here referring also to false statements generated by controls), and asked to judge whether the invented situation described in each of the presented ‘confabulations’, when compared to the actual reality (given in parenthesis alongside each ‘confabulation’), was more pleasant or more unpleasant from the perspective of the patient or the subject. Ratings were given on a seven-point Likert-type scale, anchored at 1, extremely unpleasant to 7, extremely pleasant. In cases when the raters were unable to make a judgement, they were asked to characterise these ‘confabulations’ as “Impossible to judge”. Finally, the option was provided for the raters to make any qualitative comments regarding their judgement.

For example, in the following instance the judges had to decide, using the seven-point scale, whether ES’s statement regarding his false belief that he travelled to the clinic by car was more pleasant or more unpleasant than the corresponding reality, which in this case was the fact that he travelled to the clinic by bus:

Example: Confabulation 128. The patient explains how he got to the clinic:

Usually I come in my car.

(In reality, the patient comes by bus.)

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

This particular confabulation was judged as slightly more pleasant than the corresponding reality with a mean score of $M = 4.58$ (see Appendix A for more examples).

All subjects, including raters, gave written informed consent. Raters were paid to participate in the study. The study was approved by the local research Ethics Committee.

4.3. Data analysis

In order to avoid confounding the data analysis with confabulations that many raters had evaluated as “Impossible to judge”, an additional criterion of exclusion was used. If more than 5/15 raters agreed that a confabulation ES made was impossible to judge, this confabulation was excluded from the analysis. A similar criterion was not applicable in the rating of the controls’ false memories, because none of the self-generated memories was considered impossible to judge. Following from the use of the seven-point scale, ratings below the 4/7 Likert mid-point were considered negative (unpleasant), and ratings greater than 4/7 were considered positive (pleasant).[1] Ratings of 4/7 were rated as neutral.

[1] The use of the characterisations “positive” and “negative” here refers to the pleasantness and unpleasantness of the confabulations and not to ‘negative’ and ‘positive’ symptoms in the Jacksonian sense.

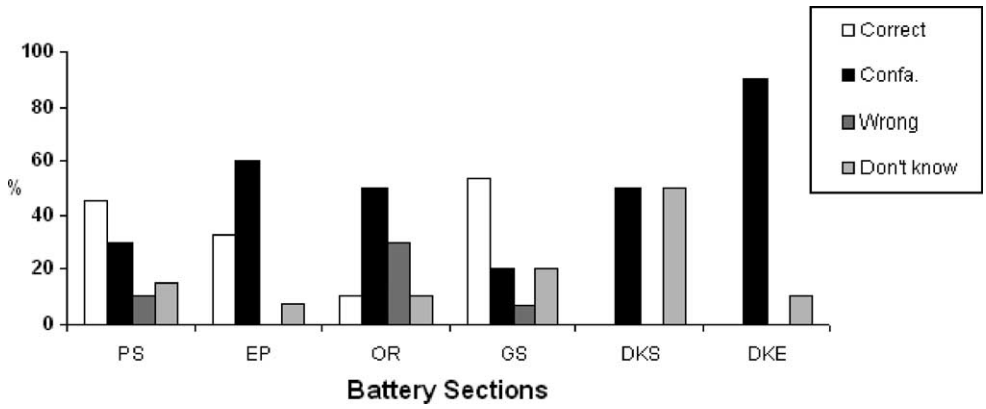

Fig. 1. ES's performance on the confabulation battery. PS, personal semantic; EP, episodic; GS, general semantic; DKS, 'Don't Know' semantic; DKE, 'Don't Know' episodic.

5. Results

5.1. Confabulation battery results

Fig. 1 shows ES's general performance, in percentage terms, across each category of items within the confabulation battery. Fig. 2 shows the percentage of confabulatory statements made by ES and by normal subjects across all sections.

ES confabulated in every section of the battery. The most striking confabulatory tendency was observed in response to the "Episodic Memory" items (60%) and "I don't know" episodic questions (90%). Similar patterns of results has been documented in other confabulating patients (Dalla Barba, 1993a; Dalla Barba, Mantovan, Cappelletti, & Denes, 1998; Kopelman et al., 1997).

Somewhat surprisingly, ES confabulated only minimally in response to General Semantic questions (6.6%), in contrast with Kopelman et al.'s (1997) confabulating and control subjects who produced more confabulations in this section. This result could be partly attributed to ES's higher educational level (university degree in engineering) in comparison with control subjects. It should also be noted that ES produced a substantial number of correct responses (53.3%) in this section.

These responses concerned mainly questions referring to the remote past (e.g. When did the first World War start?); while more mistakes and confabulations were produced as the facts which he had to recall became more recent. Although, this suggests a possible temporal gradient in his retrograde general semantic memory, a test such as that employed by Kopelman et al. (1997) which distributes events knowledge requirements and exposure evenly in time is needed to verify such a conclusion. Indeed they observed a temporal gradient in their patient's retrograde semantic memory, particularly in the recognition version of the test used.

In both the "I don't know" sections the patient confabulated freely, in contrast to control subjects. This performance has not been observed in all confabulating patients, as some do not confabulate at all in these sections (Box et al., 1999; Dalla Barba, 1993a,b; Dalla et al., 1997b). Nevertheless, ES's performance was similar to that of other patients (Dalla Barba, 1995; Kopelman et al., 1997) in that he

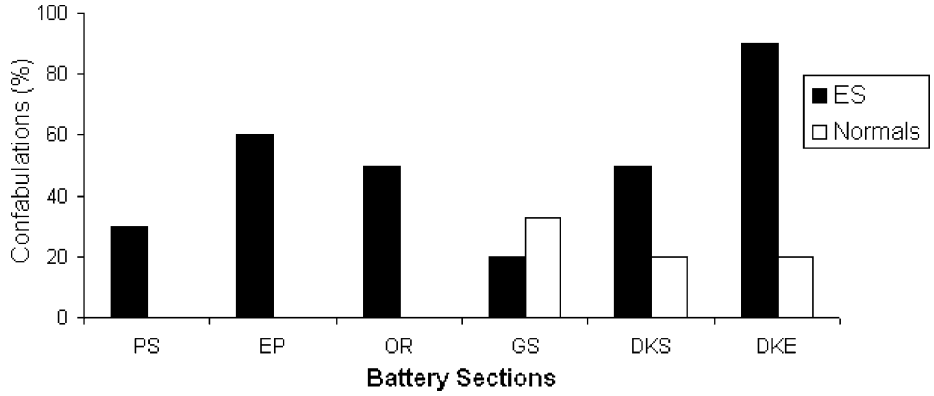

Fig. 2. Percentage of confabulations: comparison with controls. PS, personal semantic; EP, episodic; GS, general semantic; DKS, 'Don't Know' semantic; DKE, 'Don't Know' episodic.

clearly showed a tendency to confabulate more in response to episodic "I don't know" questions, than semantic "I don't know" questions.

Overall, in the 60 questions comprising the battery (excluding the "I don't know" sections which have independent scoring criteria, i.e. where correct answers are the "I don't know answers"). ES's answers were either correct or confabulatory, with 23 correct answers (38.3%) and 21 confabulations (35%). Wrong answers and "I don't know" answers were less common, at 11.6 and 23.3%, respectively. In sum, therefore, ES can be classified unequivocally as a confabulating patient, showing confabulation in both episodic and semantic memory.

5.2. Affective valence results

Confabulations, the affective valence of which the raters found "Impossible to judge" on the exclusion criterion developed earlier, totalled six (3.9%). These were not included in the analyses. The data consisted of the remaining 149 confabulations, each of which were judged by more than 10/15 raters. Inter-rater reliability was good (alpha = 0.92). There were no significant differences between the ratings of male and female judges.

As regards the control data, there were no false memories whose affective valence the raters found "Impossible to judge". Thus, the control data consisted of 120 false memories. Inter-rater reliability between the two raters was good ($r = 0.87$, $p < 0.001$).

5.2.1. ES: estimating 'pleasantness' by comparing frequencies

Out of 149 confabulations, 118 (79.2%) were rated as positive (pleasant) ($M = 5.42$). Two (1.3%) confabulations were judged as neutral, and 29 (19.5%) confabulations were judged as negative (unpleasant) ($M = 3.21$). Thus, many more confabulations were rated as positive than negative and neutral. A χ^2 goodness-of-fit test confirmed the significance of the observed difference, $\chi^2(2) = 148.4$; $p < 0.01$.

5.2.2. ES: estimating the 'degree of pleasantness' by comparing means

The overall mean of the 149 confabulations was 4.98, and the 95% confidence interval for mean extended from 4.80 to 5.12. A one-sample *t*-test showed that the difference between the sample mean and the hypothetical mean value (4, or neutral) was highly significant, $t(148) = 11.17$; $p < 0.001$. These results confirmed that the content of the confabulations were significantly more positive (i.e. more pleasant) than neutral or negative (unpleasant).

5.2.3. Controls: estimating 'pleasantness' by comparing frequencies

Out of 120 false memories, 55 (46%) were rated as positive (pleasant), 18 (15%) were judged as neutral, and 47 (39%) false memories were judged as negative (unpleasant). A χ^2 goodness-of-fit test failed to reject the null hypothesis that there is no emotional bias ($\chi^2(1) = 0.83$; $p > 0.05$), indicating that the false memories of control subjects did not distort reality in any given emotional direction (pleasant or unpleasant).

5.2.4. Controls: estimating the 'degree of pleasantness' by comparing means

The overall mean of the 120 false memories was $M = 4.13$, S.D. = 1.2. A one-sample *t*-test showed the difference between the sample mean and the hypothetical mean value (4, or neutral) was not significant, $t(119) = 1.23$, $p > 0.05$. One-sample *t*-tests also showed the same results for the false memories of every individual control, $t(19)$, $p > 0.05$, with values ranging from 0.28 to 1.92. These results show that, although the false memories produced by control subjects were generally rated as slightly more positive than reality, they did not differ significantly from the hypothetical neutral rating.

5.2.5. ES and controls: comparing 'pleasantness' frequencies directly

ES produced a substantially higher number of pleasant, rather than unpleasant and neutral, confabulations. In contrast, controls produced marginally more unpleasant and neutral false memories than pleasant ones. This difference was significant ($\chi^2 = 32.23$; d.f. = 1; $p < 0.01$) between the groups (ES versus controls) and emotional valence ratings (pleasant versus unpleasant and neutral). This finding is depicted in Fig. 3.

5.2.6. ES and controls: comparing 'pleasantness' means directly

When examined independently, as well as combined, controls subjects had lower means of pleasantness than ES (ranging from 3.57 to 4.47). There was a significant effect of control group on pleasantness rating, $F(6, 262) = 8.13$; $p < 0.01$, as tested using one-way ANOVA. Furthermore, planned contrasts revealed that ES's confabulations were rated as significantly more pleasant than controls' false memories, $t(213) = 6.07$, $p < 0.01$. These results are depicted in Fig. 4.

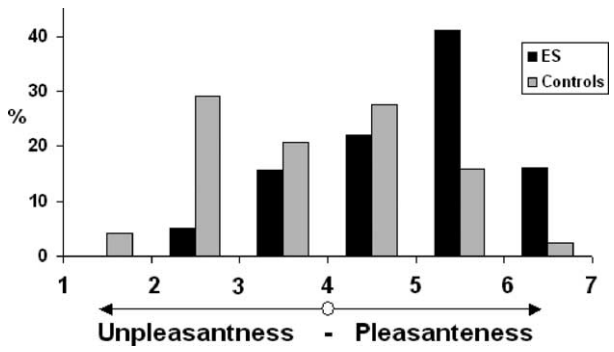

Fig. 3. Percentage of pleasant and unpleasant 'Confabulations': ES and controls.

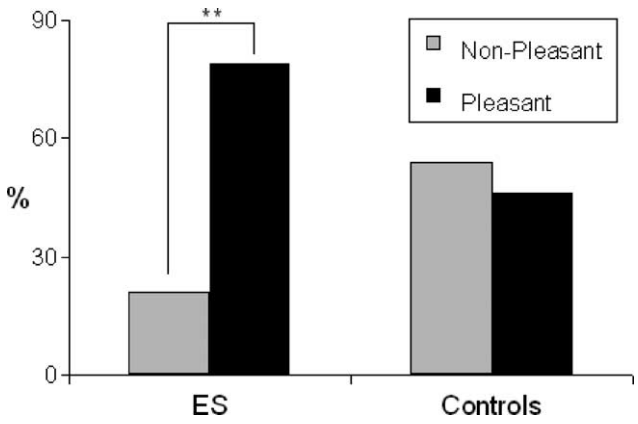

Fig. 4. Percentage of mean pleasantness scores for ES and controls.

In summary, both direct and indirect comparisons between control subjects and ES revealed significant differences between the groups in the frequency and magnitude of 'confabulations' rated as pleasant rather than neutral or unpleasant. Control subjects overall showed a marginally (and non-significant) positive bias in their 'false memories', which was significantly different from the marked bias towards pleasantness seen in ES's confabulations.

6. Discussion

In the context of profound memory loss and selective executive dysfunction, ES showed abundant evidence of confabulation. His confabulations were produced without provocation, had strikingly bizarre content, and were often acted upon. ES would be classified as a 'spontaneous', 'fantastic' or 'severe' confabulator, according to the criteria set by different authors. Our preliminary task was to identify whether ES's bizarre memories and beliefs are explicable with reference to previously proposed accounts of confabulation, focussing on general executive dysfunction (Baddeley & Wilson, 1986; Benson et al., 1996; Kapur & Couchlan, 1980; Kopelman, 1987; Luria, 1976; Papagno & Baddeley, 1997), temporal confusion (Dalla Barba, 1995; Korsakoff, 1889; Schnider et al., 1996; Talland, 1961), impaired semantics (Dalla Barba, 1993b), some specific memory control impairment (Burgess & Shallice, 1996; Moscovitch, 1989; Schacter et al., 1998), or a combination of the above deficits.

6.1. Confabulation and executive functions

A frontal lesion was not demonstrable by neuro-imaging but this does not exclude the possibility of frontal abnormality. Although ES was not impaired on all executive tests assessed (e.g. Brixton test, Weigl colour form sorting, tapping test) his impaired performance on various tests (e.g. cognitive estimates, Hayling task, WCST) clearly demonstrated executive dysfunction. This finding is consistent with other studies which have proposed that a specific, rather than a general, executive disorder, is associated with confabulation (Burgess & Shallice, 1996; Johnson, 1991; Johnson et al., 1997; Kopelman et al., 1997; Schnider et al., 1996). However, the finding of executive dysfunction does not, by itself, predict confabulation and nor does it explain the nature of the confabulatory content in ES.

6.2. Confabulation and temporal confusion

The nature of ES's retrograde amnesia is highly informative. He had clear difficulties in sequencing recent and remote events in time and could not date events about which he had good episodic knowledge. Furthermore, ES's performance on the orientation in time and place section of the confabulation battery was markedly defective and contaminated by confabulation. Finally, his persistent and spontaneous tendency to date events resulted in the same episodes being variously defined in time, without his being aware of the emerging contradictions. However, achronogenesis by itself does not account for the nature of ES' confabulation, which clearly involved more than mere temporal dislocations. A substantial number of ES's confabulations were unrelated to his present or past life, so that his confabulations could not be described as valid memories misplaced in time.

The presence of both types of confabulation (temporal confusion of events and fabrication of events) suggests that the motivational bias identified in the present study cannot be accounted for by either temporal confusion or fabrication of events alone. Rather, both types of confabulation appear to have been recruited in the service of wishful distortion. For example, ES misidentified his unsuccessful brain operation as a successful dental procedure he underwent some years previously (temporal confusion), and he claimed he owned various Italian sports cars which in reality he never owned (fabricated events). This suggests that motivational bias represents an additional feature of confabulation, which needs to be considered in any account of its underlying mechanism(s).

6.3. Confabulation and semantic processing

Although ES gave confabulatory answers to one-third of the personal semantic memory questions, and to half the "I don't Know" semantic questions, he confabulated only minimally in response to the general semantic items of the confabulation battery. Kopelman et al. (1997) have claimed that the semantic and episodic confabulations in their patient AB were produced by distinct cognitive impairments, i.e. perseveration and temporal confusion, respectively. Although such differences were not observed in ES, the behavioural observation that his retrieval latency for answers to semantic questions, and particularly those that he answered correctly, appeared to be shorter, combined with ES's high educational level and the number of correct answers he gave in this section, suggests that ES's low confabulation score in general semantic memory may be explicable

by his preserved ability to retrieve such information directly, without requiring 'generative' or 'strategic' retrieval control processes (Burgess & Shallice, 1996; Conway & Pleydell-Pearce, 2000; Moscovitch, 1989; see also below).

By contrast, in episodic memory (but also in personal semantic knowledge, and in semantic 'I don't know' memory questions in which he did not or could not know the answer) ES produced many confabulations. In this section, ES showed "clouded" retrieval (Baddeley & Wilson, 1986) suggesting an inability to achieve a successful "generative retrieval cycle" (Conway & Fthenaki, 2000, p. 297) and to accurately contextualise (including temporally) a memory within his personal history (Conway & Fthenaki, 2000; see also later).

Finally, ES's confabulation was not confined to episodic memory; it clearly also affected his semantic memory, although apparently to a lesser extent. This finding, in combination with the described 'implausibility' of ES's confabulations, is consistent with Dalla Barba's (1993a,b) hypothesis (see also Dalla Barba et al., 1997b, 1998; Nedjam, Dalla Barba, & Pillon, 2000) to the effect that the appearance of confabulation is determined by an impairment in monitoring, but the *implausibility* of its content is determined by the presence of a semantic deficit. However, this begs the question whether a semantic deficit by itself can account for the multiple features of ES's confabulations.

6.4. Confabulation and retrieval control processes

Which *specific* memory control impairments might account for ES's implausible confabulations? Firstly, the neuropsychological findings show a marked impairment in response suppression, as revealed by his poor performance in the Hayling, Stroop and verbal fluency tasks. Such deficits appear to be linked in confabulating patients with their inability to suppress irrelevant memory traces and disengage from current representations, in order to initiate 'volitional' memory search procedures (Burgess & Shallice, 1996; Cunningham, Pliskin, Cassissi, Tsang, & Rao, 1997; Mercer, Wapner, Gardner, & Benson, 1977; Moscovitch, 1989; Shapiro, Alexander, Gardner, & Mercer, 1981). Consistent with this, ES appeared to be unaware of the contradictions in, and the implausibility of, his memory recollections, suggesting an impairment in the monitoring (Moscovitch, 1989) or editing (Burgess & Shallice, 1996) of memory output. Finally, ES's poor performance on the cognitive estimates test, including unreasonable responses, are consistent with a damaged 'mediator' (i.e. problem-solving) mechanism in memory retrieval (Burgess & Shallice, 1996). The principal finding of the present study demonstrates, however, that these retrieval control deficits do not result in 'random' retrieval errors. The irrelevant memory traces that ES was unable to suppress, for example, displayed an affective content bias. This bias requires an explanation which supplements existing cognitive 'deficit' accounts (although see Burgess & McNeil, 1999; Burgess & Shallice, 1996 discussed below).

In summary, ES's confabulatory syndrome presented negative features consistent with several recent accounts of the neuropsychological basis of confabulation, but none of these accounts seem capable of explaining all aspects of his confabulation syndrome (see Burgess & McNeil, 1999; Johnson et al., 1997; Kopelman et al., 1997; Shapiro et al., 1981 for other multiple impairments explanations).

7. The pleasantness of ES's confabulations

ES's confabulations were rated as significantly more pleasant than the corresponding actual reality. In contrast, the valence of the control subjects' confabulations was not significantly biased either positively or negatively. In the light of existing theories, the 'positive valence' distortions of ES's memory might be interpreted in two ways.

7.1. A conscious intention to fill gaps in memory

According to this view, the patient's conscious wishful thoughts and memories might actively cause confabulation. This interpretation would be similar to the well-known 'gap-filling' account, according to which confabulation occurs as a purposive act contrived by the patient to spare him from the embarrassment of not being able to remember the events of his life (Barbizet, 1963, cited in Berlyne, 1972; Bonhoeffer, 1901, cited in Talland, 1965). Indeed, among all the sections of the confabulation battery, ES showed the highest rate of confabulatory answers (90%) in the episodic "I Don't Know" section, which appears to favour the gap-filling hypothesis (Dalla Barba et al., 1997b; Kopelman et al., 1997; Schnider et al., 1996). However, this explanation seems incomplete in ES's case since, as the formal testing and the behavioural observations reveal, he was profoundly amnesic *and unaware* of his memory deficit. Thus, his wishful confabulations were unlikely to have been *conscious* attempts to compensate for memory loss. The possible relationship between motivated confabulation and anosognosia clearly warrants further study, given that "no generally accepted theory of anosognosia exists in neuropsychology" (Burgess & Shallice, 1996, p. 398) to which the present findings could be related.

7.2. Combinations of and interactions between preserved and damaged processes

A second possible explanation would be that ES's pleasant and wishful thoughts were not *causative* of his confabulations, but rather contributed to the content of his confabulations by way of the *retrieval processes used in normal autobiographical memory*. This explanation would be consistent with accounts that explain confabulation through complex combinations of damaged and spared memory functions (Conway & Tacchi, 1996; Downes & Mayes, 1995; Johnson et al., 1997; Kopelman et al., 1997; Prigatano & Weistein, 1996).

Normal distortion in autobiographical memory has been widely studied, and these investigations provide a useful background to the present findings. The latter revealed that control participants, in contrast with ES, showed only a mild positive bias in constructing false memories on experimental demand—although the differences in self-engagement and motivational complexity between the two experimental procedures should be taken into account. In this light, it is assumed that the positive bias found in this study would be even greater in the reconstruction of one's own past in natural settings. The latter assumption is consistent with recent findings of studies on autobiographical memory (for reviews see Conway & Pleydell-Pearce, 2000; McAdams, 2001; Pillemer, 2001; Singer & Salovey, 1993; Stein, Wade, & Liwag, 1997; Walker, Skowronski, & Thompson, 2003; Woike, Gershkovich, Piorkowski, & Polo, 1999), which highlight the connection and interdependence of self-goals and autobiographical memory.

More specifically, autobiographical memory appears to serve purposes of identity formation, self-coherence, and emotion-regulation (Barclay, 1996; Bluck & Habermas, 2001; Conway, 1996; Fivush, 1998; McAdams, 2001; Neisser, 1988; Pasupathi, 2003; Pillemer, 1992). Such purposes, as well as other self-focused motives, appear to facilitate access to specific autobiographical memories (Conway & Pleydell-Pearce, 2000; Woike, 2003). Crucially, memory distortions of event content, time reference or significance serve the purpose of positive self-appraisal (De Vries, Blando & Walker, 1995; Greenwald, 1980; Wilson & Ross, 2003); and distortions of emotional intensity are employed in order to sustain a pleasant representation of one's autobiography (for a review see Walker, Skowronski, & Thompson, 2003).

Taken together, these data suggest that although memory distortion is typically minimal in the construction of normal autobiographical memory, personal goals and emotions may be particularly salient in the distortion process. Thus, despite the many apparent differences between confabulation and normal memory distortion, the two phenomena may share underlying motivational factors.

Conway and his colleagues (see Conway & Fthenaki, 2000; Conway & Pleydell-Pearce, 2000 for recent reviews) have put forward a model of autobiographical memory in which memories are effortful mental constructions, within a self-memory system (SMS). The SMS contains an autobiographical knowledge base, and current goals of the 'working' self. Within such a model, memories are far from veridical records of experienced events. Instead, they are incomplete records, represented by transitory and complex patterns of activation across multilayered knowledge structures. Such endogenous patterns of activation may not coalesce into memories, nor do they necessarily (or even usually) enter consciousness. Instead, the way that they become conscious is modulated by central executive processes. These control processes implement plans generated from currently active goals of the 'working self'. Moreover, the knowledge base constrains (or 'grounds') the goals of the working self; therefore the relation of the system's knowledge base to the self's active goals is reciprocal.

However, when this relation is disrupted, as in the case of a lesion affecting the frontal lobes, the working self is no longer fully constrained, or guided by, the autobiographical memory base (which is disrupted or inaccessible). Thus, confronted with major problems, such as making sense of the external world, and making sense of one's own intentions, the working self confabulates memories and beliefs. Crucially, for Conway and Tacchi (1996) this dissolution of the constraining influence of memory allows for the generation of false memories that do *more* than simply provide a rationale for the external bewildering perplexity (cf. 'gap-filling'). Their patient, OP, was unable to distinguish between fantasies and memories (i.e. reality monitoring deficit Johnson, 1991) and she used her fantasies to re-create her personal past and present in a way that served the purpose (not necessarily conscious) of protecting the self from the unpleasantness of her actual reality. In this account, when the 'self' becomes partly disconnected from the knowledge base, the compromised ability to form autobiographical memories is heavily shaped by unconstrained self-goals (wishes) and thus by the emotional consequences of a particular thought or memory—so that the patient is more likely to affirm thoughts or memories that have positive affective consequences.

ES's striking tendency to experience his past and present reality as pleasant could be explained in a similar way. ES's memory control processes appeared to be disrupted, in that he was unable to voluntarily suppress, monitor and verify the thoughts and memories that enter consciousness (see also Burgess & McNeil, 1999; Burgess & Shallice, 1996; Moscovitch, 1989). Additionally, ES's memory disorder was characterised by clouding and temporal confusion, indicating that his autobiographical memory was *inaccessible* rather than permanently *unavailable* (Baddeley & Wilson, 1986; Conway & Pleydell-Pearce, 2000; Papagno & Muggia, 1996). Indeed, although ES was unable to correctly describe specific events upon request, his 'accidental' retrievals showed preserved knowledge of some personal facts (e.g. his profession) and apparently the personal goals, intentions and feelings associated with these facts (e.g. his professional success prior to his pathology).

Thus, the affective bias of ES's confabulations could be regarded as a combination of dysfunctional mechanisms of retrieval and evaluation, *together with preserved knowledge of his personal goals* (*wishes*), *and of the emotional consequences of particular thoughts and memories*. The disruption to ES's retrieval mechanisms thus allowed for a greater proportion of imagined events and wishful thoughts to emerge, and to be accepted as real memories. In other words, what was previously endogenously activated, but recognised as not-real and hence inhibited, is no longer rejected as inaccurate (Johnson et al., 1997). This implicit material thereby found its way into ES's explicit recollections

and beliefs, creating a more pleasant personal past, present and future.

Not all false memories created by ES were positive and wishful. Indeed, the findings of this study confirm that at least 29 (19.5%) of his observed confabulations were more unpleasant in comparison with the corresponding actual situation. This finding is similar to previously reported cases of confabulation, in which strenuously and repeatedly defended confabulations (Downes & Mayes, 1995; Stuss et al., 1978, cases 3–5; Talland, 1961, patient AI) included very unpleasant events, such as descriptions of the violent death or injury of relatives or oneself, and often were paranoid in nature (Benson & Stuss, 1990, case 3; Kopelman et al., 1997; Talland, 1961, patients AI/MO; Weinstein & Lyerly, 1968; Weinstein et al., 1956). Conway and Fthenaki (2000) have argued that these cases provide another example of memory construction being disconnected from the knowledge base, and grounded solely on unconstrained emotions, in this case negative ones. The consequence is the creation of confabulations which are characteristically resistant to challenge and immune to contradictory evidence (even other contradictory autobiographical memories, see also Burgess & McNeil, 1999).

However, in ES's presentation, negative emotions were less influential than the positive emotions that coloured his recollections—such that his unpleasant confabulations were significantly less common than the unpleasant false memories constructed by controls (39%). Moreover, ES did not present the confabulatory constancy described in the above cases. This accords with previous accounts of extensive and abnormal positive emotion (euphoria) accompanying the presentation of less constant and somewhat 'grandiose' or 'narcissistic' confabulation (Berlyne, 1972; Damasio et al., 1985; Jorn & Rybarczyk, 1995; Sabhesan & Natarajan, 1988, patients I/II, Talland, 1961, patients HS/LH/HT, Talland, Sweet, & Ballantine, 1967, patients ER/GO). It would be of great interest in future research to investigate the differential basis of positive versus negative affective biases in confabulation.

Burgess and Shallice's (1996) account of confabulation as an exaggeration of normal memory distortion phenomena, describing similar control mechanisms in autobiographical recall, can accommodate an explanation of motivated confabulation. They claim that "the marked personal significance for the individual" (Burgess & McNeil, 1999, p. 179) of some generic memories render them capable of "motivating the emergence of this particular generic memory over others". However, this process does not appear to be anticipated specifically by the hypothesised descriptor mechanism dysfunction proposed by these authors (although see Costello, Fletcher, Dolan, Frith, & Shallice, 1998 for a more specific consideration of the relation between memory and motivational factors). Instead, descriptor failure seems to result in generic memories of all possible emotional valence and significance dominating memory search by their power as "starting values" of the recollection process—without the need for further "motivation". The specific issue of selection between the various possible generic memories thus remains unexplained by the descriptor process dysfunction itself. Therefore, their model addresses confabulation specificity, constancy and resistance to contradiction (dysfunctional editor processes), but it does not provide adequate explanation of the specificity and constancy of the emotional bias observed in the content of the present patient's confabulations.

Dalla Barba (2001, 2002) and Dalla et al. (1997a,b), adopting a view different from that of most other authors mentioned, has argued against the existence of unconscious control processes in memory retrieval on theoretical grounds. However, Schnider, Valenza, Morand, and Michel (2002) in a recent high resolution event-related potential study, have provided evidence for the assumption that normal subjects suppress currently irrelevant memory traces (e.g. memories of a different source) before the conscious stages of learning and recognition. They have argued on this basis that the suppression of currently irrelevant memories is a pre-conscious mechanism, intervening before the content of a memory is consciously recognised and consolidated. This finding is consistent with other models of normal memory retrieval, which assume unconscious retrieval stages before the stage of conscious recollection and post-retrieval monitoring (e.g. Burgess & Shallice, 1996; Conway & Tacchi, 1996; Johnson, 1991; Moscovitch, 1989; Schacter et al., 1998).

Considering the above, it is unclear why Schnider (2003), Schnider and Ptak (1999), Schnider et al. (2002) persist in claiming that "the stories (of confabulating patients) can virtually always be traced back to elements of real events", when their model explicitly states that the suppression mechanism, whose failure is associated with confabulation, "may also explain the ability to distinguish between the memory of a true event and the memory of a thought" (Schnider et al., 2002, p. 59). Thus, not only memories but also thoughts (and potentially other mental processes e.g. dreams, fantasies) may also become the stuff that confabulations are made of. In fact, Schnider et al. (2002) cite animal studies which show (anatomically and behaviourally) a comparable failure in monkeys to suppress their previous responses to cues that are no longer *rewarded*, and postulate that "if one accepts the idea that human behaviour, too, is motivated by predicted goals, this model may be applied to the human ability to adapt behaviour and thinking to the changing reality".

The findings of the present study do not contradict Schnider et al.'s (2002) results, but further broaden the "currently irrelevant" information which confabulation patients cannot suppress in everyday interaction (as opposed to laboratory conditions). There is a potentially infinite number of memories, thoughts and fantasies available as candidates for recollection, which in normal autobiographical memory construction are selected, combined and checked (Burgess & Shallice, 1996; Conway & Tacchi, 1996; Moscovitch,

1989) according to both personal significance (Conway & Pleydell-Pearce, 2000; McAdams, 2001) and current reality criteria (Johnson, 1991; Schnider, 2000, 2003). The present study suggests that in confabulation, in which such reality-based recollection processes are dysfunctional, the memories finally selected and retrieved are the ones most relevant to, and in agreement with, the patient's self-goals and emotions.

8. Conclusions

Confabulation after brain lesions in the anterior forebrain has been explained by several cognitive 'deficit' theories. The many ways in which confabulation can manifest suggest that these theories might best be regarded as complementary rather than competing. The findings from ES provide empirical support for the hypothesis that confabulation can in part be 'motivated', or at least show a consistent positive emotional bias. This 'positive' feature of confabulation has not previously received due attention in accounts of the mechanism(s) of confabulation. However, it can readily be considered in parallel with the 'negative' aspects of the cognitive profile, such that a complex combination of damaged (poor retrieval control) and spared (emotionally driven retrieval) procedures apparently interact in generating false beliefs and memories.

Acknowledgements

This work was funded in part, by the grant from National Alliance for Research on Schizophrenia and Depression (NARSAD) and the Wellcome Trust to Dr. Turnbull. We thank Gianfranco Dalla Barba for kindly making his battery available to us, as well as Paul Burgess, Tony Marcel and Jamie Ward for their helpful comments on the study. We are also thankful to Martin Conway and Alexis Laskaris for reading the manuscript and making critical suggestions, to Nicolas Sevdalis and Gerda Arts for their contribution to statistical analysis and to Paula Barkay for her valuable logistical support. We are particularly grateful to ES and his family for their extensive help in this study.

Appendix A. Examples of confabulation ratings

A.1. Rated as positive

Confabulation 55, $M = 5.92$, $N = 12$. The patient continues talking about his eyesight problems. He concludes: "**Then last year I had a complete repair of the eyes**" (This did not occur in reality).

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

A.2. Rated as positive

Confabulation 130, $M = 6.38$, $N = 14$. The patient continues:

"**Other people take my cars** . . . **take them somewhere**, people feel . . . um . . . they have a car have, a Porsche. That's from buying a ticket or whatever the case is."

The examiner is confused. He asks: "What did you say? People have a car . . . a Porsche."

Patient: "**No, I've got a Porsche. The 540** . . . **54, 94, I don't even know—I must check if I have still got it. It's been in the garage for almost a month**."

The patient does not possess a Porsche in reality.

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

A.3. Rated as negative

Confabulation 22, $M = 2.42$, $N = 12$.

The patient continues:

"**And I did the job [described before] but I wasn't too happy and then everything worked fine. About 6 months later we had to do another run and I got a hole here**."

The 'hole' the patient is pointing to is the craniotomy scar caused by the surgery that triggered his amnesia.

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

A.4. Rated as negative

Confabulation 98, $M = 3.20$, $N = 12$.

Examiner: "Was it the valve that they replaced or the whole heart?"

Patient: "Actually it wasn't the heart they replaced."

Examiner: "What was it?"

Patient: "**The surroundings. What have we got around our hearts? I don't know. But they took the whole thing out** . . . I mean I have been playing soccer here for Wits for 20 odd years. Saw my captain about a month ago. **And**

about 8 years ago I had a pump—what do you call it? **It is quite a strong pump here**?

Examiner: "Do you mean the heart?"

Patient: "Must be the heart. Anyway they replaced that thing. He replaced that and said it's fine. **And it was fine for quite a while but then they decided to replace inside my heart. Got a lot of damage**."

Examiner: "Was it the vessels that were blocked?"

Patient: "**That's what I said. But I was happy that I had it done**."

The patient did play soccer for Wits for many years. It is uncertain whether or not he saw his captain a month ago. The connection between this activity and the alleged heart operation is unclear.

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

A.5. Rated as neutral

Confabulation 32, $M = 4.0$, $N = 13$). A few moments later:

"**About 2 weeks ago I went to see Duncan**." (A dental surgeon previously mentioned by the patient.)

This did not occur in reality.

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

A.6. Rated as neutral

Confabulation, 143, $M = 4.15$, $N = 13$.

Patient: "Oh, lovely . . . **We were at school together**. (Referring to his wife).

Examiner: You were at school together?

Patient: **We still are**.

Examiner: You and Val? Really? I didn't know that. When you say you still are, do you mean you are still at school now?

Patient: **Well not at school, at university**.

Examiner: Oh. So the two of you are at university together?

Patient: **Yes. She is doing third year and I am doing computers**.

Examiner: What is she studying?

Patient: **I don't know. I think criminology. I am not really sure**.

In reality, the patient left university (where he studied electronic engineering) many years ago. Val (who is 20 years his junior) was never at school or university with him.

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

A.7. Rated as unscorable

Confabulation 135, $N = 6$. The patient then tells the examiner how he went to a certain person (apparently a garage owner) to confront him about his missing car. It is unclear whether or not the episode in question ever occurred (with reference to some other car of the patient's). However, the patient then asks the examiner what aspect of the car business he is in. The examiner clarifies that he is not in that trade, that he works with brains not cars.

Patient: "**Oh I see, so how come you have my car**?"

Examiner: "I haven't got your car!"

Patient: "**Come off it**!" (Looks incredulous.)

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

A.8. Rated as unscorable

Confabulation 140, $N = 9$.

Examiner: "Oh, so you were married twice. And Val?

Patient: **She's Italian**.

In reality, the patient's second wife is South African, not Italian.

Is the confabulated situation more pleasant or more unpleasant (for the patient) than the actual reality?

(a) Extremely unpleasant 1–2–3–4–5–6–7 extremely pleasant.
(b) Impossible to judge.

Comments . . .

References

Baddeley, A. D., & Wilson, B. (1986). Amnesia, autobiographical memory and confabulation. In D. C. Rubin (Ed.), *Autobiographical memory* (pp. 225–252). New York: Cambridge University Press.

Barclay, C. R. (1996). Autobiographical remembering: Narrative constrains on objectified selves. In D. C. Rubin (Ed.), *Remembering our*

past: Studies in autobiographical memory (pp. 94–125). Cambridge: Cambridge University Press.

Barclay, C. R., & DeCooke, P. (1988). Ordinary everyday memories: Some of the things which selves are made of. In U. Neisser, & E. Winograd (Eds.), *Remembering reconsidered* (pp. 91–125). New York: Cambridge University Press.

Bartlett, F. C. (1932). *Remembering*. Cambridge: Cambridge University Press.

Benson, D. F., Djenderedjian, A., Miller, M. D., Pachana, N. A., Chang, M. D., Itti, L., & Mena, I. (1996). Neural basis of confabulation. *Neurology*, *46*, 1239–1243.

Benson, D. F., & Stuss, D. T. (1990). Frontal influences on delusions: A clinical perspective. *Schizophrenia Bulletin*, *16*, 403–411.

Berlyne, N. (1972). Confabulation. *British Journal of Psychiatry*, *120*, 31–39.

Berrios, G. E. (1998). Confabulations: A conceptual history. *Journal of the History of the Neurosciences*, *7*(3), 225–241.

Betlheim, S., Hartmann, H. (1924/1951). On parapraxes in the Korsakow psychosis. In D. Rapaport (Ed.), *Organization and pathology of thought* (pp. 289–307). New York: Columbia University Press.

Bluck, S., & Habermas, T. (2001). The life story schema. *Motivation and Emotion*, *24*, 121–147.

Box, O., Laing, H., & Kopelman, M. D. (1999). The evolution of spontaneous confabulation, delusion, misidentification and a related delusion in a case of severe head injury. *Neurocase*, *5*, 251–262.

Burgess, P. W., & McNeil, J. E. (1999). Content-specific confabulation. *Cortex*, *35*, 163–182.

Burgess, P. W., & Shallice, T. (1996). Confabulation and the control of recollection. *Memory*, *4*, 359–411.

Conway, M. A. (1996). Autobiographical knowledge and autobiographical memories. In D. C. Rubin (Ed.), *Remembering our past: Studies in autobiographical memory* (pp. 67–93). Cambridge: Cambridge University Press.

Conway, M. A., Collins, A. F., Gathercole, S. E., & Anderson, S. J. (1996). Recollections of true and false autobiographical memories. *Journal of Experimental Psychology: General*, *125*, 69–95.

Conway, M. A., & Fthenaki, A. (2000). Disruption and loss of autobiographical memory. In F. Boller, & J. Grafman (Eds.), *Handbook of neuropsychology* (Vol. 2. 2nd ed., pp. 281–312). Amsterdam: Elsevier.

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review*, *107*(2), 261–288.

Conway, M. A., & Tacchi, P. C. (1996). Motivated confabulation. *Neurocase*, *2*, 325–338.

Costello, A., Fletcher, P. C., Dolan, R. J., Frith, C. D., & Shallice, T. (1998). The origins of forgetting in a case of isolated retrograde amnesia following a haemorrhage: Evidence from functional imaging. *Neurocase*, *4*, 437–446.

Cunningham, J. M., Pliskin, N. H., Cassissi, J. E., Tsang, B., & Rao, S. M. (1997). Relationship between confabulation and measures of memory and executive function. *Journal of Clinical and Experimental Neuropsychology*, *19*, 867–877.

Dab, S., Claes, T., Morais, J., & Shallice, T. (1999). Confabulation with a selective descriptor process impairment. *Cognitive Neuropsychology*, *16*(3–5), 215–242.

Dalla Barba, G. (1993a). Different patterns of confabulation. *Cortex*, *29*, 567–581.

Dalla Barba, G. (1993b). Confabulation: Knowledge and recollective experience. *Cognitive Neuropsychology*, *10*(1), 1–20.

Dalla Barba, G. (1995). Confabulation: Remembering "another" past. In R. Cambell, & M. A. Conway (Eds.), *Broken memories* (pp. 102–111). Oxford: Blackwell.

Dalla Barba, G. (2001). Beyond the memory-trace paradox and the fallacy of the homunculus: A hypothesis concerning the relation between memory, consciousness and temporality. *Journal of Consciousness Studies*, *8*, 51–78.

Dalla Barba, G. (2002). *Memory, consciousness and temporality*. Boston: Kluwer Academic Publishers.

Dalla Barba, G., Boisse, M. F., Bartolomeo, P., & Bachoud-Levi, A. C. (1997a). Confabulation following rupture of posterior communicative artery. *Cortex*, *33*, 563–570.

Dalla Barba, G., Cappelletti, Y. J., Signorini, M., & Denes, G. (1997b). Confabulation: Remembering "another" past, planning "another" future. *Neurocase*, *3*, 425–436.

Dalla Barba, G., Cipolotti, L., & Denes, G. (1990). Autobiographical memory loss and confabulation in Korsakoff's syndrome: A case report. *Cortex*, *26*, 525–534.

Dalla Barba, G., Mantovan, M. C., Cappelletti, J. Y., & Denes, G. (1998). Temporal gradient in confabulation. *Cortex*, *34*, 417–426.

Damasio, A. R., Graff-Radford, N. R., Eslinger, P. J., Damasio, H., & Kassell, N. (1985). Amnesia following basal forebrain lesions. *Archives of Neurology*, *42*, 263–271.

DeLuca, J. (2000). A cognitive perspective on confabulation. *Neuro-Psychoanalysis*, *2*(2), 119–132.

De Vries, B., Blando, J. A., & Walker, L. J. (1995). An exploratory analysis of the content and structure of the life review. In B. K. Haight, & J. D. Webster (Eds.), *The art and science of reminiscing* (pp. 123–137). Washington: Taylor & Francis.

Downes, J. J., & Mayes, A. R. (1995). How bad memories can sometimes lead to fantastic beliefs and strange visions. In R. Campbell, & M. A. Conway (Eds.), *Broken memories: Case studies in the neuropsychology of memory* (pp. 115–123). Oxford: Blackwell.

Fischer, R. S., Alexander, M. P., D'Esposito, M., & Otto, R. (1995). Neuropsychological and neuroanatomical correlates of confabulation. *Journal of Clinical and Experimental Neuropsychology*, *17*, 20–28.

Fivush, R. (1998). The functions of event memory: Some comments on Nelson and Barsalou. In U. Neisser, & E. Winograd (Eds.), *Remembering Reconsidered: Ecological and traditional approaches to the study of memory* (pp. 277–282). Cambridge: Cambridge University Press.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-mental state. A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*, 189–198.

Gainotti, G. (1981). Confabulation of denial in senile dementia: An experimental study. *Psychiatrica Clinica*, *8*, 99–108.

Greenwald, A. (1980). The totalitarian ego: Fabrication and revision of personal history. *American Psychologist*, *35*, 603–618.

Hashimoto, R., Tanaka, Y., & Nakano, I. (2000). Amnesic confabulatory syndrome after focal basal forebrain damage. *Archives of Neurology*, *57*, 399–403.

Heaps, C. M., & Nash, M. (2001). Comparing recollective experience in true and false autobiographical memories. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *27*, 920–930.

Heaton, R. (1981). *Wisconsin card sorting test manual*. Odessa, FL: Psychological Assessment Resources.

Hyman, I. E., & Billings, F. J. (1998). Individual differences and the creation of false childhood memories. *Memory*, *6*, 1–20.

Hyman, I. E., & Pentland, J. (1996). The role of mental imagery in the creation of false childhood memories. *Journal of Memory and Language*, *35*, 101–117.

Jackson, J. H. (1932). Evolution and dissolution of the nervous system. In J. Taylor (Ed.), *Selected writings of John Hughlings Jackson* (Vol. 2. Reprint, pp. 45–75). London: Staples Press.

Johnson, M. L. (1991). Reality monitoring: Evidence from confabulation in organic brain disease patients. In G. P. Prigatano, & D. L. Schacter (Eds.), *Awareness of deficit after brain damage* (pp. 176–197). Oxford: Oxford University Press.

Johnson, M. L. (1997). Source monitoring and memory distortion. *Philosophical Transactions: Biological Sciences*, *352*(1362), 1733–1745.

Johnson, M. L., Foley, M. A., Suengas, A. G., & Raye, C. L. (1988). Phenomenal characteristics of memories for perceived and imagined autobiographical events. *Journal of Experimental Psychology: General*, *117*, 371–376.

Johnson, M. L., Hayes, S. M., D'Esposito, M., & Raye, C. (2000). Confabulation. In F. Boller, & J. Grafman (Eds.), *Handbook of neuropsychology. Memory and its disorders* (Vol. 2. 2nd ed., pp. 383–407). Amsterdam, The Netherlands: Elsevier.

Johnson, M. L., O'Connor, M., & Cantor, J. (1997). Confabulation, memory deficit and frontal dysfunction. *Brain and Cognition*, *34*, 189–206.

Johnson, M. L., & Raye, C. (1998). False memories and confabulation. *Trends in Cognitive Science*, *2*(4), 137–145.

Jorn, M. L., & Rybarczyk, B. (1995). Interpreting the confabulations of geriatric medical inpatients: Two case studies. *Clinical Gerontologist*, *16*, 59–62.

Kaplan-Solms, K., & Solms, M. (2000). *Clinical studies in neuro-psychoanalysis: Introduction to a depth neuropsychology*. Madison, CT: International Universities Press.

Kapur, N., & Couchlan, A. K. (1980). Confabulation after frontal lobe dysfunction. *Journal of Neurology, Neurosurgery and Psychiatry*, *43*, 461–463.

Kopelman, M. D. (1987). Two types of confabulation. *Journal of Neurology, Neurosurgery, and Psychiatry*, *50*, 1482–1487.

Kopelman, M. D. (1999). Varieties in false memory. *Cognitive Neuropsychology*, *16*(3–5), 197–214.

Kopelman, M. D., Ng, N., & Van den Brooke, O. (1997). Confabulation extending across episodic, personal and general semantic memory. *Cognitive Neuropsychology*, *14*, 683–712.

Korsakoff, S. S. (1889). Medico-psychological study of a memory disorder. *Consciousness and Cognition*, *5*, 2–21.

Lampinen, J. M., Neuschatz, J. S., & Payne, D. G. (1998). Memory illusions and consciousness: Examining the phenomenology of true and false memories. *Current Psychology*, *16*, 181–224.

Lezak, M. D. (1995). *Neuropsychological assessment* (3rd ed.). Oxford: Oxford University Press.

Lidz, T. (1942). The amnestic syndrome. Archives of Neurology and Psychiatry, 47, 588–605.

Loftus, E. F. (1993). The reality of repressed memories. *American Psychologist*, *48*, 518–537.

Loftus, E. F., Miller, D. G., & Burns, H. J. (1978). Semantic integration of verbal information into visual memory. *Journal of Experimental Psychology: Human Learning and Memory*, *4*, 19–31.

Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychiatric Annuals*, *25*, 270–275.

Luria, A. R. (1966). *Higher cortical functions in man*. New York: Basic Books.

Luria, A. R. (1976). *The neuropsychology of memory*. New York. Wiley.

Marshall, J., Halligan, P. W., & Wade, C. (1995). Reduplication of an event after head injury. A cautionary case report. *Cortex*, *31*, 183–190.

McAdams, D. P. (2001). The psychology of life stories. *Review of General Psychology*, *5*(2), 100–122.

McKenna, P., & Warrington, E. K. (1983). *Grated naming test manual*. Windsor: Nelson.

Mercer, B., Wapner, W., Gardner, H., & Benson, F. (1977). A study of confabulation. *Archives of Neurology*, *34*, 429–433.

Moll, J. M. (1915). The "amnestic" or "Korsakoff" syndrome, with alcoholic aetiology: An analysis of thirty cases. *Journal of Mental Sciences*, *61*, 424–443.

Moscovitch, M. (1989). Confabulation and the frontal system: Strategic versus associative retrieval in neuropsychological theories of memory. In H. L. Roediger, & F. I. Craik (Eds.), *Varieties of memory and consciousness: Essays in the honour of Endel Tulving* (pp. 133–160). Hillsdale: Lawrence Erlbaum Associates.

Moscovitch, M. (1995). Confabulation. In D. L. Schacter (Ed.), *Memory distortion*. Cambridge: Harvard University Press.

Moscovitch, M., & Melo, B. (1997). Strategic retrieval and the frontal lobes: Evidence from confabulation and amnesia. *Neuropsychologia*, *35*, 1017–1034.

Nedjam, Z., Dalla Barba, G., & Pillon, B. (2000). Confabulation in fronto-temporal dementia and Alzheimer's disease. *Cortex*, *36*, 571–577.

Neisser, U. (1988). Five kinds of self-knowledge. *Philosophical Psychology*, *1*, 35–59.

Papagno, C., & Muggia, S. (1996). Confabulation: Dissociation between everyday life and neuropsychological performance. *Neurocase*, *2*, 111–118.

Papagno, C., & Baddeley, A. D. (1997). Confabulation and dysexecutive patient: Implications for models of retrieval. *Cortex*, *33*, 743–752.

Pasupathi, M. (2003). Emotion regulation during social remembering: Differences between emotions elicited during an event and emotions elicited when talking about it. *Memory*, *11*, 151–163.

Pezdek, K., Finger, K., & Hodge, D. (1997). Planting false auto-biographical memories: The role of event plausibility. *Psychological Science*, *8*, 437–441.

Pillemer, D. B. (1992). Remembering personal circumstances: A functional analysis. In E. Winograd, & U. Neisser (Eds.), *Affect and accuracy in recall: Studies in "flashbulb" memories* (4th ed., pp. 236–264). New York: Cambridge University Press.

Pillemer, D. B. (2001). Momentous events and the life story. *Review of General Psychology*, *5*, 123–134.

Prigatano, G. P., & Weistein, E. A. (1996). Edwin A. Weistein's contributions to neuropsychological rehabilitation. *Neuropsychological Rehabilitation*, *6*(4), 305–326.

Sabhesan, S., & Natarajan, M. (1988). Fantastic confabulations after head injury. *Indian Journal of Psychological Medicine*, *11*, 29–32.

Schacter, D. L., & Prigatano, G. P. (1991). Forms of unawareness. In G. P. Prigatano, & D. L. Schacter (Eds.), *Awareness of deficit after brain injury* (pp. 258–262). Oxford: Oxford University Press.

Schacter, D. L., Norman, K. A., & Koutstaal, W. (1998). The cognitive neuroscience of memory. *Annual Review of Psychology*, *49*, 289–318.

Schnider, A. (2000). Spontaneous confabulations, disorientation, and the processing of 'now'. *Neuropsychologia*, *38*, 175–185.

Schnider, A. (2003). Spontaneous confabulation and the adaptation of thought to ongoing reality. *Nature Reviews Neuroscience*, *4*, 662–671.

Schnider, A., & Ptak, R. (1999). Spontaneous confabulators fail to suppress currently irrelevant memory traces. *Nature Neuroscience*, *2*(7), 677–681.

Schnider, A., Valenza, N., Morand, S., & Michel, C. M. (2002). Early cortical distinction between memories that pertain to ongoing reality and memories that don't. *Cerebral Cortex*, *12*, 54–61.

Schnider, A., von Daniken, C., & Gutbrod, K. (1996). The mechanisms of provoked and spontaneous confabulations. *Brain*, *119*, 1365–1375.

Shallice, T., & Evans, M. E. (1978). The involvement of the frontal lobes in cognitive estimation. *Cortex*, *14*, 294–303.

Shallice, T., & Burgess, P. (1991). Deficit in strategic application following frontal lobe lesions in man. *Brain*, *114*, 727–741.

Shallice, T., & Burgess, P. (1997). *The Haying and Brixton tests manual*. Thames Valley Test Company.

Shapiro, D. E., Alexander, M. P., Gardner, H., & Mercer, B. (1981). Mechanisms of confabulation. *Neurology*, *31*, 1070–1076.

Singer, J. A., & Salovey, P. (1993). *The remembered self: Emotion and memory in personality*. New York: Free Press.

Solms, M. (2000). A psychoanalytic perspective on confabulation. *Neuro-Psychoanalysis*, *2*(2), 133–138.

Spreen, O., & Strauss, E. (1991). *A compendium of neuropsychological tests*. New York: Oxford University Press.

Stein, N. L., Wade, E., & Liwag, M. D. (1997). A theoretical approach to understanding and remembering emotional events. In N. L. Stein, P. A. Ornstein, B. Tversky, & C. Brainerd (Eds.), *Memory for everyday and emotional events* (pp. 15–48). Hillsdale, NJ: Erlbaum.

Stuss, D. T., Alexander, M. P., Lieberman, A., & Levine, H. (1978). An extraordinary form of confabulation. *Neurology*, *28*, 1166–1172.

Suengas, A. G., & Johnson, M. K. (1988). Qualitative effects of rehearsal on memories for perceived and imagined complex events. *Journal of Experimental Psychology: General*, *117*, 377–389.

Talland, G. A. (1965). *Deranged memory*. London: Academic Press.

Talland, G. A. (1961). Confabulation in the Wernicke–Korsakoff syndrome. *Journal of Nervous and Mental Disease*, *132*, 361–381.

Talland, G. A., Sweet, W. H., & Ballantine, H. T. (1967). Amnestic syndrome with anterior communicating artery aneurysm. *The Journal of Nervous and Mental Disease*, *145*, 179–192.

Trenerry, M. R., Crosson, B., DeBoe, J., & Leber, W. R. (1989). *Stroop, a neuropsychological screening test*. Odessa: Psychological Assessment Resources.

Turnbull, O. H., Berry, H., & Evans, C. E. Y. (in press). A positive emotional bias in confabulatory false beliefs about place. *Brain and Cognition*.

Villiers, C. D., Zent, R., Eastman, R. W., & Swingler, D. (1996). A flight of fantasy: False memories in frontal lobe disease. *Journal of Neurology, Neurosurgery and Psychiatry*, *61*, 652–653.

Walker, W. R., Skowronski, J. J., & Thompson, C. P. (2003). Life is pleasant—and memory helps to keep it that way. *Review of General Psychology*, *7*(2), 203–210.

Wechsler, D. (1945). A standard memory scale for clinical use. *Journal of Psychology*, *19*, 87–95.

Wechsler, D. (1981). *Wechsler adult intelligence—revised*. San Antonio: Psychological Corporation.

Weinstein, E. A. (1996). Symbolic aspects of confabulation following brain damage: Influence of premorbid personality. *Bulletin of the Menninger Clinic*, *60*, 331–350.

Weinstein, E. A., & Kahn, R. L. (1955). *Denial of illness: Symbolic and physiological aspects*. Springfield, IL: Charles C. Thomas.

Weinstein, E. A., Kahn, R. L., & Malitz, S. (1956). Confabulation as a social process. *Psychiatry*, *19*, 383–396.

Weinstein, E. A., & Lyerly, A. B. (1968). Confabulation following brain injury. Its analogues and sequelae. *Archives of General Psychiatry*, *18*, 348–354.

Whitlock, F. A. (1981). Some observations on the meaning of confabulation. *British Journal of Medical Psychology*, *54*, 213–218.

Williams, H. W., & Rupp, C. (1938). Observations on confabulation. *American Journal of Psychiatry*, *95*, 395–405.

Wilson, A. E., & Ross, M. (2003). The identity function of autobiographical memory: Time is on our side. *Memory*, *11*, 137–149.

Woike, B. (2003). *The influence of implicit and explicit motives on autobiographical memory.* Manuscript submitted for publication.

Woike, B., Gershkovich, I., Piorkowski, R., & Polo, M. (1999). The role of motives in the content and structure of autobiographical memory. *Journal of Personality and Social Psychology*, *76*, 600–612.

Wright, R. A., Boeve, B. F., & Malec, J. F. (1999). Amnesia after basal forebrain damage due to anterior communicating artery aneurysm rupture. *Journal of Clinical Neuroscience*, *6*, 511–515.